

KEYSIGHT
TECHNOLOGIES

Keysight 34980A Multifunction Switch/Measure Unit Programmer's Reference Help

This Help file contains reference information to help you program the Keysight 34980A over the remote interface using the SCPI programming language. The 34980A supports the SCPI command language on all of its remote I/O interfaces.

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NOTE

For information on configuring the remote I/O interfaces, see the Keysight 34980A *Mainframe User's Guide*.

Related Information

[IO Libraries and Instrument Drivers](#)

IO Libraries:

To easily configure and verify an interface connection between the 34980A and your PC, you can use the Keysight IO Libraries Suite or an equivalent. For more information about Keysight's I/O connectivity software, go to www.keysight.com/find/iolib.

- Previous versions of the Keysight IO Libraries software are also available. For more information and to download the current or an earlier version from the Web, go to www.keysight.com/find/iolib.

For information on connecting instruments to USB, LAN, and GPIB and how to configure and troubleshoot these interfaces, refer to the Keysight *Connectivity Guide*. If you have installed the Keysight IO Libraries Suite, you can access the guide from the Keysight IO Libraries Control icon. Or you can download the guide from the Web at www.keysight.com/find/connectivity.

Instrument Drivers:

To communicate programmatically with the 34980A, you can use either the SCPI instrument command language or the provided instrument drivers. The following table shows the instrument drivers currently available for the 34980A.

Programming Environment	Supported Drivers
Microsoft® Visual C Ver 6.0, Visual C++, and ANSI C	IVI-C, IVI-COM
Microsoft® Visual Basic Ver 6.0	IVI-C, IVI-COM
Microsoft® Visual Studio® .NET for C#, C, and Visual Basic	IVI-COM
Keysight VEE	IVI-COM
National Instruments LabVIEW	LabVIEW Plug&Play (native mode), IVI-C
National Instruments LabWindows/CVI	IVI-C

To install the instrument drivers and their associated Help files, go to www.keysight.com/find/34980A.

Keysight 34980A Documentation

The following online documentation is available in Adobe® Acrobat® PDF format. For the most up-to-date information on the 34980A, including documentation, firmware updates, and calibration procedures, go to www.keysight.com/find/34980A.

- 34980A *Mainframe User's Guide*
- 34980A *Command Quick Reference Guide*
- 34980A Product Data Sheet
- Application Notes
- 34980A Plug-In Module Wiring Logs

For information on connecting instruments to USB, LAN, and GPIB interfaces and how to configure and troubleshoot these interfaces, refer to the Keysight *Connectivity Guide*. If you have installed the Keysight IO Libraries Suite, you can access the guide from the Keysight IO Libraries Control icon. Or, you can download the guide from the Web at www.keysight.com/find/connectivity.

For detailed information on configuring, wiring and operating the plug-in modules, see the *User's Guides* specific to the individual modules or module families.

Keysight 34980A Web Browser Interface

The Keysight 34980A provides a Web Interface which is built into the instrument. You can use this interface over LAN for remote access and control of the instrument via a Java™-enabled Web browser, such as Microsoft® Internet Explorer.

To access and use the 34980A Web Interface:

1. Establish a LAN interface connection from your PC to the 34980A.
2. Open your PC's Web browser.
3. Launch the 34980A Web Interface by entering the IP address of your 34980A, or its fully-qualified host name, in the browser address field.
4. Follow the instructions in the 34980A Web Interface's on-line Help.

For more information on using the 34980A Web Interface, see the 34980A *Getting Started Guide*.

Programming Examples

To help you get started with programming the 34980A, we have developed a series of programming examples for the following environments:

- Microsoft® Visual C
- Microsoft® Visual Basic
- Microsoft® Excel
- Keysight VEE
- National Instruments LabVIEW

To install the programming examples, go to www.keysight.com/find/34980A.

Contact Keysight Technologies

Introduction to the SCPI Language

SCPI (Standard Commands for Programmable Instruments) is an ASCII-based instrument command language designed for test and measurement instruments. SCPI commands are based on a hierarchical structure, also known as a *tree system*. In this system, associated commands are grouped together under a common node or root, thus forming *subsystems*. A portion of the SENSE subsystem is shown below to illustrate the tree system.

SENSe:

VOLTage:

DC:RANGe {<range>|MIN|MAX}[,(@<ch_list>)]

DC:RANGe? [(@<ch_list>)|MIN|MAX]

RESistance:

OCOMPensated {OFF|0|ON|1}[,(@<ch_list>)]

OCOMPensated? [(@<ch_list>)]

TEMPerature:

RJUNction? [(@<ch_list>)]

SENSe is the root keyword of the command, **VOLTage** and **RESistance** are second-level keywords, and **DC** and **OCOMPensated** are third-level keywords. A colon (:) separates a command keyword from a lower-level keyword.

Syntax Conventions

The format used to show commands is illustrated below:

VOLTage:DC:RANGe {<range>|MIN|MAX}[,(@<ch_list>)]

The command syntax shows most commands (and some parameters) as a mixture of upper- and lower-case letters. The upper-case letters indicate the abbreviated spelling for the command. For shorter program lines, you can send the abbreviated form. For better program readability, you can send the long form.

For example, in the above syntax statement, VOLT and VOLTAGE are both acceptable forms. You can use upper- or lower-case letters. Therefore, VOLTAGE, volt, and Volt are all acceptable. Other forms, such as VOL and VOLTAG, are not valid and will generate an error.

- Braces ({ }) enclose the parameter choices for a given command string. The braces are not sent with the command string.
- A vertical bar (|) separates multiple parameter choices for a given command string.
- Triangle brackets (< >) indicate that you must specify a value for the enclosed parameter. For example, the above syntax statement shows the <range> parameter enclosed in triangle brackets. The brackets are not sent with the command string. You must specify a value for the parameter (e.g., "VOLT:DC:RANG 10").
- Some parameters are enclosed in square brackets ([]). This indicates that the parameter is optional and can be omitted. The brackets are not sent with the command string. If you do not specify a value for an optional parameter, the instrument chooses a default value.

Command Separators

A colon (:) is used to separate a command keyword from a lower-level keyword. You must insert a blank space to separate a parameter from a command keyword. If a command requires more than one parameter, you must separate adjacent parameters using a comma as shown below:

```
"CONF:VOLT:DC 10,0.003"
```

A semicolon (;) is used to separate commands within the same subsystem, and can also minimize typing. For example, sending the following command string:

```
"TRIG:SOUR EXT; COUNT 10"
```

... is the same as sending the following two commands:

```
"TRIG:SOUR EXT"  
"TRIG:COUNT 10"
```

Use a colon and a semicolon to link commands from different subsystems. For example, in the following command string, an error is generated if you do not use both the colon and semicolon:

```
"ROUT:CHAN:DELAY 1;;TRIG:SOUR EXT"
```

Using the MIN and MAX Parameters

For many commands, you can substitute "MIN" or "MAX" in place of a parameter. For example, consider the following command:

```
VOLTage:DC:RANGe {<range>|MIN|MAX}[,(@<ch_list>)]
```

Instead of selecting a specific value for the <range> parameter, you can substitute MIN to set the range to its minimum value or MAX to set the range to its maximum value.

Querying Parameter Settings

You can query the current value of most parameters by adding a question mark (?) to the command. For example, the following command sets the scan count to 10 sweeps:

```
"TRIG:COUNT 10"
```

You can then query the scan count value by sending:

```
"TRIG:COUNT?"
```

You can also query the minimum or maximum scan count allowed as follows:

```
"TRIG:COUNT? MIN"  
"TRIG:COUNT? MAX"
```

SCPI Command Terminators

A command string sent to the instrument must terminate with a <new line> (<NL>) character. The IEEE-488 EOI (End-Or-Identify) message is interpreted as a <NL> character and can be used to terminate a command string in place of a <NL> character. A <carriage return> followed by a <NL> is also accepted. Command string termination will always reset the current SCPI command path to the root level.

IEEE-488.2 Common Commands

The IEEE-488.2 standard defines a set of common commands that perform functions such as reset, self-test, and status operations. Common commands always begin with an asterisk (*), are three characters in length, and may include one or more parameters. The command keyword is separated from the first parameter by a blank space. Use a semicolon (;) to separate multiple commands as shown below:

```
"*RST; *CLS; *ESE 32; *OPC?"
```

SCPI Parameter Types

The SCPI language defines several data formats to be used in program messages and response messages.

Numeric Parameters

Commands that require numeric parameters will accept all commonly used decimal representations of numbers including optional signs, decimal points, and scientific notation. Special values for numeric parameters such as MIN, MAX, and DEF are also accepted. You can also send engineering unit suffixes with numeric parameters (e.g., M, K, or u). If only specific numeric values are accepted, the instrument will automatically round the input numeric parameters. The following command requires a numeric parameter for the range value:

```
VOLTage:DC:RANGe {<range>|MIN|MAX}[,(@<ch_list>)]
```

Discrete Parameters

Discrete parameters are used to program settings that have a limited number of values (like BUS, IMMEDIATE, EXTERNAL). They have a short form and a long form just like command keywords. You can mix upper- and lower-case letters. Query responses will always return the short form in all upper-case letters. The following command requires a discrete parameter for the temperature units:

```
UNIT:TEMPerature {C|F|K}[,(@<ch_list>)]
```

Boolean Parameters

Boolean parameters represent a single binary condition that is either true or false. For a false condition, the instrument will accept "OFF" or "0". For a true condition, the instrument will accept "ON" or "1". When you query a boolean setting, the instrument will always return "0" or "1". The following command requires a boolean parameter:

```
INPut:IMPedance:AUTO {OFF|0|ON|1}[,(@<ch_list>)]
```

ASCII String Parameters

String parameters can contain virtually any set of ASCII characters. A string must begin and end with matching quotes; either with a single quote or a double quote. You can include the quote delimiter as part of the string by typing it twice without any characters in between. The following command uses a string parameter:

DISPlay:TEXT <*quoted string*>

For example, the following command displays the message "SCANNING..." on the instrument's front panel (the quotes are not displayed).

```
DISP:TEXT "SCANNING..."
```

You can also display the same message using the following command with single quotes.

```
DISP:TEXT 'SCANNING...'
```

Channel List Parameters

Channel list parameters have the form (@**sccc**), where **s** is the mainframe slot number (1 through 8) and **ccc** is the channel number. You can specify a single channel, multiple channels, or a range of channels. The channel list must be preceded with the "@" symbol and must be enclosed in parentheses. The following commands use a channel list (<ch_list>) parameter:

ROUTe:CLOSe (@<ch_list>)

INPut:IMPedance:AUTO <mode> [, (@<ch_list>)]

As shown above, the <ch_list> parameter is optional for some commands (as indicated by square brackets). If you omit the <ch_list> parameter, the command will be applied to the internal DMM.

The following command closes channel 10 on the module in slot 3.

```
ROUT:CLOS (@3010)
```

The following command closes channels 10, 12, and 15 on the module in slot 2.

```
ROUT:CLOS (@2010,2012,2015)
```

The following command closes channels 5 through 10 (slot 1) and channel 15 (slot 2). When you specify a range of channels, any channels that are invalid will be ignored (no error will be generated) but the first and last channel in the range must be valid.

```
ROUT:CLOS (@1005:1010,2015)
```

The Analog Bus relays (numbered **s911**, **s912**, **s913**, etc.) on the multiplexer and matrix modules are ignored if they are included in a range of channels. An error will be generated if an Analog Bus relay is specified as the first or last channel in a range of channels. For example, the following command closes all valid channels between channel 30 (slot 1) and channel 5 (slot 2). In addition, this command closes Analog Bus relay 911 on the module

in slot 1 (Bank 1). Note that although the specified range of channels includes the other Analog Bus relays, they are ignored and are not closed by this command.

```
ROUT:CLOS (@1030:2005,1911)
```

The following command will generate an error since the Analog Bus relays cannot be specified as the first or last channel in a range of channels (none of the channels will be closed).

```
ROUT:CLOS (@1005:1911) !Generates an error
```

In the following command, since the optional <ch_list> parameter is omitted, the command will be applied to the internal DMM. If the internal DMM is disabled (see **INSTrument:DMM[:STATe]** command) or is not present, an error will be generated.

```
INP:IMP:AUTO ON !Applies to the internal DMM
```

Scan List Parameters

Before you can initiate a scan, you must set up a *scan list* to include the desired multiplexer, digital, or totalizer channels. Like channel list parameters (see [Channel List Parameters](#) above), scan list parameters specify one or more channels in the instrument. The scan list must be preceded with the "@" symbol and must be enclosed in parentheses. The following command uses a scan list (<scan_list>) parameter:

```
ROUTe:SCAN (@<scan_list>)
```

Commands which accept a <scan_list> parameter will reprogram the scan list each time you send the command to the instrument. The <scan_list> parameter is *never* an optional parameter. By default, the instrument scans the list of channels in ascending order from slot 1 through slot 8 (channels are reordered as needed). If your application requires non-ordered scanning of the channels in the present scan list, you can use the **ROUTe:SCAN:ORDered** command to enable the non-sequential scanning mode. In either mode, channels which are not in the scan list are skipped during the scan.

If a command specifies an illegal operation on a given channel, the instrument will generate an error on the offending channel and the command will not be performed on any of the channels. For example, the following command will generate an error since channel 911 is an Analog Bus relay which cannot be added to the scan list (assumes a multiplexer module is installed in slot 1).

```
ROUT:SCAN (@1001,1911) !Generates an error
```

The Analog Bus relays (numbered **s911**, **s912**, **s913**, etc.) on the multiplexer modules are ignored if they are included in a range of channels in a scan list. An error will be generated if an Analog Bus relay is specified as the first or last channel in a range of channels. For example, the following command configures the scan list to include all valid channels between channel 30 (slot 1) and channel 5 (slot 2). Note that although the specified range of channels includes the four Analog Bus relays, they are ignored and are not added to the scan list.

```
ROUT:SCAN (@1030:2005)
```

However, if an illegal channel is either the first or last channel specified in the range, the instrument *will* generate an error (none of the channels will be added to the scan list). For example, the following command will generate an error since Analog Bus relay 911 is specified as the ending point in the range.

```
ROUT:SCAN (@1001:1911) !Generates an error
```

Using Device Clear

Device Clear is an IEEE-488 low-level bus message that you can use to return the instrument to a responsive state (e.g., during a lengthy query). Different programming languages and IEEE-488 interface cards provide access to this capability through their own unique commands. The status registers, the error queue, and all configuration states are left unchanged when a Device Clear message is received.

Device Clear performs the following actions:

- If a scan is running, it is aborted.
- The instrument returns to the trigger "idle" state.
- The instrument's input and output buffers are cleared.
- The instrument is prepared to accept a new command string.
- An overlapped command, if any, will be terminated with no "Operation Complete" indication.

NOTE

The **ABORT** command is the recommended method to terminate a measurement.

NOTE

It is recommended that you allow for a two-second wait following a Device Clear to enable the instrument to process the clear operation.

Commands A-Z

A – E | F – J | M – O | P – T | U – Z

NOTE

Hold the mouse cursor over a command to view the full syntax statement.

A

ABORt

C

***CLS**

CALCulate:AVERage:AVERage?

CALCulate:AVERage:CLEAr

CALCulate:AVERage:COUNT?

CALCulate:AVERage:MAXimum:TIME?

CALCulate:AVERage:MAXimum?

CALCulate:AVERage:MINimum:TIME?

CALCulate:AVERage:MINimum?

CALCulate:AVERage:PTPeak?

CALCulate:COMPare:DATA[:<width>]

CALCulate:COMPare:DATA?

CALCulate:COMPare:MASK[:<width>]

CALCulate:COMPare:MASK?

CALCulate:COMPare:STATe

CALCulate:COMPare:STATe?

CALCulate:COMPare:TYPE

CALCulate:COMPare:TYPE?

CALCulate:LIMit:LOWer

CALCulate:LIMit:LOWer?

CALCulate:LIMit:LOWer:STATe

CALCulate:LIMit:LOWer:STATe?

CALCulate:LIMit:UPPer

CALCulate:LIMit:UPPer?

CALCulate:LIMit:UPPer:STATe

CALCulate:LIMit:UPPer:STATe?

CALCulate:SCALE:GAIN

CALCulate:SCALE:GAIN?

CALCulate:SCALE:OFFSet

CALCulate:SCALE:OFFSet?

CALCulate:SCALE:STATe

CALCulate:SCALE:STATe?

CALCulate:SCALE:UNIT
CALCulate:SCALE:UNIT?
CALibration?
CALibration:ABORT
CALibration:BEGin[:VOLTage]
CALibration:COUNt?
CALibration:LFRequency
CALibration:LFRequency?
CALibration:MODule?
CALibration:POINt?
CALibration:SECure:CODE
CALibration:SECure:STATe
CALibration:SECure:STATe?
CALibration:STRing
CALibration:STRing?
CALibration:VALue
CALibration:VALue?
CONFigure:COUNter:DCYCLE
CONFigure:COUNter:FREQuency
CONFigure:COUNter:FREQuency
CONFigure:COUNter:PERiod
CONFigure:COUNter:PWIDth
CONFigure:COUNter:TOTalize
CONFigure:CURREnt:AC
CONFigure:CURREnt[:DC]
CONFigure:DIGital
CONFigure:DIGital:DIRection
CONFigure:DIGital:DIRection?
CONFigure:DIGital:HANDshake
CONFigure:DIGital:HANDshake:CTIME
CONFigure:DIGital:HANDshake:CTIME?
CONFigure:DIGital:HANDshake:DRIVE
CONFigure:DIGital:HANDshake:DRIVE?
CONFigure:DIGital:HANDshake:POLarity
CONFigure:DIGital:HANDshake:POLarity?
CONFigure:DIGital:HANDshake:RATE
CONFigure:DIGital:HANDshake:RATE?
CONFigure:DIGital:HANDshake:STATe
CONFigure:DIGital:HANDshake:STATe?
CONFigure:DIGital:HANDshake:SYNChronous:STRobe[:SOURce]
CONFigure:DIGital:HANDshake:SYNChronous:STRobe[:SOURce]?
CONFigure:DIGital:INTerrupt:POLarity
CONFigure:DIGital:INTerrupt:POLarity?
CONFigure:DIGital:POLarity

CONFigure:DiGital:POLarity?
CONFigure:DiGital:WIDTh
CONFigure:DiGital:WIDTh?
CONFigure:FREQuency
CONFigure:FRESistance
CONFigure:PERiod
CONFigure:RESistance
CONFigure:TEMPerature
CONFigure:TOTalize
CONFigure[:VOLTage]:AC
CONFigure[:VOLTage][:DC]
CONFigure?
COUNter:ABORT
COUNter:DATA?
COUNter:DCYCLE[:DATA]?
COUNter:FREQuency[:DATA]?
COUNter:FUNCTion
COUNter:FUNCTion?
COUNter:GATE:POLarity
COUNter:GATE:POLarity?
COUNter:GATE:SOURce
COUNter:GATE:SOURce?
COUNter:GATE:TIME[:INTernal]
COUNter:GATE:TIME[:INTernal]?
COUNter:INITiate
COUNter:PERiod[:DATA]?
COUNter:PWIDth[:DATA]?
COUNter:SLOPe
COUNter:SLOPe?
COUNter:THReshold:VOLTage
COUNter:THReshold:VOLTage?
COUNter:TOTalize:CLEar:IMMediate
COUNter:TOTalize[:DATA]?
COUNter:TOTalize:TYPE
COUNter:TOTalize:TYPE?
CURRent:AC:BANDwidth
CURRent:AC:BANDwidth?
CURRent:AC:RANGe
CURRent:AC:RANGe?
CURRent:AC:RANGe:AUTO
CURRent:AC:RANGe:AUTO?
CURRent[:DC]:APERture
CURRent[:DC]:APERture?
CURRent[:DC]:APERture:ENABled?

CURRent[:DC]:NPLC
CURRent[:DC]:NPLC?
CURRent[:DC]:RANGe
CURRent[:DC]:RANGe?
CURRent[:DC]:RANGe:AUTO
CURRent[:DC]:RANGe:AUTO?
CURRent[:DC]:RESolution
CURRent[:DC]:RESolution?
CURRent[:DC]:ZERO:AUTO
CURRent[:DC]:ZERO:AUTO?

D

DATA:LAST?
DATA:POINts:EVENT:THReshold
DATA:POINts:EVENT:THReshold?
DATA:POINts?
DATA:REMOve?
DIAGnostic:DMM:CYCLes?
DIAGnostic:RELAy:CYCLes?
DIGital:DATA[:<width>]?
DIGital:DATA:BIT?
DIGital:HANDshake:THReshold
DIGital:HANDshake:THReshold?
DIGital:INTerrupt[:ENABle]
DIGital:INTerrupt[:ENABle]?
DIGital:INTerrupt:MODE
DIGital:INTerrupt:MODE?
DIGital:INTerrupt:STATus?
DIGital:MEMory:CLEar
DIGital:MEMory:COMPare:ACTion
DIGital:MEMory:COMPare:ACTion?
DIGital:MEMory[:DATA]?
DIGital:MEMory[:DATA]:ALL?
DIGital:MEMory[:DATA]:FORMat
DIGital:MEMory[:DATA]:FORMat?
DIGital:MEMory[:DATA]:POINts?
DIGital:MEMory:ENABle
DIGital:MEMory:ENABle?
DIGital:MEMory:MATCH[:DATA]?
DIGital:MEMory:SAMPle:COUNt
DIGital:MEMory:STARt
DIGital:MEMory:STEP
DIGital:MEMory:STOP

DIGital:THReshold
DIGital:THReshold?
DISPlay:TEXT
DISPlay:TEXT?
DISPlay:TEXT:CLEar
DISPlay[:STATe]
DISPlay[:STATe]?

E

*ESE
*ESE?
*ESR?



F

FETCh?
FORMat:BORDer
FORMat:BORDer?
FORMat:READIng:ALARm
FORMat:READIng:ALARm?
FORMat:READIng:CHANnel
FORMat:READIng:CHANnel?
FORMat:READIng:TIME
FORMat:READIng:TIME?
FORMat:READIng:TIME:TYPE
FORMat:READIng:TIME:TYPE?
FORMat:READIng:UNIT
FORMat:READIng:UNIT?
FREQuency:APERture
FREQuency:APERture?
FREQuency:RANGe:LOWer
FREQuency:RANGe:LOWer?
FREQuency:VOLTage:RANGe
FREQuency:VOLTage:RANGe?
FREQuency:VOLTage:RANGe:AUTO
FREQuency:VOLTage:RANGe:AUTO?
FRESistance:APERture
FRESistance:APERture?
FRESistance:APERture:ENABLEd?
FRESistance:NPLC
FRESistance:NPLC?

FRESistance:OCOMpensated
FRESistance:OCOMpensated?
FRESistance:RANGe
FRESistance:RANGe?
FRESistance:RANGe:AUTO
FRESistance:RANGe:AUTO?
FRESistance:RESolution
FRESistance:RESolution?
FUNction
FUNction?

|

*IDN?
INITiate
INSTrument:DMM:CONNect
INSTrument:DMM:CONNect?
INSTrument:DMM:DISConnect
INSTrument:DMM:DISConnect?
INSTrument:DMM:INSTalled?
INSTrument:DMM[:STATe]
INSTrument:DMM[:STATe]?

M

MEASure:COUNter:DCYClE?
MEASure:COUNter:FREQuency?
MEASure:COUNter:PERiod?
MEASure:COUNter:PWIDth?
MEASure:COUNter:TOTAlize?
MEASure:CURREnt:AC?
MEASure:CURREnt[:DC]?
MEASure:DIGital?
MEASure:FREQuency?
MEASure:FRESistance?
MEASure:PERiod?
MEASure:RESistance?
MEASure:TEMPerature?
MEASure:TOTAlize?
MEASure[:VOLTage]:AC?
MEASure[:VOLTage][:DC]?
MEMory:NSTATes?
MEMory:STATe:CATalog?
MEMory:STATe:DELeTe
MEMory:STATe:DELeTe:ALL

MEMory:STATe:NAME
MEMory:STATe:NAME?
MEMory:STATe:RECall:AUTO
MEMory:STATe:RECall:AUTO?
MEMory:STATe:RECall:SElect
MEMory:STATe:RECall:SElect?
MEMory:STATe:VALid?
MODule:COUNter:GATE:THReshold[:VOLTage]
MODule:COUNter:GATE:THReshold[:VOLTage]?

O

*OPC
*OPC?
OUTPut:ALARm<n>:CLEar
OUTPut:ALARm:CLEar:ALL
OUTPut:ALARm:MODE
OUTPut:ALARm:MODE?
OUTPut:ALARm:SLOPe
OUTPut:ALARm:SLOPe?
OUTPut:ALARm<n>:SEQuence?
OUTPut:ALARm<n>:SOURce
OUTPut:ALARm<n>:SOURce?
OUTPut[:STATe]
OUTPut[:STATe]?



P

PERiod:APERture
PERiod:APERture?
PERiod:VOLTage:RANGe
PERiod:VOLTage:RANGe?
PERiod:VOLTage:RANGe:AUTO
PERiod:VOLTage:RANGe:AUTO?

R

*RCL
*RST
R?
READ?
RESistance:APERture
RESistance:APERture?

RESistance:APERTure:ENABLEd?
RESistance:NPLC
RESistance:NPLC?
RESistance:OCOMpensated
RESistance:OCOMpensated?
RESistance:RANGe
RESistance:RANGe?
RESistance:RANGe:AUTO
RESistance:RANGe:AUTO?
RESistance:RESolution
RESistance:RESolution?
RESistance:ZERO:AUTO
RESistance:ZERO:AUTO?
ROUTe:CHANnel:ADVance:SOURce
ROUTe:CHANnel:ADVance:SOURce?
ROUTe:CHANnel:DELay
ROUTe:CHANnel:DELay?
ROUTe:CHANnel:DELay:AUTO
ROUTe:CHANnel:DELay:AUTO?
ROUTe:CHANnel:DRIVE:CLOSe:DEFault
ROUTe:CHANnel:DRIVE:CLOSe:DEFault?
ROUTe:CHANnel:DRIVE:OPEN:DEFault
ROUTe:CHANnel:DRIVE:OPEN:DEFault?
ROUTe:CHANnel:DRIVE:PAIRed[:MODE]
ROUTe:CHANnel:DRIVE:PAIRed[:MODE]?
ROUTe:CHANnel:DRIVE:PULSe[:MODE]
ROUTe:CHANnel:DRIVE:PULSe[:MODE]?
ROUTe:CHANnel:DRIVE:PULSe:WIDTh
ROUTe:CHANnel:DRIVE:PULSe:WIDTh?
ROUTe:CHANnel:DRIVE:STATe?
ROUTe:CHANnel:DRIVE:TIME:RECOvery
ROUTe:CHANnel:DRIVE:TIME:RECOvery?
ROUTe:CHANnel:DRIVE:TIME:SETTle
ROUTe:CHANnel:DRIVE:TIME:SETTle?
ROUTe:CHANnel:FWIRe
ROUTe:CHANnel:FWIRe?
ROUTe:CHANnel:LABel:CLEar:MODule
ROUTe:CHANnel:LABel[:DEFine]
ROUTe:CHANnel:LABel[:DEFine]?
ROUTe:CHANnel:VERify[:ENABLE]
ROUTe:CHANnel:VERify[:ENABLE]?
ROUTe:CHANnel:VERify:POLarity
ROUTe:CHANnel:VERify:POLarity?
ROUTe:CHANnel:VERify:POSition:STATe?

ROUTe:CLOSE
ROUTe:CLOSE?
ROUTe:CLOSE:EXCLusive
ROUTe:CLOSE:PAIR
ROUTe:CLOSE:PAIR?
ROUTe:MODule:BUSY?
ROUTe:MODule:WAIT
ROUTe:MODule:WAIT?
ROUTe:MONitor[:CHANnel]
ROUTe:MONitor[:CHANnel]?
ROUTe:MONitor[:CHANnel]:ENABLE
ROUTe:MONitor[:CHANnel]:ENABLE?
ROUTe:MONitor:DATA?
ROUTe:MONitor:MODE
ROUTe:MONitor:MODE?
ROUTe:MONitor:STATe
ROUTe:MONitor:STATe?
ROUTe:OPEN
ROUTe:OPEN?
ROUTe:OPEN:ABUS
ROUTe:OPEN:ALL
ROUTe:OPEN:PAIR
ROUTe:OPEN:PAIR?
ROUTe:OPERation:OVERlap[:ENABle]
ROUTe:OPERation:OVERlap[:ENABle]?
ROUTe:RMODule:BANK:DRIVE[:MODE]
ROUTe:RMODule:BANK:DRIVE[:MODE]?
ROUTe:RMODule:BANK:LED:DRIVE[:ENABle]
ROUTe:RMODule:BANK:LED:DRIVE[:ENABle]?
ROUTe:RMODule:BANK:LED:DRIVE:LEVel
ROUTe:RMODule:BANK:LED:DRIVE:LEVel?
ROUTe:RMODule:BANK:PRESet
ROUTe:RMODule:DRIVE:LIMit
ROUTe:RMODule:DRIVE:LIMit?
ROUTe:RMODule:DRIVE:SOURce:BOOT
ROUTe:RMODule:DRIVE:SOURce:BOOT?
ROUTe:RMODule:DRIVE:SOURce[:IMMEDIATE]
ROUTe:RMODule:DRIVE:SOURce[:IMMEDIATE]?
ROUTe:SEQuence:ABORt
ROUTe:SEQuence:BUSY?
ROUTe:SEQuence:CATalog?
ROUTe:SEQuence:DEFine
ROUTe:SEQuence:DEFine?

ROUTe:SEQuence:DELeTe:ALL
ROUTe:SEQuence:DELeTe[:NAME]
ROUTe:SEQuence:RU NNing:NAME?
ROUTe:SEQuence:TRIGGer[:IMMediate]
ROUTe:SEQuence:TRIGGer:SOURce
ROUTe:SEQuence:TRIGGer:SOURce?
ROUTe:SEQuence:WAIT
ROUTe:SCAN
ROUTe:SCAN?
ROUTe:SCAN:ADD
ROUTe:SCAN:ORDeRed
ROUTe:SCAN:ORDeRed?
ROUTe:SCAN:REMOve
ROUTe:SCAN:SIZE?

S

*SAV
*SRE
*SRE?
*STB?
SAMPle:COUNT
SAMPle:COUNT?
[SENSe:]COUNter:ABORt
[SENSe:]COUNter:DATA?
[SENSe:]COUNter:DCYClE[:DATA]?
[SENSe:]COUNter:FREQuency[:DATA]?
[SENSe:]COUNter:FUNCTion
[SENSe:]COUNter:FUNCTion?
[SENSe:]COUNter:GATE:POLarity
[SENSe:]COUNter:GATE:POLarity?
[SENSe:]COUNter:GATE:SOURce
[SENSe:]COUNter:GATE:SOURce?
[SENSe:]COUNter:GATE:TIME[:INTernAl]
[SENSe:]COUNter:GATE:TIME[:INTernAl]?
[SENSe:]COUNter:INITiate
[SENSe:]COUNter:PERiod[:DATA]?
[SENSe:]COUNter:PWIDth[:DATA]?
[SENSe:]COUNter:SLOPe
[SENSe:]COUNter:SLOPe?
[SENSe:]COUNter:THReShold:VOLTage
[SENSe:]COUNter:THReShold:VOLTage?
[SENSe:]COUNter:TOTalize:CLEar:IMMediate
[SENSe:]COUNter:TOTalize[:DATA]?

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 [SENSe:]COUNter:TOTalize:TYPE?
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 [SENSe:]CURRent:AC:BANDwidth?
 [SENSe:]CURRent:AC:RANGe
 [SENSe:]CURRent:AC:RANGe?
 [SENSe:]CURRent:AC:RANGe:AUTO
 [SENSe:]CURRent:AC:RANGe:AUTO?
 [SENSe:]CURRent[:DC]:APERTure
 [SENSe:]CURRent[:DC]:APERTure?
 [SENSe:]CURRent[:DC]:APERTure:ENABled?
 [SENSe:]CURRent[:DC]:NPLC
 [SENSe:]CURRent[:DC]:NPLC?
 [SENSe:]CURRent[:DC]:RANGe
 [SENSe:]CURRent[:DC]:RANGe?
 [SENSe:]CURRent[:DC]:RANGe:AUTO
 [SENSe:]CURRent[:DC]:RANGe:AUTO?
 [SENSe:]CURRent[:DC]:RESolution
 [SENSe:]CURRent[:DC]:RESolution?
 [SENSe:]CURRent[:DC]:ZERO:AUTO
 [SENSe:]CURRent[:DC]:ZERO:AUTO?
 [SENSe:]DIGital:DATA[:<width>]?
 [SENSe:]DIGital:DATA:BIT?
 [SENSe:]DIGital:HANDshake:THReshold
 [SENSe:]DIGital:HANDshake:THReshold?
 [SENSe:]DIGital:INTerrupt[:ENABLE]
 [SENSe:]DIGital:INTerrupt[:ENABLE]?
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 [SENSe:]DIGital:INTerrupt:MODE?
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 [SENSe:]DIGital:MEMory:CLEar
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 [SENSe:]DIGital:MEMory[:DATA]:FORMat?
 [SENSe:]DIGital:MEMory[:DATA]:POINts?
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 [SENSe:]DIGital:MEMory:MATCH[:DATA]?
 [SENSe:]DIGital:MEMory:SAMPle:COUNt
 [SENSe:]DIGital:MEMory:STARt
 [SENSe:]DIGital:MEMory:STEP

[SENSe:]DIGital:MEMory:STOP
[SENSe:]DIGital:THReshold
[SENSe:]DIGital:THReshold?
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[SENSe:]FREQuency:APERTure?
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[SENSe:]FREQuency:VOLTage:RANGe
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[SENSe:]FREQuency:VOLTage:RANGe:AUTO?
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[SENSe:]FREStance:APERTure?
[SENSe:]FREStance:APERTure:ENABled?
[SENSe:]FREStance:NPLC
[SENSe:]FREStance:NPLC?
[SENSe:]FREStance:OCOMpensated
[SENSe:]FREStance:OCOMpensated?
[SENSe:]FREStance:RANGe
[SENSe:]FREStance:RANGe?
[SENSe:]FREStance:RANGe:AUTO
[SENSe:]FREStance:RANGe:AUTO?
[SENSe:]FREStance:RESolution
[SENSe:]FREStance:RESolution?
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[SENSe:]FUNctiOn?
[SENSe:]MODule:COUNter:GATE:THReshold[:VOLTage]
[SENSe:]MODule:COUNter:GATE:THReshold[:VOLTage]?
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[SENSe:]RESistance:APERTure?
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[SENSe:]RESistance:NPLC?
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[SENSe:]RESistance:OCOMpensated?
[SENSe:]RESistance:RANGe
[SENSe:]RESistance:RANGe?
[SENSe:]RESistance:RANGe:AUTO

[SENSe:]RESistance:RANGe:AUTO?
[SENSe:]RESistance:RESolution
[SENSe:]RESistance:RESolution?
[SENSe:]RESistance:ZERO:AUTO
[SENSe:]RESistance:ZERO:AUTO?
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[SENSe:]TEMPerature:APERture?
[SENSe:]TEMPerature:APERture:ENABLEd?
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[SENSe:]TEMPerature:RJUNction[:INTernal]?
[SENSe:]TEMPerature:TRANSducer:FRTD:OCOMpensated
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[SENSe:]TEMPerature:TRANSducer:FRTD:REFerence
[SENSe:]TEMPerature:TRANSducer:FRTD:REFerence?
[SENSe:]TEMPerature:TRANSducer:FRTD:RESistance[:REFerence]
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[SENSe:]TEMPerature:TRANSducer:FRTD:TYPE?
[SENSe:]TEMPerature:TRANSducer:RTD:OCOMpensated
[SENSe:]TEMPerature:TRANSducer:RTD:OCOMpensated?
[SENSe:]TEMPerature:TRANSducer:RTD:REFerence
[SENSe:]TEMPerature:TRANSducer:RTD:REFerence?
[SENSe:]TEMPerature:TRANSducer:RTD:RESistance[:REFerence]
[SENSe:]TEMPerature:TRANSducer:RTD:RESistance[:REFerence]?
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[SENSe:]TEMPerature:TRANSducer:RTD:TYPE?
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[SENSe:]TEMPerature:TRANSducer:TCouple:CHECK?
[SENSe:]TEMPerature:TRANSducer:TCouple:IMPedance:AUTO
[SENSe:]TEMPerature:TRANSducer:TCouple:IMPedance:AUTO?
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[SENSe:]TEMPerature:TRANSducer:TCouple:TYPE?
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[SENSe:]TEMPerature:TRANSducer:THERmistor:REFerence?
[SENSe:]TEMPerature:TRANSducer:THERmistor:TYPE
[SENSe:]TEMPerature:TRANSducer:THERmistor:TYPE?
[SENSe:]TEMPerature:TRANSducer:TYPE
[SENSe:]TEMPerature:TRANSducer:TYPE?

[SENSe:]TEMPerature:ZERO:AUTO
 [SENSe:]TEMPerature:ZERO:AUTO?
 [SENSe:]TOTAlize:CLear:IMMediate
 [SENSe:]TOTAlize:DATA?
 [SENSe:]TOTAlize:SLOPe
 [SENSe:]TOTAlize:SLOPe?
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 [SENSe:]TOTAlize:THReshold[:MODE]?
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 [SENSe:]TOTAlize:THReshold:VOLTage?
 [SENSe:]TOTAlize:TYPE
 [SENSe:]TOTAlize:TYPE?
 [SENSe:]VOLTage:AC:BANDwidth
 [SENSe:]VOLTage:AC:BANDwidth?
 [SENSe:]VOLTage:AC:RANGe
 [SENSe:]VOLTage:AC:RANGe?
 [SENSe:]VOLTage:AC:RANGe:AUTO
 [SENSe:]VOLTage:AC:RANGe:AUTO?
 [SENSe:]VOLTage[:DC]:APERTure
 [SENSe:]VOLTage[:DC]:APERTure?
 [SENSe:]VOLTage[:DC]:APERTure:ENABled?
 [SENSe:]VOLTage[:DC]:IMPedance:AUTO
 [SENSe:]VOLTage[:DC]:IMPedance:AUTO?
 [SENSe:]VOLTage[:DC]:NPLC
 [SENSe:]VOLTage[:DC]:NPLC?
 [SENSe:]VOLTage[:DC]:RANGe
 [SENSe:]VOLTage[:DC]:RANGe?
 [SENSe:]VOLTage[:DC]:RANGe:AUTO
 [SENSe:]VOLTage[:DC]:RANGe:AUTO?
 [SENSe:]VOLTage[:DC]:RESolution
 [SENSe:]VOLTage[:DC]:RESolution?
 [SENSe:]VOLTage[:DC]:ZERO:AUTO
 [SENSe:]VOLTage[:DC]:ZERO:AUTO?



SOURce:CURRent[:LEVel]
 SOURce:CURRent[:LEVel]?
 SOURce:DIGital:DATA[:<width>]
 SOURce:DIGital:DATA[:<width>]?
 SOURce:DIGital:DATA:BIT
 SOURce:DIGital:DATA:BIT?
 SOURce:DIGital:DRIVE

SOURce:DIGital:DRIVE?
SOURce:DIGital:HANDshake:LEVel
SOURce:DIGital:HANDshake:LEVel?
SOURce:DIGital:INTerrupt[:ENABle]
SOURce:DIGital:INTerrupt[:ENABle]?
SOURce:DIGital:INTerrupt:MODE
SOURce:DIGital:INTerrupt:MODE?
SOURce:DIGital:LEVel
SOURce:DIGital:LEVel?
SOURce:DIGital:MEMory:ABORT
SOURce:DIGital:MEMory:ENABLE
SOURce:DIGital:MEMory:ENABLE?
SOURce:DIGital:MEMory:NCYCles
SOURce:DIGital:MEMory:NCYCles?
SOURce:DIGital:MEMory:START
SOURce:DIGital:MEMory:STEP
SOURce:DIGital:MEMory:STOP
SOURce:DIGital:MEMory:TRACe
SOURce:DIGital:MEMory:TRACe?
SOURce:DIGital:STATe
SOURce:DIGital:STATe?
SOURce:FUNCTion:CLOCK:EXTernal:DIVisor
SOURce:FUNCTion:CLOCK:EXTernal:DIVisor?
SOURce:FUNCTion:CLOCK:SOURce
SOURce:FUNCTion:CLOCK:SOURce?
SOURce:FUNCTion:CURREnt:GAIN
SOURce:FUNCTion:CURREnt:GAIN?
SOURce:FUNCTion:CURREnt:OFFSet
SOURce:FUNCTion:CURREnt:OFFSet?
SOURce:FUNCTion:ENABLE
SOURce:FUNCTion:ENABLE?
SOURce:FUNCTion:FREQuency
SOURce:FUNCTion:FREQuency?
SOURce:FUNCTion:HALT
SOURce:FUNCTion:SAMPle:PERiod
SOURce:FUNCTion:SAMPle:PERiod?
SOURce:FUNCTion:TRACe:NCYCles
SOURce:FUNCTion:TRACe:NCYCles?
SOURce:FUNCTion:TRACe:SINDex
SOURce:FUNCTion:TRACe:SINDex?
SOURce:FUNCTion:TRACe[:NAME]
SOURce:FUNCTion:TRACe[:NAME]?
SOURce:FUNCTion:TRIGger:IMMediate
SOURce:FUNCTion:TRIGger:SOURce

SOURce:FUNctIon:TRIGger:SOURce?
SOURce:FUNctIon:VOLTagE:GAIN
SOURce:FUNctIon:VOLTagE:GAIN?
SOURce:FUNctIon:VOLTagE:OFFSet
SOURce:FUNctIon:VOLTagE:OFFSet?
SOURce:MODE
SOURce:MODE?
SOURce:MODule:CLOCK:FREQuency
SOURce:MODule:CLOCK:FREQuency?
SOURce:MODule:CLOCK:LEVel
SOURce:MODule:CLOCK:LEVel?
SOURce:MODule:CLOCK:STATe
SOURce:MODule:CLOCK:STATe?

SOURce:MODule:TRIGger:EXtErnal:IMMediate
SOURce:MODule:TRIGger:OUTPut
SOURce:MODule:TRIGger:OUTPut?
SOURce:VOLTagE[:LEVel]
SOURce:VOLTagE[:LEVel]?
STATus:ALARm:CONDition?
STATus:ALARm:ENABle
STATus:ALARm:ENABle?
STATus:ALARm[:EVENT]?
STATus:MODule:ENABle
STATus:MODule:ENABle?
STATus:MODule:EVENT?
STATus:MODule:SLOT[n]:CONDition?
STATus:MODule:SLOT[n]:ENABle
STATus:MODule:SLOT[n]:ENABle?
STATus:MODule:SLOT[n][:EVENT]?
STATus:OPERation:CONDition?
STATus:OPERation:ENABle
STATus:OPERation:ENABle?
STATus:OPERation[:EVENT]?
STATus:PRESet
STATus:QUEStionable:CONDition?
STATus:QUEStionable:ENABle
STATus:QUEStionable:ENABle?
STATus:QUEStionable[:EVENT]?
SWEep:COUNT
SWEep:COUNT?
SYSTem:ABUS:INTerlock:SIMulate
SYSTem:ABUS:INTerlock:SIMulate?
SYSTem:ALARm?

SYSTem:BEEPer
SYSTem:BEEPer:STATe
SYSTem:CDEscription?
SYSTem:CDEscription:RMOdule?
SYSTem:COMMunicate:ENABle
SYSTem:COMMunicate:ENABle?
SYSTem:COMMunicate:LAN:AUTOip
SYSTem:COMMunicate:LAN:AUTOip?
SYSTem:COMMunicate:LAN:BSTatus?
SYSTem:COMMunicate:LAN:CONTRol?
SYSTem:COMMunicate:LAN:DHCP
SYSTem:COMMunicate:LAN:DHCP?
SYSTem:COMMunicate:LAN:DNS
SYSTem:COMMunicate:LAN:DNS?
SYSTem:COMMunicate:LAN:DOMain
SYSTem:COMMunicate:LAN:DOMain?
SYSTem:COMMunicate:LAN:GATEway
SYSTem:COMMunicate:LAN:GATEway?
SYSTem:COMMunicate:LAN:HISTory?
SYSTem:COMMunicate:LAN:HISTory:CLEar
SYSTem:COMMunicate:LAN:HOSTname
SYSTem:COMMunicate:LAN:HOSTname?
SYSTem:COMMunicate:LAN:IPADdress
SYSTem:COMMunicate:LAN:IPADdress?
SYSTem:COMMunicate:LAN:KEEPlive
SYSTem:COMMunicate:LAN:KEEPlive?
SYSTem:COMMunicate:LAN:MAC?
SYSTem:COMMunicate:LAN:SMASk
SYSTem:COMMunicate:LAN:SMASk?
SYSTem:COMMunicate:LAN:TELNet:PROMpt
SYSTem:COMMunicate:LAN:TELNet:PROMpt?
SYSTem:COMMunicate:LAN:TELNet:WMESsage
SYSTem:COMMunicate:LAN:TELNet:WMESsage?
SYSTem:CPON
SYSTem:CTYPe?
SYSTem:CTYPe:RMOdule?
SYSTem:DATE
SYSTem:DATE?
SYSTem:DELay[:IMMediate]
SYSTem:ERRor?
SYSTem:LOCK:OWNer?
SYSTem:LOCK:RELease
SYSTem:LOCK:REQuest?
SYSTem:MODule?

SYSTem:MODUle:PFAil:JUMPer:AMP5?
SYSTem:MODUle:ROW:PROTection
SYSTem:MODUle:ROW:PROTection?
SYSTem:MODUle:ROW:PROTection DEFault
SYSTem:MODUle:ROW:PROTection? DEFault
SYSTem:MODUle:TEMPerature?
SYSTem:MODUle:WIRE:MODE
SYSTem:PRESet
SYSTem:RMODUle:RESet
SYSTem:RMODUle:STATus?
SYSTem:SECurity:IMMediate
SYSTem:TIME
SYSTem:TIME?
SYSTem:TIME:SCAN?
SYSTem:VERSion?



T

*TRG
*TST?
TEMPerature:APERture
TEMPerature:APERture?
TEMPerature:APERture:ENABled?
TEMPerature:NPLC
TEMPerature:NPLC?
TEMPerature:RJUNction[:INTernal]?
TEMPerature:TRANsdUcer:FRTD:OCOMpensated
TEMPerature:TRANsdUcer:FRTD:OCOMpensated?
[SENSe:]TEMPerature:TRANsdUcer:FRTD:REFerence
[SENSe:]TEMPerature:TRANsdUcer:FRTD:REFerence?
TEMPerature:TRANsdUcer:FRTD:RESistance[:REFerence]
TEMPerature:TRANsdUcer:FRTD:RESistance[:REFerence]?
TEMPerature:TRANsdUcer:FRTD:TYPE
TEMPerature:TRANsdUcer:FRTD:TYPE?
TEMPerature:TRANsdUcer:RTD:OCOMpensated
TEMPerature:TRANsdUcer:RTD:OCOMpensated?
TEMPerature:TRANsdUcer:RTD:REFerence
TEMPerature:TRANsdUcer:RTD:REFerence?
TEMPerature:TRANsdUcer:RTD:RESistance[:REFerence]
TEMPerature:TRANsdUcer:RTD:RESistance[:REFerence]?
TEMPerature:TRANsdUcer:RTD:TYPE
TEMPerature:TRANsdUcer:RTD:TYPE?

TEMPerature:TRANsducer:TCouple:CHECK
 TEMPerature:TRANsducer:TCouple:CHECK?
 TEMPerature:TRANsducer:TCouple:IMPedance:AUTO
 TEMPerature:TRANsducer:TCouple:IMPedance:AUTO?
 TEMPerature:TRANsducer:TCouple:RJUNction
 TEMPerature:TRANsducer:TCouple:RJUNction?
 TEMPerature:TRANsducer:TCouple:RJUNction:EXternal?
 TEMPerature:TRANsducer:TCouple:RJUNction:TYPE
 TEMPerature:TRANsducer:TCouple:RJUNction:TYPE?
 TEMPerature:TRANsducer:TCouple:TYPE
 TEMPerature:TRANsducer:TCouple:TYPE?
 TEMPerature:TRANsducer:THERmistor:REference
 TEMPerature:TRANsducer:THERmistor:REference?
 TEMPerature:TRANsducer:THERmistor:TYPE
 TEMPerature:TRANsducer:THERmistor:TYPE?
 TEMPerature:TRANsducer:TYPE
 TEMPerature:TRANsducer:TYPE?
 TEMPerature:ZERO:AUTO
 TEMPerature:ZERO:AUTO?
 TOTalize:CLEar:IMMEDIATE
 TOTalize:DATA?
 TOTalize:SLOPe
 TOTalize:SLOPe?
 TOTalize:THReshold[:MODE]
 TOTalize:THReshold[:MODE]?
 TOTalize:THReshold:VOLTage
 TOTalize:THReshold:VOLTage?
 TOTalize:TYPE
 TOTalize:TYPE?
 TRACe:CATalog?
 TRACe:DELeTe:ALL
 TRACe:DELeTe[:NAME]
 TRACe:FREE?
 TRACe:POINts?
 TRACe[:DATA]
 TRACe[:DATA]:DAC
 TRACe[:DATA]:DIGital[:<width>]
 TRACe[:DATA]:DIGital:FUNCTion
 TRACe[:DATA]:FUNCTion
 TRIGger:COUNt
 TRIGger:COUNt?
 TRIGger:DELay
 TRIGger:DELay?
 TRIGger:DELay:AUTO

TRIGger:DElay:AUTO?
TRIGger:SOURce
TRIGger:SOURce?
TRIGger:SOURce:ALARm[:MODE]
TRIGger:SOURce:ALARm[:MODE]?
TRIGger:TIMer
TRIGger:TIMer?

U

UNIT:TEMPerature
UNIT:TEMPerature?

V

VOLTage:AC:BANDwidth
VOLTage:AC:BANDwidth?
VOLTage:AC:RANGe
VOLTage:AC:RANGe?
VOLTage:AC:RANGe:AUTO
VOLTage:AC:RANGe:AUTO?
VOLTage[:DC]:APERture
VOLTage[:DC]:APERture?
VOLTage[:DC]:APERture:ENABLEd?
VOLTage[:DC]:IMPedance:AUTO
VOLTage[:DC]:IMPedance:AUTO?
VOLTage[:DC]:NPLC
VOLTage[:DC]:NPLC?
VOLTage[:DC]:RANGe
VOLTage[:DC]:RANGe?
VOLTage[:DC]:RANGe:AUTO
VOLTage[:DC]:RANGe:AUTO?
VOLTage[:DC]:RESolution
VOLTage[:DC]:RESolution?
VOLTage[:DC]:ZERO:AUTO
VOLTage[:DC]:ZERO:AUTO?

W

*WAI



Keysight 34980A Command Quick Reference

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Syntax Conventions

- Braces ({ }) enclose the parameter choices for a given command string. The braces are not sent with the command string.
- A vertical bar (|) separates multiple parameter choices for a given command string.
- Triangle brackets (< >) indicate that you must specify a value for the enclosed parameter. For example, the above syntax statement shows the <range> parameter enclosed in triangle brackets. The brackets are not sent with the command string. You must specify a value for the parameter (e.g., "VOLT:DC:RANG 10").
- Some parameters are enclosed in square brackets ([]). The square brackets indicate that the parameter is optional and can be omitted. The brackets are not sent with the command string. If you do not specify a value for an optional parameter, the instrument chooses a default value.

Measurement Commands

```
MEASure:CURRent:AC? [{<range>|AUTO|MIN|MAX|DEF} [, {<resolution>|MIN|MAX|DEF} ] , ] [(@<ch_list>)]
MEASure:CURRent[:DC]? [{<range>|AUTO|MIN|MAX|DEF} [, {<resolution>|MIN|MAX|DEF} ] , ] [(@<ch_list>)]
MEASure:DIGital? {BYTE|1|WORD|2|LWORD|4}, [<voltage> , ] [{NORMa|INVerted} , ] (@<ch_list>)
MEASure:FREQuency? [{<range>|MIN|MAX|DEF} [, {<resolution>|MIN|MAX|DEF} ] , ] [(@<ch_list>)]
MEASure:FRESistance? [{<range>|AUTO|MIN|MAX|DEF} [, {<resolution>|MIN|MAX|DEF} ] , ] [(@<ch_list>)]
MEASure:PERiod? [{<range>|MIN|MAX|DEF} [, {<resolution>|MIN|MAX|DEF} ] , ] [(@<ch_list>)]
MEASure:RESistance? [{<range>|AUTO|MIN|MAX|DEF} [, {<resolution>|MIN|MAX|DEF} ] , ] [(@<ch_list>)]
MEASure:TEMPerature? {TCouple|RTD|FRTD|THERmistor|DEF}, {<type>|DEF} [, 1 [, {<resolution>|MIN|MAX|DEF} ] ] [, (@<ch_list>)]
MEASure:TOTalize? [{READ|RRESet} , ] (@<ch_list>)
MEASure[:VOLTage]:AC? [{<range>|AUTO|MIN|MAX|DEF} [, {<resolution>|MIN|MAX|DEF} ] , ] [(@<ch_list>)]
MEASure[:VOLTage][:DC]? [{<range>|AUTO|MIN|MAX|DEF} [, {<resolution>|MIN|MAX|DEF} ] , ] [(@<ch_list>)]
```

Temperature Configuration Commands

```
CONFigure:TEMPerature {TCouple|RTD|FRTD|THERmistor|DEF}, {<type>|DEF} [, 1 [, {<resolution>|MIN|MAX|DEF} ] ] [, (@<ch_list>)]
CONFigure? [(@<ch_list>)]

[SENSe:]TEMPerature:APERture {<seconds>|MIN|MAX|DEF} [, (@<ch_list>)]
[SENSe:]TEMPerature:APERture? [(@<ch_list>)|MIN|MAX]

[SENSe:]TEMPerature:APERture:ENABLEd? [(@<ch_list>)]

[SENSe:]TEMPerature:NPLC {<PLCs>|MIN|MAX|DEF} [, (@<ch_list>)]
[SENSe:]TEMPerature:NPLC? [(@<ch_list>)|MIN|MAX]
```

[SENSe:]TEMPerature:TRANsducer:TYPE {TCouple|RTD|FRTD|THERmistor} [, (@<ch_list>)]
 [SENSe:]TEMPerature:TRANsducer:TYPE? [(@<ch_list>)]
 [SENSe:]TEMPerature:ZERO:AUTO {OFF|0|ON|1} [, (@<ch_list>)]
 [SENSe:]TEMPerature:ZERO:AUTO? [(@<ch_list>)]
 UNIT:TEMPerature {C|F|K} [, (@<ch_list>)]
 UNIT:TEMPerature? [(@<ch_list>)]

Thermocouple Configuration

[SENSe:]TEMPerature:RJUNction[:INTernal]? (@<ch_list>)
 [SENSe:]TEMPerature:TRANsducer:TCouple:CHECK {OFF|0|ON|1} [, (@<ch_list>)]
 [SENSe:]TEMPerature:TRANsducer:TCouple:CHECK? [(@<ch_list>)]
 [SENSe:]TEMPerature:TRANsducer:TCouple:IMPedance:AUTO
 [SENSe:]TEMPerature:TRANsducer:TCouple:IMPedance:AUTO?
 [SENSe:]TEMPerature:TRANsducer:TCouple:RJUNction {<temperature>|MIN|MAX|DEF} [, (@<ch_list>)]
 [SENSe:]TEMPerature:TRANsducer:TCouple:RJUNction? [{(@<ch_list>)|MIN|MAX}]
 [SENSe:]TEMPerature:TRANsducer:TCouple:RJUNction:EXTernal?
 [SENSe:]TEMPerature:TRANsducer:TCouple:RJUNction:TYPE {EXTernal|FIXed|INTernal} [, (@<ch_list>)]
 [SENSe:]TEMPerature:TRANsducer:TCouple:RJUNction:TYPE? [(@<ch_list>)]
 [SENSe:]TEMPerature:TRANsducer:TCouple:TYPE {B|E|J|K|N|R|S|T} [, (@<ch_list>)]
 [SENSe:]TEMPerature:TRANsducer:TCouple:TYPE? [(@<ch_list>)]

RTD Configuration

[SENSe:]TEMPerature:TRANsducer:FRTD:OCOMpensated {OFF|0|ON|1} [, (@<ch_list>)]
 [SENSe:]TEMPerature:TRANsducer:FRTD:OCOMpensated? [(@<ch_list>)]
 [SENSe:]TEMPerature:TRANsducer:FRTD:REFerence {OFF|0|ON|1} [, (@<ch_list>)]
 [SENSe:]TEMPerature:TRANsducer:FRTD:REFerence? [(@<ch_list>)]
 [SENSe:]TEMPerature:TRANsducer:FRTD:RESistance[:REFerence] {<reference>|MIN|MAX|DEF} [, (@<ch_list>)]
 [SENSe:]TEMPerature:TRANsducer:FRTD:RESistance[:REFerence]? [{(@<ch_list>)|MIN|MAX}]
 [SENSe:]TEMPerature:TRANsducer:FRTD:TYPE {85|91} [, (@<ch_list>)]
 [SENSe:]TEMPerature:TRANsducer:FRTD:TYPE? [(@<ch_list>)]
 [SENSe:]TEMPerature:TRANsducer:RTD:OCOMpensated {OFF|0|ON|1} [, (@<ch_list>)]
 [SENSe:]TEMPerature:TRANsducer:RTD:OCOMpensated? [(@<ch_list>)]
 [SENSe:]TEMPerature:TRANsducer:RTD:REFerence {OFF|0|ON|1} [, (@<ch_list>)]
 [SENSe:]TEMPerature:TRANsducer:RTD:REFerence? [(@<ch_list>)]
 [SENSe:]TEMPerature:TRANsducer:RTD:RESistance[:REFerence] {<reference>|MIN|MAX|DEF} [, (@<ch_list>)]
 [SENSe:]TEMPerature:TRANsducer:RTD:RESistance[:REFerence]? [{(@<ch_list>)|MIN|MAX}]
 [SENSe:]TEMPerature:TRANsducer:RTD:TYPE {85|91} [, (@<ch_list>)]
 [SENSe:]TEMPerature:TRANsducer:RTD:TYPE? [(@<ch_list>)]

Thermistor Configuration

[SENSe:]TEMPerature:TRANsducer:THERmistor:REFerence {OFF|0|ON|1} [, (@<ch_list>)]
 [SENSe:]TEMPerature:TRANsducer:THERmistor:REFerence? [(@<ch_list>)]
 [SENSe:]TEMPerature:TRANsducer:THERmistor:TYPE {2252|5000|10000} [, (@<ch_list>)]
 [SENSe:]TEMPerature:TRANsducer:THERmistor:TYPE? [(@<ch_list>)]

Voltage Configuration Commands

DC Voltage Configuration

```
CONFigure[:VOLTage][:DC] [{<range>|AUTO|MIN|MAX|DEF} [, {<resolution>|MIN|MAX|DEF}] , ] [(@<ch_list>)]
CONFigure? [(@<ch_list>)]

[SENSe:]VOLTage[:DC]:APERTure {<seconds>|MIN|MAX|DEF} [, (@<ch_list>)]
[SENSe:]VOLTage[:DC]:APERTure? [(@<ch_list>)|MIN|MAX]

[SENSe:]VOLTage[:DC]:APERTure:ENABLEd? [(@<ch_list>)]

[SENSe:]VOLTage[:DC]:IMPedance:AUTO {OFF|0|ON|1} [, (@<ch_list>)]
[SENSe:]VOLTage[:DC]:IMPedance:AUTO? [(@<ch_list>)]

[SENSe:]VOLTage[:DC]:NPLC {<PLCs>|MIN|MAX|DEF} [, (@<ch_list>)]
[SENSe:]VOLTage[:DC]:NPLC? [(@<ch_list>)|MIN|MAX]

[SENSe:]VOLTage[:DC]:RANGe {<range>|MIN|MAX|DEF} [, (@<ch_list>)]
[SENSe:]VOLTage[:DC]:RANGe? [(@<ch_list>)|MIN|MAX]

[SENSe:]VOLTage[:DC]:RANGe:AUTO {OFF|0|ON|1} [, (@<ch_list>)]
[SENSe:]VOLTage[:DC]:RANGe:AUTO? [(@<ch_list>)]

[SENSe:]VOLTage[:DC]:RESolution {<resolution>|MIN|MAX|DEF} [, (@<ch_list>)]
[SENSe:]VOLTage[:DC]:RESolution? [(@<ch_list>)|MIN|MAX]

[SENSe:]VOLTage[:DC]:ZERO:AUTO {OFF|0|ON|1} [, (@<ch_list>)]
[SENSe:]VOLTage[:DC]:ZERO:AUTO? [(@<ch_list>)]
```

AC Voltage Configuration

```
CONFigure[:VOLTage]:AC [{<range>|AUTO|MIN|MAX|DEF} [, {<resolution>|MIN|MAX|DEF}] , ] [(@<ch_list>)]
CONFigure? [(@<ch_list>)]

[SENSe:]VOLTage:AC:BANDwidth {3|20|200|MIN|MAX|DEF} [, (@<ch_list>)]
[SENSe:]VOLTage:AC:BANDwidth? [(@<ch_list>)|MIN|MAX]

[SENSe:]VOLTage:AC:RANGe {<range>|MIN|MAX|DEF} [, (@<ch_list>)]
[SENSe:]VOLTage:AC:RANGe? [(@<ch_list>)|MIN|MAX]

[SENSe:]VOLTage:AC:RANGe:AUTO {OFF|0|ON|1} [, (@<ch_list>)]
[SENSe:]VOLTage:AC:RANGe:AUTO? [(@<ch_list>)]
```

Resistance Configuration Commands

2-Wire Resistance Configuration

```
CONFigure:RESistance [{<range>|AUTO|MIN|MAX|DEF} [, {<resolution>|MIN|MAX|DEF}] , ] [(@<ch_list>)]
CONFigure? [(@<ch_list>)]

[SENSe:]RESistance:APERTure {<seconds>|MIN|MAX|DEF} [, (@<ch_list>)]
[SENSe:]RESistance:APERTure? [(@<ch_list>)|MIN|MAX]

[SENSe:]RESistance:APERTure:ENABLEd? [(@<ch_list>)]
```

```
[SENSe:]RESistance:NPLC {<PLCs>|MIN|MAX|DEF} [, (@<ch_list>)]
[SENSe:]RESistance:NPLC? [({@<ch_list>})|MIN|MAX]

[SENSe:]RESistance:OCOMpensated {OFF|0|ON|1} [, (@<ch_list>)]
[SENSe:]RESistance:OCOMpensated? [({@<ch_list>})]

[SENSe:]RESistance:RANGe {<range>|MIN|MAX|DEF} [, (@<ch_list>)]
[SENSe:]RESistance:RANGe? [({@<ch_list>})|MIN|MAX]

[SENSe:]RESistance:RANGe:AUTO {OFF|0|ON|1} [, (@<ch_list>)]
[SENSe:]RESistance:RANGe:AUTO? [({@<ch_list>})]

[SENSe:]RESistance:RESolution {<resolution>|MIN|MAX|DEF} [, (@<ch_list>)]
[SENSe:]RESistance:RESolution? [({@<ch_list>})|MIN|MAX]

[SENSe:]RESistance:ZERO:AUTO {OFF|0|ON|1} [, (@<ch_list>)]
[SENSe:]RESistance:ZERO:AUTO? [({@<ch_list>})]
```

4-Wire Resistance Configuration

```
CONFigure:FRESistance [{<range>|AUTO|MIN|MAX|DEF} [, {<resolution>|MIN|MAX|DEF}] , ] [({@<ch_list>})]
CONFigure? [({@<ch_list>})]

[SENSe:]FRESistance:APERture {<seconds>|MIN|MAX|DEF} [, (@<ch_list>)]
[SENSe:]FRESistance:APERture? [({@<ch_list>})|MIN|MAX]

[SENSe:]FRESistance:APERture:ENABLEd? [({@<ch_list>})]

[SENSe:]FRESistance:NPLC {<PLCs>|MIN|MAX|DEF} [, (@<ch_list>)]
[SENSe:]FRESistance:NPLC? [({@<ch_list>})|MIN|MAX]

[SENSe:]FRESistance:OCOMpensated {OFF|0|ON|1} [, (@<ch_list>)]
[SENSe:]FRESistance:OCOMpensated? [({@<ch_list>})]

[SENSe:]FRESistance:RANGe {<range>|MIN|MAX|DEF} [, (@<ch_list>)]
[SENSe:]FRESistance:RANGe? [({@<ch_list>})|MIN|MAX]

[SENSe:]FRESistance:RANGe:AUTO {OFF|0|ON|1} [, (@<ch_list>)]
[SENSe:]FRESistance:RANGe:AUTO? [({@<ch_list>})]

[SENSe:]FRESistance:RESolution {<resolution>|MIN|MAX|DEF} [, (@<ch_list>)]
[SENSe:]FRESistance:RESolution? [({@<ch_list>})|MIN|MAX]
```



Current Configuration Commands

DC Current Configuration

```
CONFigure:CURREnt[:DC] [{<range>|AUTO|MIN|MAX|DEF} [, {<resolution>|MIN|MAX|DEF}] , ] [({@<ch_list>})]
CONFigure? [({@<ch_list>})]

[SENSe:]CURREnt[:DC]:APERture {<seconds>|MIN|MAX|DEF} [, (@<ch_list>)]
[SENSe:]CURREnt[:DC]:APERture? [({@<ch_list>})|MIN|MAX]

[SENSe:]CURREnt[:DC]:APERture:ENABLEd? [({@<ch_list>})]

[SENSe:]CURREnt[:DC]:NPLC {<PLCs>|MIN|MAX|DEF} [, (@<ch_list>)]
[SENSe:]CURREnt[:DC]:NPLC? [({@<ch_list>})|MIN|MAX]
```

```
[SENSe:]CURRent[:DC]:RANGe {<range>|MIN|MAX|DEF} [, (@<ch_list>)]
[SENSe:]CURRent[:DC]:RANGe? [({@<ch_list>})|MIN|MAX]

[SENSe:]CURRent[:DC]:RANGe:AUTO {OFF|0|ON|1} [, (@<ch_list>)]
[SENSe:]CURRent[:DC]:RANGe:AUTO? [({@<ch_list>})]

[SENSe:]CURRent[:DC]:RESolution {<resolution>|MIN|MAX|DEF} [, (@<ch_list>)]
[SENSe:]CURRent[:DC]:RESolution? [({@<ch_list>})|MIN|MAX]

[SENSe:]CURRent[:DC]:ZERO:AUTO {OFF|0|ON|1} [, (@<ch_list>)]
[SENSe:]CURRent[:DC]:ZERO:AUTO? [({@<ch_list>})]
```

AC Current Configuration

```
CONFigure:CURRent:AC [{<range>|AUTO|MIN|MAX|DEF} [{<resolution>|MIN|MAX|DEF}] , ] [({@<ch_list>})]
CONFigure? [({@<ch_list>})]

[SENSe:]CURRent:AC:BANDwidth {3|20|200|MIN|MAX|DEF} [, (@<ch_list>)]
[SENSe:]CURRent:AC:BANDwidth? [({@<ch_list>})|MIN|MAX]

[SENSe:]CURRent:AC:RANGe {<range>|MIN|MAX|DEF} [, (@<ch_list>)]
[SENSe:]CURRent:AC:RANGe? [({@<ch_list>})|MIN|MAX]

[SENSe:]CURRent:AC:RANGe:AUTO {OFF|0|ON|1} [, (@<ch_list>)]
[SENSe:]CURRent:AC:RANGe:AUTO? [({@<ch_list>})]
```

Frequency and Period Configuration Commands

Frequency Configuration

```
CONFigure:FREQuency [{<range>|MIN|MAX|DEF} [{<resolution>|MIN|MAX|DEF}] , ] [({@<ch_list>})]
CONFigure? [({@<ch_list>})]

[SENSe:]FREQuency:APERTure {<seconds>|MIN|MAX|DEF} [, (@<ch_list>)]
[SENSe:]FREQuency:APERTure? [({@<ch_list>})|MIN|MAX]

[SENSe:]FREQuency:RANGe:LOWer {<timeout>|MIN|MAX|DEF} [, (@<ch_list>)]
[SENSe:]FREQuency:RANGe:LOWer? [({@<ch_list>})|MIN|MAX]

[SENSe:]FREQuency:VOLTage:RANGe {<voltage_range>|AUTO|MIN|MAX|DEF} [, (@<ch_list>)]
[SENSe:]FREQuency:VOLTage:RANGe? [({@<ch_list>})|MIN|MAX]

[SENSe:]FREQuency:VOLTage:RANGe:AUTO {OFF|0|ON|1} [, (@<ch_list>)]
[SENSe:]FREQuency:VOLTage:RANGe:AUTO? [({@<ch_list>})]
```

Period Configuration

```
CONFigure:PERiod [{<range>|MIN|MAX|DEF} [{<resolution>|MIN|MAX|DEF}] , ] [({@<ch_list>})]
CONFigure? [({@<ch_list>})]

[SENSe:]PERiod:APERTure {<seconds>|MIN|MAX|DEF} [, (@<ch_list>)]
[SENSe:]PERiod:APERTure? [({@<ch_list>})|MIN|MAX]

[SENSe:]PERiod:VOLTage:RANGe {<voltage_range>|MIN|MAX|DEF} [, (@<ch_list>)]
[SENSe:]PERiod:VOLTage:RANGe? [({@<ch_list>})|MIN|MAX]

[SENSe:]PERiod:VOLTage:RANGe:AUTO {OFF|0|ON|1} [, (@<ch_list>)]
[SENSe:]PERiod:VOLTage:RANGe:AUTO? [({@<ch_list>})]
```

Digital I/O and Totalizer Configuration Commands

Digital I/O Configuration

CONFigure:DiGital {BYTE|1|WORD|2|LWORD|4}, [<voltage>], [{NORMal|INVerted}], (@<ch_list>)

CONFigure:DiGital:DiRection {INPut|0|OUTPut|1}, (@<ch_list>)

CONFigure:DiGital:DiRection? (@<ch_list>)

CONFigure:DiGital:HANdshake SYNChronous, [<thresh_voltage>, [<level_voltage>, [<polarity>]]] (@<ch_list>)

CONFigure:DiGital:HANdshake:CTIME {<seconds>|MIN|MAX|DEF}, (@<ch_list>)

CONFigure:DiGital:HANdshake:CTIME? [{MIN|MAX}], (@<ch_list>)

CONFigure:DiGital:HANdshake:DRive {ACTive|OCOLlector}, (@<ch_list>)

CONFigure:DiGital:HANdshake:DRive? (@<ch_list>)

CONFigure:DiGital:HANdshake:POLarity {NORMal|INVerted}, [{H0|0|H1|1|H2|2|ALL}], (@<ch_list>)

CONFigure:DiGital:HANdshake:POLarity? {H0|0|H1|1|H2|2}, (@<ch_list>)

CONFigure:DiGital:HANdshake:RATE {<frequency>|MIN|MAX|DEF}, (@<ch_list>)

CONFigure:DiGital:HANdshake:RATE? [{MIN|MAX}], (@<ch_list>)

CONFigure:DiGital:HANdshake:STATe {HIMPedance|OFF|ON}, (@<ch_list>)

CONFigure:DiGital:HANdshake:STATe? (@<ch_list>)

CONFigure:DiGital:HANdshake:SYNChronous:STRobe[:SOURce] {INTernal|EXTernal}, (@<ch_list>)

CONFigure:DiGital:HANdshake:SYNChronous:STRobe[:SOURce]? (@<ch_list>)

CONFigure:DiGital:INTerrupt:POLarity {NORMal|INVerted}, (@<ch_list>)

CONFigure:DiGital:INTerrupt:POLarity? (@<ch_list>)

CONFigure:DiGital:POLarity {NORMal|INVerted}, (@<ch_list>)

CONFigure:DiGital:POLarity? (@<ch_list>)

CONFigure:DiGital:WIDTh {BYTE|1|WORD|2|LWORD|4}, (@<ch_list>)

CONFigure:DiGital:WIDTh? (@<ch_list>)

[SENSe:]DiGital:DATA[:{BYTE|1|WORD|2|LWORD|4}]? [{DECimal|BINary|HEXadecimal|OCTal}], (@<ch_list>)

[SENSe:]DiGital:DATA:BIT? <bit>, (@<ch_list>)

[SENSe:]DiGital:HANdshake:THReshold {<voltage>|MIN|MAX|DEF}, (@<ch_list>)

[SENSe:]DiGital:HANdshake:THReshold? [{MIN|MAX}], (@<ch_list>)

[SENSe:]DiGital:INTerrupt[:ENABLE] {OFF|0|ON|1}, (@<ch_list>)

[SENSe:]DiGital:INTerrupt[:ENABLE]? (@<ch_list>)

[SENSe:]DiGital:INTerrupt:MODE {MFUL|COMPare}, (@<ch_list>)

[SENSe:]DiGital:INTerrupt:MODE? (@<ch_list>)

[SENSe:]DiGital:INTerrupt:STATus? (@<ch_list>)

SOURce:DiGital:DATA[:{BYTE|1|WORD|2|LWORD|4}] <data>, (@<ch_list>)

SOURce:DiGital:DATA[:{BYTE|1|WORD|2|LWORD|4}]? [{DECimal|BINary|HEXadecimal|OCTal}], (@<ch_list>)

SOURce:DiGital:DATA:BIT {0|1}, <bit>, (@<ch_list>)

SOURce:DiGital:DATA:BIT? <bit>, (@<ch_list>)

SOURce:DiGital:DRive {ACTive|OCOLlector}, (@<ch_list>)

SOURce:DiGital:DRive? (@<ch_list>)

SOURce:DiGital:HANdshake:LEVel {<voltage>|MIN|MAX|DEF}, (@<ch_list>)

SOURce:DiGital:HANdshake:LEVel? [{MIN|MAX}], (@<ch_list>)

SOURce:DiGital:INTErrupt[:ENABle] {OFF|0|ON|1}, (@<ch_list>)
 SOURce:DiGital:INTErrupt[:ENABle]? (@<ch_list>)

 [SENSe:]DiGital:INTErrupt:MODE {START|STOP|GATE}, (@<ch_list>)
 [SENSe:]DiGital:INTErrupt:MODE? (@<ch_list>)

 [SENSe:]DiGital:MEMory:CLEar (@<ch_list>)

 [SENSe:]DiGital:MEMory:COMPare:ACTIon {CONTinue|START|STOP}, (@<ch_list>)
 [SENSe:]DiGital:MEMory:COMPare:ACTIon? (@<ch_list>)

 [SENSe:]DiGital:MEMory[:DATA]? <index>, <count>, (@<channel>)

 [SENSe:]DiGital:MEMory[:DATA]:ALL? (@<channel>)

 [SENSe:]DiGital:MEMory[:DATA]:FORMat {LIST|BLOCK}
 [SENSe:]DiGital:MEMory[:DATA]:FORMat?

 [SENSe:]DiGital:MEMory[:DATA]:POINts? [MAX,] (@<ch_list>)

 [SENSe:]DiGital:MEMory:ENABle {OFF|0|ON|1}, (@<ch_list>)
 [SENSe:]DiGital:MEMory:ENABle? (@<ch_list>)

 [SENSe:]DiGital:MEMory:MATCH[:DATA]? (@<ch_list>)

 [SENSe:]DiGital:MEMory:SAMPle:COUNT {<count>|MIN|MAX|DEF|INFinity}, (@<ch_list>)

 [SENSe:]DiGital:MEMory:STARt (@<ch_list>)

 [SENSe:]DiGital:MEMory:STEP (@<ch_list>)

 [SENSe:]DiGital:MEMory:STOP (@<ch_list>)

 SOURce:DiGital:MEMory:TRACe <name>, (@<channel>)
 SOURce:DiGital:MEMory:TRACe? (@<channel>)

 [SENSe:]DiGital:THREshold {<voltage>|MIN|MAX|DEF}, (@<ch_list>)
 [SENSe:]DiGital:THREshold? [{MIN|MAX},] (@<ch_list>)

 SOURce:DiGital:LEVel {<voltage>|MIN|MAX|DEF}, (@<ch_list>)
 SOURce:DiGital:LEVel? [{MIN|MAX},] (@<ch_list>)

 SOURce:DiGital:MEMory:ABORt (@<ch_list>)

 SOURce:DiGital:MEMory:ENABle {OFF|0|ON|1}, (@<ch_list>)
 SOURce:DiGital:MEMory:ENABle? (@<ch_list>)

 SOURce:DiGital:MEMory:NCYCles {<count>|MIN|MAX|DEF|INFinity}, (@<ch_list>)
 SOURce:DiGital:MEMory:NCYCles? [{MIN|MAX},] (@<ch_list>)

 SOURce:DiGital:MEMory:STARt (@<ch_list>)

 SOURce:DiGital:MEMory:STEP (@<ch_list>)

 SOURce:DiGital:MEMory:STOP (@<ch_list>)

 SOURce:DiGital:STATe {OFF|0|ON|1}, (@<ch_list>)
 SOURce:DiGital:STATe? (@<ch_list>)

Trace Pattern Configuration

TRACe:CATalog? {(@<channel>)|<slot>}

 TRACe[:DATA]:DiGital[:BYTE|1|WORD|2|LWORD|4]] (@<channel>), <name>, {<binary_block>|<value>, <value> [, <value>, ...]}

 TRACe[:DATA]:DiGital:FUNCTion (@<channel>), {COUNT|WONes}, <name>, <points>

 TRACe:DELeTe:ALL {(@<channel>)|<slot>}

TRACe:DELeT[:NAME] {(@<channel>)|<slot>}, <name>

TRACe:FREE? {(@<channel>)|<slot>}

TRACe:POINtS? {(@<channel>)|<slot>}, <name>

Digital Input Pattern Comparison

CALCulate:COMParE:DATA[:{BYTE|1|WORD|2|LWORD|4}] <data>, (@<ch_list>)

CALCulate:COMParE:DATA? (@<ch_list>)

CALCulate:COMParE:MASK[:{BYTE|1|WORD|2|LWORD|4}] <data>, (@<ch_list>)

CALCulate:COMParE:MASK? (@<ch_list>)

CALCulate:COMParE:STATe {OFF|0|ON|1}, (@<ch_list>)

CALCulate:COMParE:STATe? (@<ch_list>)

CALCulate:COMParE:TYPE {EQUal|NEQual}, (@<ch_list>)

CALCulate:COMParE:TYPE? (@<ch_list>)

[SENSe:]DIGital:MEMory:COMParE:ACtion {CONTinue|START|STOP}, (@<ch_list>)

[SENSe:]DIGital:MEMory:COMParE:ACtion? (@<ch_list>)

[SENSe:]DIGital:MEMory:MATCH[:DATA]? (@<ch_list>)

Totalizer Configuration

CONFigure:COUNter:DCYCLE [{<gate_time>|MIN|MAX|DEF},] (@<ch_list>)

CONFigure:COUNter:FREQuency [{<gate_time>|MIN|MAX|DEF},] (@<ch_list>)

CONFigure:COUNter:PERiod [{<gate_time>|MIN|MAX|DEF},] (@<ch_list>)

CONFigure:COUNter:PWIDth [{<gate_time>|MIN|MAX|DEF},] (@<ch_list>)

CONFigure:COUNter:TOTalize [{READ|RRESet},] (@<ch_list>)

CONFigure:TOTalize [{READ|RRESet},] (@<ch_list>)

MEASure:COUNter:DCYCLE? [{<gate_time>|MIN|MAX|DEF},] (@<ch_list>)

MEASure:COUNter:FREQuency? [{<gate_time>|MIN|MAX|DEF},] (@<ch_list>)

MEASure:COUNter:PERiod? [{<gate_time>|MIN|MAX|DEF},] (@<ch_list>)

MEASure:COUNter:PWIDth? [{<gate_time>|MIN|MAX|DEF},] (@<ch_list>)

MEASure:COUNter:TOTalize? [{READ|RRESet},] (@<ch_list>)

[SENSe:]COUNter:ABORT (@<ch_list>)

[SENSe:]COUNter:DATA? (@<ch_list>)

[SENSe:]COUNter:FREQuency[:DATA]? (@<ch_list>)

[SENSe:]COUNter:FUNCTion {FREQuency|PERiod|DCYCLE|PWIDth|TOTalize}, (@<ch_list>)

[SENSe:]COUNter:FUNCTion? (@<ch_list>)

[SENSe:]COUNter:GATE:POLarity {NORMal|INVerted}, (@<ch_list>)

[SENSe:]COUNter:GATE:POLarity? (@<ch_list>)

[SENSe:]COUNter:GATE:SOURce {INTernal|EXTernal}, (@<ch_list>)

[SENSe:]COUNter:GATE:SOURce? (@<ch_list>)

[SENSe:]COUNter:GATE:TIME[:INTernal] {<time>|MIN|MAX|DEF}, (@<ch_list>)

[SENSe:]COUNter:GATE:TIME[:INTernal]? [{MIN|MAX},] (@<ch_list>)

[SENSe:]COUNter:INITiate (@<ch_list>)
 [SENSe:]COUNter:PERiod[:DATA]? (@<ch_list>)
 [SENSe:]COUNter:PWIDth[:DATA]? (@<ch_list>)
 [SENSe:]COUNter:SLOPe {NEGative|POSitive}, (@<ch_list>)
 [SENSe:]COUNter:SLOPe? (@<ch_list>)
 [SENSe:]COUNter:THReshold:VOLTage {<voltage>|MIN|MAX|DEF}, (@<ch_list>)
 [SENSe:]COUNter:THReshold:VOLTage? [{MIN|MAX},] (@<ch_list>)
 [SENSe:]COUNter:TOTalize:CLEar:IMMediate (@<ch_list>)
 [SENSe:]COUNter:TOTalize[:DATA]? (@<ch_list>)
 [SENSe:]COUNter:TOTalize:TYPE {READ|RRESet}, (@<ch_list>)
 [SENSe:]COUNter:TOTalize:TYPE? (@<ch_list>)
 [SENSe:]MODule:COUNter:GATE:THReshold[:VOLTage] {<voltage>|MIN|MAX|DEF}, {1|2|3|4|5|6|7|8}
 [SENSe:]MODule:COUNter:GATE:THReshold[:VOLTage]? [{MIN|MAX},] {1|2|3|4|5|6|7|8}
 [SENSe:]TOTalize:CLEar:IMMediate (@<ch_list>)
 [SENSe:]TOTalize:DATA? (@<ch_list>)
 [SENSe:]TOTalize:SLOPe {NEGative|POSitive}, (@<ch_list>)
 [SENSe:]TOTalize:SLOPe? (@<ch_list>)
 [SENSe:]TOTalize:THReshold[:MODE] {AC|TTL}, (@<ch_list>)
 [SENSe:]TOTalize:THReshold[:MODE]? (@<ch_list>)
 [SENSe:]TOTalize:THReshold:VOLTage {<voltage>|MIN|MAX|DEF}, (@<ch_list>)
 [SENSe:]TOTalize:THReshold:VOLTage? [{MIN|MAX},] (@<ch_list>)
 [SENSe:]TOTalize:TYPE {READ|RRESet}, (@<ch_list>)
 [SENSe:]TOTalize:TYPE? (@<ch_list>)

External Clock Output Configuration

SOURce:MODule:CLOCK:FREQuency {<frequency>|MIN|MAX|DEF}, {1|2|3|4|5|6|7|8}
 SOURce:MODule:CLOCK:FREQuency? [{MIN|MAX},] {1|2|3|4|5|6|7|8}
 SOURce:MODule:CLOCK:LEVel {<voltage>|MIN|MAX|DEF}, <slot>
 SOURce:MODule:CLOCK:LEVel? [{MIN|MAX},] <slot>
 SOURce:MODule:CLOCK:STATe {OFF|0|ON|1}, {1|2|3|4|5|6|7|8}
 SOURce:MODule:CLOCK:STATe? {1|2|3|4|5|6|7|8}



DAC Configuration Commands

OUTPut[:STATe] {OFF|0|ON|1}, (@<ch_list>)
 OUTPut[:STATe]? (@<ch_list>)
 SOURce:CURREnt[:LEVel] {<current>|MIN|MAX|DEF}, (@<ch_list>)
 SOURce:CURREnt[:LEVel]? [{MIN|MAX},] (@<ch_list>)
 SOURce:FUNCTion:TRIGger:SOURce {IMMediate|MANual|EXTernal}, (@<ch_list>)
 SOURce:FUNCTion:TRIGger:SOURce? (@<ch_list>)

SOURce:MODE {VOLTage|CURRent}, (@<ch_list>)
 SOURce:MODE? (@<ch_list>)

 SOURce:MODule:CLOCK:FREQuency {<frequency>|MIN|MAX|DEF}, {1|2|3|4|5|6|7|8}
 SOURce:MODule:CLOCK:FREQuency? [{MIN|MAX},] {1|2|3|4|5|6|7|8}

 SOURce:MODule:CLOCK:STATe {OFF|0|ON|1}, {1|2|3|4|5|6|7|8}
 SOURce:MODule:CLOCK:STATe? {1|2|3|4|5|6|7|8}

 SOURce:MODule:TRIGger:EXTernal:IMMediate {1|2|3|4|5|6|7|8}

 SOURce:MODule:TRIGger:OUTPut {OFF|0|ON|1}, {1|2|3|4|5|6|7|8}
 SOURce:MODule:TRIGger:OUTPut? {1|2|3|4|5|6|7|8}

 SOURce:VOLTage[:LEVel] {<voltage>|MIN|MAX|DEF}, (@<ch_list>)
 SOURce:VOLTage[:LEVel]? [{MIN|MAX},] (@<ch_list>)

Trace Waveform Configuration

SOURce:FUNCTion:CLOCK:EXTernal:DIVisor {<value>|MIN|MAX|DEF}, (@<ch_list>)
 SOURce:FUNCTion:CLOCK:EXTernal:DIVisor? [{MIN|MAX},] (@<ch_list>)

 SOURce:FUNCTion:CLOCK:SOURce {INTERNAL|EXTERNAL|STEP}, (@<ch_list>)
 SOURce:FUNCTion:CLOCK:SOURce? (@<ch_list>)

 SOURce:FUNCTion:CURRent:GAIN {<gain>|MIN|MAX|DEF}, (@<ch_list>)
 SOURce:FUNCTion:CURRent:GAIN? [{MIN|MAX},] (@<ch_list>)

 SOURce:FUNCTion:CURRent:OFFSet {<offset>|MIN|MAX|DEF}, (@<ch_list>)
 SOURce:FUNCTion:CURRent:OFFSet? [{MIN|MAX},] (@<ch_list>)

 SOURce:FUNCTion:ENABLE {OFF|0|ON|1}, (@<ch_list>)
 SOURce:FUNCTion:ENABLE? (@<ch_list>)

 SOURce:FUNCTion:FREQuency {<frequency>|MIN|MAX|DEF}, (@<ch_list>)
 SOURce:FUNCTion:FREQuency? [{MIN|MAX},] (@<ch_list>)

 SOURce:FUNCTion:HALT (@<ch_list>)

 SOURce:FUNCTion:SAMPlE:PERiod {<period>|MIN|MAX|DEF}, (@<ch_list>)
 SOURce:FUNCTion:SAMPlE:PERiod? [{MIN|MAX},] (@<ch_list>)

 SOURce:FUNCTion:TRACe:NCYCles {<count>|MIN|MAX|DEF|INFinity}, (@<ch_list>)
 SOURce:FUNCTion:TRACe:NCYCles? [{MIN|MAX},] (@<ch_list>)

 SOURce:FUNCTion:TRACe:SINDex <point>, (@<ch_list>)
 SOURce:FUNCTion:TRACe:SINDex? (@<ch_list>)

 SOURce:FUNCTion:TRACe[:NAME] <name>, (@<ch_list>)
 SOURce:FUNCTion:TRACe[:NAME]? (@<ch_list>)

 SOURce:FUNCTion:TRIGger:IMMediate (@<ch_list>)

 SOURce:FUNCTion:VOLTage:GAIN {<gain>|MIN|MAX|DEF}, (@<ch_list>)
 SOURce:FUNCTion:VOLTage:GAIN? [{MIN|MAX},] (@<ch_list>)

 SOURce:FUNCTion:VOLTage:OFFSet {<offset>|MIN|MAX|DEF}, (@<ch_list>)
 SOURce:FUNCTion:VOLTage:OFFSet? [{MIN|MAX},] (@<ch_list>)

 TRACe:CATalog? {(@<channel>)|<slot>}

 TRACe:DELeTe:ALL {(@<channel>)|<slot>}

 TRACe:DELeTe[:NAME] {(@<channel>)|<slot>}, <name>

 TRACe:FREE? {(@<channel>)|<slot>}

TRACe:POINts? {(@<channel>)|<slot>}, <name>
 TRACe[:DATA] {1|2|3|4|5|6|7|8}, <name>, {<binary_block>|<value>, <value> [, <value>, ...]}
 TRACe[:DATA]:DAC {1|2|3|4|5|6|7|8}, <name>, {<binary_block>|<value>, <value> [, <value>, ...]}
 TRACe[:DATA]:FUNctIon {1|2|3|4|5|6|7|8}, <type>, <name>, <points>

Monitor Commands

ROUTe:MONitor:DATA?
 ROUTe:MONitor:MODE {CHANnel|DMM}
 ROUTe:MONitor:MODE?
 ROUTe:MONitor:STATe {OFF|0|ON|1}
 ROUTe:MONitor:STATe?
 ROUTe:MONitor[:CHANnel] (@<channel>)
 ROUTe:MONitor[:CHANnel]?
 ROUTe:MONitor[:CHANnel]:ENABLE {OFF|0|ON|1}, (@<ch_list>)
 ROUTe:MONitor[:CHANnel]:ENABLE? (@<ch_list>)



Scan Configuration Commands

ABORT
 INITiate
 FORMat:BORDer {NORMal|SWAPped}
 FORMat:BORDer?
 FORMat:READing:ALARm {OFF|0|ON|1}
 FORMat:READing:ALARm?
 FORMat:READing:CHANnel {OFF|0|ON|1}
 FORMat:READing:CHANnel?
 FORMat:READing:TIME {OFF|0|ON|1}
 FORMat:READing:TIME?
 FORMat:READing:TIME:TYPE {ABSolute|RELative}
 FORMat:READing:TIME:TYPE?
 FORMat:READing:UNIT {OFF|0|ON|1}
 FORMat:READing:UNIT?
 READ? [(@<ch_list>)]
 ROUTe:CHANnel:ADVance:SOURce <source>
 ROUTe:CHANnel:ADVance:SOURce?
 ROUTe:CHANnel:DELay {<seconds>|MIN|MAX|DEF}, (@<ch_list>)
 ROUTe:CHANnel:DELay? [{MIN|MAX},] (@<ch_list>)
 ROUTe:CHANnel:DELay:AUTO {OFF|0|ON|1}, (@<ch_list>)
 ROUTe:CHANnel:DELay:AUTO? (@<ch_list>)

ROUTe:CHANnel:FWIRe <mode>, (@<ch_list>)
 ROUTe:CHANnel:FWIRe? (@<ch_list>)

 ROUTe:SCAN (@<scan_list>)
 ROUTe:SCAN?

 ROUTe:SCAN:ADD (@<ch_list>)

 ROUTe:SCAN:REMOve (@<ch_list>)

 ROUTe:SCAN:ORDer {OFF|0|ON|1}
 ROUTe:SCAN:ORDer?

 ROUTe:SCAN:SIZE?

 SAMPlE:COUNt {<count>|MIN|MAX|DEF}
 SAMPlE:COUNt? [{MIN|MAX}]

 SWEEp:COUNt {<count>|MIN|MAX|DEF}
 SWEEp:COUNt? [{MIN|MAX}]

 TRIGger:COUNt {<count>|MIN|MAX|DEF|INFinity}
 TRIGger:COUNt? [{MIN|MAX}]

 TRIGger:SOURce {IMMediate|BUS|EXTeRnal|ALARm1|ALARm2|ALARm3|ALARm4|TImEr}
 TRIGger:SOURce?

 TRIGger:SOURce:ALARm[:MODE] {SINGle|CONTInuous}
 TRIGger:SOURce:ALARm[:MODE]?

 TRIGger:TImEr {<seconds>|MIN|MAX|DEF}
 TRIGger:TImEr? [{MIN|MAX}]

Switch Control Commands

ROUTe:CHANnel:DRIVE:CLOSe:DEFault (@<ch_list>)
 ROUTe:CHANnel:DRIVE:CLOSe:DEFault? (@<ch_list>)

 ROUTe:CHANnel:DRIVE:OPEN:DEFault (@<ch_list>)
 ROUTe:CHANnel:DRIVE:OPEN:DEFault? (@<ch_list>)

 ROUTe:CHANnel:DRIVE:PAIRed[:MODE] {OFF|0|ON|1}, (@<ch_list>)
 ROUTe:CHANnel:DRIVE:PAIRed[:MODE]? (@<ch_list>)

 ROUTe:CHANnel:DRIVE:PULSe[:MODE] {OFF|0|ON|1}, (@<ch_list>)
 ROUTe:CHANnel:DRIVE:PULSe[:MODE]? (@<ch_list>)

 ROUTe:CHANnel:DRIVE:PULSe:WIDTh {<seconds>|MIN|MAX|DEF}, (@<ch_list>)
 ROUTe:CHANnel:DRIVE:PULSe:WIDTh? [{MIN|MAX},] (@<ch_list>)

 ROUTe:CHANnel:DRIVE:STATe? (@<ch_list>)

 ROUTe:CHANnel:DRIVE:TIME:RECOvery {<seconds>|MIN|MAX|DEF}, (@<ch_list>)
 ROUTe:CHANnel:DRIVE:TIME:RECOvery? [{MIN|MAX},] (@<ch_list>)

 ROUTe:CHANnel:DRIVE:TIME:SETTle {<seconds>|MIN|MAX|DEF}, (@<ch_list>)
 ROUTe:CHANnel:DRIVE:TIME:SETTle? [{MIN|MAX},] (@<ch_list>)

 ROUTe:CHANnel:LABel:CLEar:MODule {1-8|SLOT1-SLOT8|ALL}

 ROUTe:CHANnel:LABel[:DEFine] "<label>", (@<ch_list>)
 ROUTe:CHANnel:LABel[:DEFine]? [<type>,] (@<ch_list>)

 ROUTe:CHANnel:VERify[:ENABLE] {OFF|0|ON|1}, (@<ch_list>)
 ROUTe:CHANnel:VERify[:ENABLE]? (@<ch_list>)

ROUTe:CHANnel:VERify:POLarity {NORMal|INVerted}, (@<ch_list>)
 ROUTe:CHANnel:VERify:POLarity? (@<ch_list>)
 ROUTe:CHANnel:VERify:POSition:STATe? (@<ch_list>)
 ROUTe:CLOSe (@<ch_list>)
 ROUTe:CLOSe? (@<ch_list>)
 ROUTe:CLOSe:EXCLusive (@<ch_list>)
 ROUTe:CLOSe:PAIR (@<ch_list>)
 ROUTe:CLOSe:PAIR? (@<ch_list>)
 ROUTe:MODule:BUSY? {1-8|SLOT1-SLOT8|ANY}
 ROUTe:MODule:WAIT {1-8|SLOT1-SLOT8|ANY}
 ROUTe:MODule:WAIT? {1-8|SLOT1-SLOT8|ANY}
 ROUTe:OPEN (@<ch_list>)
 ROUTe:OPEN? (@<ch_list>)
 ROUTe:OPEN:ABUS [{<abus>|ALL}]
 ROUTe:OPEN:ALL [{1-8|SLOT1-SLOT8|ALL}]
 ROUTe:OPEN:PAIR (@<ch_list>)
 ROUTe:OPEN:PAIR? (@<ch_list>)
 ROUTe:OPERation:OVERlap[:ENABLE] {OFF|0|ON|1}
 ROUTe:OPERation:OVERlap[:ENABLE]?
 ROUTe:RMODule:BANK:DRIVE[:MODE] {TTL|OCOLlector}, {1-4|BANK1-BANK4|ALL}, (@<rem_ch_list>)
 ROUTe:RMODule:BANK:DRIVE[:MODE]? {1-4|BANK1-BANK4}, (@<rem_ch_list>)
 ROUTe:RMODule:BANK:LED:DRIVE[:ENABLE] {OFF|0|ON|1}, {1-4|BANK1-BANK4|ALL}, (@<rem_ch_list>)
 ROUTe:RMODule:BANK:LED:DRIVE[:ENABLE]? {1-4|BANK1-BANK4}, (@<rem_ch_list>)
 ROUTe:RMODule:BANK:LED:DRIVE:LEVel {<amps>|MIN|MAX|DEF}, {1-4|BANK1-BANK4|ALL}, (@<rem_ch_list>)
 ROUTe:RMODule:BANK:LED:DRIVE:LEVel? {1-4|BANK1-BANK4}, (@<rem_ch_list>)
 ROUTe:RMODule:BANK:PRESet {1-4|BANK1-BANK4|ALL}, (@<rem_ch_list>)
 ROUTe:RMODule:DRIVE:LIMit {<max_drives>|MIN|MAX|DEF}, (@<rem_ch_list>)
 ROUTe:RMODule:DRIVE:LIMit? [{MIN|MAX},] (@<rem_ch_list>)
 ROUTe:RMODule:DRIVE:SOURce:BOOT {OFF|INTernal|EXTernal}, (@<rem_ch_list>)
 ROUTe:RMODule:DRIVE:SOURce:BOOT? (@<rem_ch_list>)
 ROUTe:RMODule:DRIVE:SOURce[:IMMediate] {OFF|INTernal|EXTernal}, (@<rem_ch_list>)
 ROUTe:RMODule:DRIVE:SOURce[:IMMediate]? (@<rem_ch_list>)
 SYSTem:CDEscription? {1|2|3|4|5|6|7|8}
 SYSTem:CDEscription:RMODule? (@<rem_ch>) [,{DISTribution1-DISTribution4}]
 SYSTem:CPON {1|2|3|4|5|6|7|8}
 SYSTem:CTYPe? {1|2|3|4|5|6|7|8}
 SYSTem:CTYPe:RMODule? (@<rem_ch>) [,{DISTribution1-DISTribution4}]
 SYSTem:MODule:PFAil:JUMPer:AMP5? {1|2|3|4|5|6|7|8} (34937A/938A only)
 SYSTem:MODule:ROW:PROTection <slot>, <mode>
 SYSTem:MODule:ROW:PROTection? <slot>
 SYSTem:MODule:ROW:PROTection DEFault, <mode>
 SYSTem:MODule:ROW:PROTection? DEFault

SYSTem:MODUle:TERMinal:TYPE? <slot>
 SYSTem:MODUle:TEMPerature? [{TRANsducer|TTHReshold}], {1|2|3|4|5|6|7|8} (34937A/938A only)
 SYSTem:MODUle:WIRE:MODE {WIRE1|WIRE2}, {1|2|3|4|5|6|7|8} (34923A/925A/933A only)
 SYSTem:RMODUle:RESet {1|2|3|4|5|6|7|8}
 SYSTem:RMODUle:STATus? {1|2|3|4|5|6|7|8}

Sequence Operation Commands

ROUTe:SEQuence:ABORt
 ROUTe:SEQuence:BUSY?
 ROUTe:SEQuence:CATalog?
 ROUTe:SEQuence:DEFine <name>, "<commands>"
 ROUTe:SEQuence:DEFine? <name>
 ROUTe:SEQuence:DELeTe:ALL
 ROUTe:SEQuence:DELeTe[:NAME] <name>
 ROUTe:SEQuence:RUNNing:NAME?
 ROUTe:SEQuence:TRIGger[:IMMediate] <name>
 ROUTe:SEQuence:TRIGger:SOURce <name>, {ALARm1|ALARm2|ALARm3|ALARm4|MANual}
 ROUTe:SEQuence:TRIGger:SOURce? <name>
 ROUTe:SEQuence:WAIT

Triggering Commands

*TRG
 INITiate
 READ? [{@<ch_list>}]
 TRIGger:COUNt {<count>|MIN|MAX|DEF|INFinity}
 TRIGger:COUNt? [{MIN|MAX}]
 TRIGger:DELaY {<seconds>|MIN|MAX}
 TRIGger:DELaY? [{MIN|MAX}]
 TRIGger:DELaY:AUTO {OFF|0|ON|1}
 TRIGger:DELaY:AUTO?
 TRIGger:SOURce {IMMediate|BUS|EXTErnal|TIMer}
 TRIGger:SOURce?
 TRIGger:TIMer {<seconds>|MIN|MAX|DEF}
 TRIGger:TIMer? [{MIN|MAX}]

Alarm Limit Commands

CALCulate:LIMit:LOWer {<value>|MIN|MAX|DEF}, (@<ch_list>)
 CALCulate:LIMit:LOWer? [{MIN|MAX},] (@<ch_list>)

CALCulate:LIMit:LOWer:STATe {OFF|0|ON|1}, (@<ch_list>)
 CALCulate:LIMit:LOWer:STATe? (@<ch_list>)
 CALCulate:LIMit:UPPer {<value>|MIN|MAX|DEF}, (@<ch_list>)
 CALCulate:LIMit:UPPer? [{MIN|MAX},] (@<ch_list>)
 CALCulate:LIMit:UPPer:STATe {OFF|0|ON|1}, (@<ch_list>)
 CALCulate:LIMit:UPPer:STATe? (@<ch_list>)
 OUTPut:ALARm{1|2|3|4}:CLEar
 OUTPut:ALARm:CLEar:ALL
 OUTPut:ALARm:MODE {LATCh|TRACk}
 OUTPut:ALARm:MODE?
 OUTPut:ALARm{1|2|3|4}:SEQUence?
 OUTPut:ALARm:SLOPe {NEGative|POSitive}
 OUTPut:ALARm:SLOPe?
 OUTPut:ALARm{1|2|3|4}:SOURce (@<ch_list>)
 OUTPut:ALARm{1|2|3|4}:SOURce?
 SYSTem:ALARm?

Measurement Statistics Commands

CALCulate:AVERage:AVERage? [(@<ch_list>)]
 CALCulate:AVERage:CLEar [(@<ch_list>)]
 CALCulate:AVERage:COUNt? [(@<ch_list>)]
 CALCulate:AVERage:MAXimum? [(@<ch_list>)]
 CALCulate:AVERage:MAXimum:TIME? [(@<ch_list>)]
 CALCulate:AVERage:MINimum? [(@<ch_list>)]
 CALCulate:AVERage:MINimum:TIME? [(@<ch_list>)]
 CALCulate:AVERage:PTPeak? [(@<ch_list>)]
 DATA:LAST? [,@<channel>)]

Reading Memory Commands

DATA:POINts:EVENT:THReshold <num_readings>
 DATA:POINts:EVENT:THReshold?
 DATA:POINts?
 DATA:REMOve? <num_readings>
 FETCH?
 R? [<max_count>]
 SYSTem:TIME:SCAN?

Mx+B Scaling Commands

```
CALCulate:SCALE:GAIN <gain> [, (@<ch_list>)]  
CALCulate:SCALE:GAIN? (@<ch_list>)  
  
CALCulate:SCALE:OFFSet <offset> [, (@<ch_list>)]  
CALCulate:SCALE:OFFSet? (@<ch_list>)  
  
CALCulate:SCALE:STATe {OFF|0|ON|1} [, (@<ch_list>)]  
CALCulate:SCALE:STATe? [(@<ch_list>)]  
  
CALCulate:SCALE:UNIT "<units>" [, (@<ch_list>)]  
CALCulate:SCALE:UNIT? [(@<ch_list>)]
```

Calibration Commands

```
CALibration?  
CALibration:ABORt  
CALibration:BEGin[:VOLTage] [<setup_#>, ] (@<channel>)  
CALibration:COUNt? [{1-8|SLOT1-SLOT8|MAINframe|DMM}]  
CALibration:LFRequency {50|60|400}  
CALibration:LFRequency?  
CALibration:MODule? [{1-8|SLOT1-SLOT8|ALL}]  
CALibration:POINt? <value>  
CALibration:SECure:CODE <new_code>  
CALibration:SECure:STATe {OFF|0|ON|1}, <code>  
CALibration:SECure:STATe?  
CALibration:STRing "<string>" [{1-8|SLOT1-SLOT8|MAINframe|DMM}]  
CALibration:STRing? [{1-8|SLOT1-SLOT8|MAINframe|DMM}]  
CALibration:VALue <value>  
CALibration:VALue?
```

State Storage Commands

```
*RCL {1|2|3|4|5}  
*SAV {1|2|3|4|5}  
MEMory:NSTates?  
MEMory:STATe:CATalog?  
MEMory:STATe:DELeTe {1|2|3|4|5}  
MEMory:STATe:DELeTe:ALL  
MEMory:STATe:NAME {1|2|3|4|5} [, <name>]  
MEMory:STATe:NAME? {1|2|3|4|5}
```

MEMory:STATe:RECall:AUTO {OFF|0|ON|1}
MEMory:STATe:RECall:AUTO?

MEMory:STATe:RECall:SElect {0|1|2|3|4|5}
MEMory:STATe:RECall:SElect?

MEMory:STATe:VALid? {1|2|3|4|5}

IEEE-488 Commands

*CLS

*ESE <enable_value>
*ESE?

*ESR?

*IDN?

*OPC

*OPC?

*RCL {1|2|3|4|5}

*RST

*SAV {1|2|3|4|5}

*SRE <enable_value>
*SRE?

*STB?

*TRG

*TST?

*WAI



System-Related Commands

*IDN?

*RST

*TST?

CALibration:LFRequency {50|60|400}
CALibration:LFRequency?

DISPlay[:STATe] {OFF|0|ON|1}
DISPlay[:STATe]?

DISPlay:TEXT "<string>"
DISPlay:TEXT?

DISPlay:TEXT:CLEar

SYSTem:ABUS:INTERlock:SIMulate {OFF|0|ON|1}
SYSTem:ABUS:INTERlock:SIMulate?

SYSTem:BEEPer
 SYSTem:BEEPer:STATe {OFF|0|ON|1}
 SYSTem:BEEPer:STATe?
 SYSTem:CDEscription? {1|2|3|4|5|6|7|8}
 SYSTem:CDEscription:RMODule? (@<rem_ch>) [{DISTribution1-DISTribution4}]
 SYSTem:CPON {1|2|3|4|5|6|7|8}
 SYSTem:CTYPe? {1|2|3|4|5|6|7|8}
 SYSTem:CTYPe:RMODule? (@<rem_ch>) [{DISTribution1-DISTribution4}]
 SYSTem:DATE <yyyy>,<mm>,<dd>
 SYSTem:DATE?
 SYSTem:DELAy[:IMMediate] <time>
 SYSTem:ERRor?
 SYSTem:PRESet
 SYSTem:SECurity:IMMediate
 SYSTem:TIME <hh>,<mm>,<ss.sss>
 SYSTem:TIME?
 SYSTem:TIME:SCAN?
 SYSTem:VERSion?

Remote Interface Configuration Commands

SYSTem:COMMunicate:ENABle {OFF|0|ON|1}, {GPIB|USB|LAN|SOCKets|TELNet|VXI11|WEB}
 SYSTem:COMMunicate:ENABle? {GPIB|USB|LAN|SOCKets|TELNet|VXI11|WEB}
 SYSTem:COMMunicate:GPIB:ADDReSS <address>
 SYSTem:COMMunicate:GPIB:ADDReSS?
 SYSTem:LOCK:OWNer?
 SYSTem:LOCK:RELease
 SYSTem:LOCK:REQueST?

LAN Configuration Commands

SYSTem:COMMunicate:LAN:AUTOip {OFF|0|ON|1}
 SYSTem:COMMunicate:LAN:AUTOip?
 SYSTem:COMMunicate:LAN:BSTatus?
 SYSTem:COMMunicate:LAN:CONTRol?
 SYSTem:COMMunicate:LAN:DHCP {OFF|0|ON|1}
 SYSTem:COMMunicate:LAN:DHCP?
 SYSTem:COMMunicate:LAN:DNS <address>
 SYSTem:COMMunicate:LAN:DNS?
 SYSTem:COMMunicate:LAN:DOMain "<name>"
 SYSTem:COMMunicate:LAN:DOMain? [{CURRent|STATic}]

SYSTem:COMMunicate:LAN:GATeway <address>
 SYSTem:COMMunicate:LAN:GATeway? [{CURRent|STATic}]

 SYSTem:COMMunicate:LAN:HISTory:CLEar
 SYSTem:COMMunicate:LAN:HISTory?

 SYSTem:COMMunicate:LAN:HOSTname "<name>"
 SYSTem:COMMunicate:LAN:HOSTname? [{CURRent|STATic}]

 SYSTem:COMMunicate:LAN:IPADdress <address>
 SYSTem:COMMunicate:LAN:IPADdress? [{CURRent|STATic}]

 SYSTem:COMMunicate:LAN:KEEPalive {<seconds>|MIN|MAX}
 SYSTem:COMMunicate:LAN:KEEPalive? [{MIN|MAX}]

 SYSTem:COMMunicate:LAN:MAC?

 SYSTem:COMMunicate:LAN:SMASK <mask>
 SYSTem:COMMunicate:LAN:SMASK? [{CURRent|STATic}]

 SYSTem:COMMunicate:LAN:TELNet:PROMpt "<string>"
 SYSTem:COMMunicate:LAN:TELNet:PROMpt?

 SYSTem:COMMunicate:LAN:TELNet:WMESsage "<string>"
 SYSTem:COMMunicate:LAN:TELNet:WMESsage?

Status System Commands

*CLS

 *ESE <enable_value>
 *ESE?

 *ESR?

 *SRE <enable_value>
 *SRE?

 *STB?

 STATus:ALARm:CONDition?

 STATus:ALARm:ENABle <enable_value>
 STATus:ALARm:ENABle?

 STATus:ALARm[:EVENT]?

 STATus:MODule:ENABle <enable_value>
 STATus:MODule:ENABle?

 STATus:MODule:EVENT?

 STATus:MODule:SLOT[n]:CONDition?
 STATus:MODule:SLOT[n]:ENABle <enable_value>

 STATus:MODule:SLOT[n]:ENABle?

 STATus:MODule:SLOT[n][:EVENT]?

 STATus:OPERation:CONDition?

 STATus:OPERation:ENABle <enable_value>
 STATus:OPERation:ENABle?

 STATus:OPERation[:EVENT]?

STATus:PRESet
STATus:QUESTionable:CONDition?
STATus:QUESTionable:ENABLE <enable_value>
STATus:QUESTionable:ENABLE?
STATus:QUESTionable[:EVENT]?
SYSTem:ALARm?
SYSTem:MODule?

Service-Related Commands

DIAGnostic:DMM:CYCLes? {1|2|3|4|5|6}
DIAGnostic:RELay:CYCLes? (@<ch_list>)
INSTrument:DMM:CONNect
INSTrument:DMM:CONNect?
INSTrument:DMM:DISConnect
INSTrument:DMM:DISConnect?
INSTrument:DMM:INSTalled?
INSTrument:DMM[:STATe] {OFF|0|ON|1}
INSTrument:DMM[:STATe]?



Commands by Subsystem

ABORt Command
FETCh? Command
INITiate Command
R? Command
READ? Command
CALCulate Subsystem
CALibration Subsystem
CONFigure Subsystem
DATA Subsystem
DIAGnostic Subsystem
DISPlay Subsystem
FORMat Subsystem
IEEE-488.2 Common Commands
INSTrument Subsystem
MEASure Subsystem
MEMory Subsystem
OUTPut Subsystem
ROUTe Subsystem
SAMPle Subsystem
SENSe Subsystem
SOURce Subsystem
STATus Subsystem
SWEep Subsystem
SYSTem Subsystem
TRACe Subsystem
TRIGger Subsystem
UNIT Subsystem

ABORt

Syntax | Description | Parameters | Remarks | Return Format | Example

Syntax

ABORt

Description

This command aborts a measurement in progress from a scan or internal DMM measurements.

Remarks

- For internal DMM measurements, this command may be useful when the sample count is greater than 1 (see **SAMPLE:COUNT** command).
- When you abort a measurement, the instrument will terminate any reading in progress (readings are not cleared from memory). If a scan is in progress when the command is received, the scan will not be completed and you cannot resume the scan from where it left off. Note that if you initiate a new scan, all readings are cleared from memory.
- When a measurement is aborted, the readings remain in memory and can be read (see **FETCh?** command) until you clear them or initiate a new scan.
- The ***RST** command will abort a measurement, clear the scan list, and set all measurement parameters to their factory settings. The Instrument Preset (**SYSTem:PRESet** command) also aborts a measurement but it does not clear the scan list.

Example

The following command aborts the measurement in progress.

```
ABOR
```

See Also

***RST**

SYSTem:PRESet

FETCh?

Syntax | Description | Parameters | Remarks | Return Format | Example

Syntax

FETCh?

Description

This command transfers readings from volatile memory to the instrument's output buffer where you can read them into your computer. The readings are not erased from memory when you read them. You can send the command multiple times to retrieve the same data in reading memory.

Remarks

- The FETCh? command will wait until the measurement is complete to terminate.
- Readings can be acquired during a scan using the multiplexer and digital modules or by the internal DMM independently (when a channel list is not specified).
- You can store at least 500,000 readings in memory and all readings are automatically time stamped. If memory overflows, a status register bit is set and new readings will overwrite the first (oldest) readings stored. The most recent readings are always preserved.
- Each time you start a new scan, the instrument clears all readings (including alarm data) stored in reading memory from the previous measurement. Therefore, the contents of memory are always from the most recent measurement.
- When you abort a measurement (see **ABORt** command), the instrument will terminate any reading in progress (readings are not cleared from memory). The readings remain in memory and can be read until you clear them or initiate a new scan.
- The output from this command is affected by the settings of the **FORMat:READing** commands. Depending on the formats selected, each reading may or may not be stored with measurement units, time stamp, channel number, and alarm status information. If readings are acquired using the internal DMM independently (without a multiplexer scan), the channel number will be logged as channel "0".
- The ***RST** command will clear the scan list and set all measurement parameters to their factory settings. The Instrument Preset (**SYSTem:PRESet** command) will not clear the scan list; however, this command will clear reading memory and all stored statistical data.
- The instrument clears all readings from memory when a new scan is initiated, when any measurement parameters are changed (**CONFIgure** and **SENSe** commands), and when the triggering configuration is changed (**TRIGger** commands).
- The instrument clears all readings from memory after a Factory Reset (***RST** command), after an Instrument Preset (**SYSTem:PRESet** command), or when mainframe power is cycled.

Return Format

The command transfers all readings from memory (with formatting as set by the **FORMat:READing** commands) but does not erase them. Multiple responses are separated by commas.

Example

The following program segment shows how to use the **FETCh?** command with the **CONFigure** and **INITiate** commands. The **ROUTe:SCAN** command puts the two channels into the scan list (and redefines the scan list). The **INITiate** command places the instrument in the "wait-for-trigger" state, scans the specified channels when the rear-panel **Ext Trig Input** line is pulsed low, and then sends the readings to memory. The **FETCh?** command transfers the readings from memory to the instrument's output buffer.

```
CONF:VOLT:DC 10,0.003, (@1003,1008)
ROUT:SCAN (@1003,1008)
TRIG:SOUR EXT
INIT
FETC?
```

Typical Response: +4.27150000E-03,+1.32130000E-03

See Also

INITiate

ROUTe:SCAN

INITiate

Syntax | Description | Parameters | Remarks | Return Format | Example

Syntax

INITiate

Description

This command changes the state of the triggering system from the "idle" state to the "wait-for-trigger" state. Measurements will begin when the specified trigger conditions are satisfied following the receipt of the INITiate command. Measurements are stored in memory. Note that the INITiate command also clears the previous set of readings from memory.

- If a scan list is currently defined (see **ROUTE:SCAN** command), the INITiate command performs a scan of the specified channels.
- If a scan list is not currently defined, the INITiate command performs a DMM measurement independent of any modules.

Remarks

- Storing readings in memory using the INITiate command is generally faster than sending readings to memory using the **READ?** command. The INITiate command is also an "overlapped" command. This means that after executing the INITiate command, you can send other commands that do not affect the measurements.
- You can store at least 500,000 readings in memory and all readings are automatically time stamped. If memory overflows, the new readings will overwrite the first (oldest) readings stored; the most recent readings are always preserved. In addition, bit 12 is set in the Questionable Data Register's condition register (see **Status System Introduction**).
- The Analog Bus relays are automatically opened and closed as required during the scan to connect to the internal DMM for the measurement. For example, all 2-wire measurements use the ABus1 (MEAS) relays; for 4-wire measurements, the ABus2 (SENS) relays are used in addition to the ABus1 relays.
- For scanning measurements using the multiplexer modules, an error is generated if the internal DMM is disabled (see **INSTrument:DMM[:STATe]** command) or not installed in the mainframe. The internal DMM is *not* required for operations on the digital modules.
- If a scan list containing multiplexer channels is currently defined (see **ROUTE:SCAN** command), the INITiate command performs a scan of the specified channels. The following rules apply while the scan is running.
 - a. When the scan is initiated, the instrument will open all channels in banks that contain one or more channels in the scan list.

- b. In order to guarantee that no signals are connected to the Analog Buses prior to the scan, the instrument will open all ABus1 relays (applies to all banks in all slots). In banks that contain channels in the scan list, the instrument will also open all ABus2 relays (regardless of whether 4-wire measurements are involved). If no channels configured for 4-wire measurements are included in the scan list, the state of the ABus2 relays in the non-scanned banks is not altered.
 - c. The state of the ABus3 and ABus4 relays is not altered and these relays remain available for use during the scan. However, be sure to use *CAUTION* when closing these relays on banks involved in the scan. While the scan is running, any signals present on ABus3 and/or ABus4 will be joined with the scanned measurement on ABus1 and ABus2. If you have any doubt regarding the state of the ABus3 and ABus4 relays, it is recommended that you send a **ROUTE:OPEN:ABUS ALL** command prior to scanning operations.
 - d. While the scan is running, the instrument prevents use of all channels in banks that contain one or more channels in the specified scan list (these channels are dedicated to the scan). In addition, the instrument prevents use of all ABus1 and ABus2 relays on banks containing channels in the scan list. If one or more channels configured for 4-wire measurements are included in the scan list, then the rules for ABus2 relay operations are extended to the non-scanned banks as well.
 - e. If the ABus1 relay used for current measurements (channel 931 on 34921A only) is *not* closed prior to the initiation of the scan, the four current channels (channels 41 through 44) are not affected by the scan. However, if the ABus1 relay is closed, the instrument will open the ABus1 relay as well as the four associated current channels in a *make-before-break* fashion.
 - f. At the end of the scan, the last channel that was scanned will be opened (as well as any Analog Bus relays used during the scan). Any channels that were opened during the scan will remain open at the completion of the scan.
- By default, the instrument scans the list of channels in ascending order from slot 1 through slot 8 (channels are reordered as needed). If your application requires non-ordered scanning of the channels in the present scan list, you can use the **ROUTE:SCAN:ORDERed** command to enable the non-sequential scanning mode. In either mode, channels which are not in the scan list are skipped during the scan.
 - a. For *sequential* scanning (default, ROUT:SCAN:ORDERED **ON**), the channels in the scan list are reordered as needed and duplicate channels are eliminated. For example, (@2001,1003,1001,1003) will be interpreted as (@1001,1003,2001).
 - b. For *non-sequential* scanning (ROUT:SCAN:ORDERED **OFF**), the channels remain in the order presented in the scan list (see exception below). Multiple occurrences of the same channel are allowed. For example, (@2001,2001,2001) and (@3010,1003,1001,1005) are valid and the channels will be scanned in the order presented.
 - c. When you specify a *range* of channels in the scan list, the channels are always sorted in ascending order, regardless of the ROUTe:SCAN:ORDERed setting. Therefore, (@1009:1001) will always be interpreted as 1001, 1002, 1003, etc.
 - Once you initiate a scan, an error will be generated if you attempt to change any measurement parameters (CONFigure and SENSE commands) or the triggering configuration (TRIGger commands). To abort a scan in progress, send the **ABORT** command.

- The 34923A, 34924A, and 34933A modules use *non-latching* reed relays. Due to power dissipation issues, there is a limit to the number of relays that can be closed at a time on these modules (you cannot close all channels simultaneously). See the **ROUTe:CLOSE** command for details.
- The *Safety Interlock* feature prevents connections to the Analog Buses if no terminal block or properly-wired cable is connected to the module. An error will be generated if scanning is performed on banks without a terminal block or properly-wired cable. See the **SYSTem:ABUS:INTerlock:SIMulate** command to *temporarily* disable errors generated by the Safety Interlock feature.
- To retrieve the readings from memory, use the **FETCh?** command. The readings are not erased from memory when you read them. You can send the command multiple times to retrieve the same data in reading memory.

Example

The following program segment shows how to use the INITiate command with the CONFigure and FETCh? commands. The ROUTe:SCAN command puts the two channels into the scan list (and redefines the scan list). The INITiate command places the instrument in the "wait-for-trigger" state, scans the specified channels when the rear-panel *Ext Trig Input* line is pulsed low, and then sends the readings to memory. The FETCh? command transfers the readings from memory to the instrument's output buffer.

```
CONF:VOLT:DC 10,0.003, (@1003,1008)
ROUT:SCAN (@1003,1008)
TRIG:SOUR EXT
INIT
FETCh?
```

Typical Response: +4.27150000E-03,+1.32130000E-03

See Also

FETCh?

READ?

ROUTe:SCAN

R?

Syntax | Description | Parameters | Remarks | Return Format | Example

Syntax

R? [<max_count>]

Description

This command reads and erases readings from **volatile** memory up to the specified <max_count>. The readings are erased from memory starting with the oldest (not the most recent) reading first. The purpose of this command is to allow you to periodically remove readings from memory that would normally cause reading memory to overflow (for example, during a scan with an infinite scan count).

Parameters

Name	Type	Range of Values	Default Value
<max_count>	Numeric	Maximum number of readings to be read and erased from memory.	Erase all stored readings

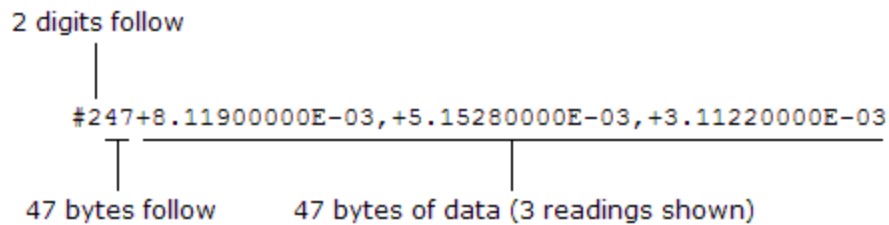
Remarks

- This command is a special version of the **DATA:REMove?** command with faster execution time. You can read memory at any time using the R? command, even during a scan.
- Readings can be acquired during a scan using the multiplexer and digital modules or by the internal DMM independently (when a channel list is not specified). For scanning measurements using the multiplexer modules, an error is generated if the internal DMM is disabled (see **INSTrument:DMM[:STATe]** command) or not installed in the mainframe. The internal DMM is *not* required for operations on the digital modules.
- You can store at least 500,000 readings in memory and all readings are automatically time stamped. If memory overflows, the new readings will overwrite the first (oldest) readings stored; the most recent readings are always preserved. In addition, bit 12 is set in the Questionable Data Register's condition register (see **Status System Introduction**).
- The output from this command is affected by the settings of the **FORMat:READing** commands. Depending on the formats selected, each reading may or may not be stored with measurement units, time stamp, channel number, and alarm status information.
- The instrument clears all readings from memory when a new scan is initiated, when any measurement parameters are changed (CONFigure and SENSE commands), and when the triggering configuration is changed (TRIGger commands).
- The instrument clears all readings from memory after a Factory Reset (***RST** command), after an Instrument Preset (**SYSTem:PRESet** command), or when mainframe power is cycled.

Return Format

The command returns a series of readings in **Definite-Length Block** format. The syntax is a pound sign (#) followed by a non-zero digit representing the number of digits in the decimal integer to follow. This digit is followed by a decimal integer indicating the number of 8-bit data bytes to follow. This is followed by a block of data containing the specified number of bytes.

For example:



Example

This command reads the two oldest readings and erases them from memory.

```
R? 2
```

Typical Response: #231+2.87536000E-04,+3.18131400E-03

See Also

DATA:REMove?

READ?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

READ? [(@<ch_list>)]

Description

This command changes the instrument's triggering system from the "idle" state to the "wait-for-trigger" state. Measurements will begin when the specified trigger conditions are satisfied following the receipt of the READ? command. Readings are then sent immediately to reading memory and the instrument's output buffer.

- If you omit the optional <ch_list> parameter and a scan list is not currently defined (see **ROUTe:SCAN** command), the READ? command applies to the internal DMM.
- If you omit the optional <ch_list> parameter and a scan list is currently defined, the READ? command performs a scan of the channels in the scan list.
- If you specify a <ch_list>, regardless of whether a scan list is currently defined, the READ? command performs a "temporary" scan of the specified channels (independent of the present scan list).

Used With:

- 34921A through 34925A Multiplexer Modules
- 34950A Digital I/O Module (digital input and counter channels only)
- 34952A Multifunction Module (digital input and totalizer channels only)

Parameters

Name	Type	Range of Values	Default Value
<ch_list>	Numeric	One or more channels in the form (@sccc) .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- Sending the READ? command is similar to sending the **INITiate** command followed immediately by the **FETCh?** command.
- You can store at least 500,000 readings in memory and all readings are automatically time stamped. If memory overflows, the new readings will overwrite the first (oldest) readings stored; the most recent readings are always preserved. In addition, bit 12 is set in the Questionable Data Register's condition register (see **Status System Introduction**).

- The Analog Bus relays are automatically opened and closed as required during the scan to connect to the internal DMM for the measurement. For example, all 2-wire measurements use the ABus1 (MEAS) relays; for 4-wire measurements, the ABus2 (SENS) relays are used in addition to the ABus1 relays.
- For scanning measurements using the multiplexer modules, an error is generated if the internal DMM is disabled (see **INSTRument:DMM[:STATe]** command) or not installed in the mainframe. The internal DMM is *not* required for operations on the digital modules.
- If you omit the optional <ch_list> parameter and a scan list is currently defined, the READ? command performs a scan of the channels in the scan list. The following rules apply while the scan is running.
 - a. When the scan is initiated, the instrument will open all channels in banks that contain one or more channels in the scan list.
 - b. In order to guarantee that no signals are connected to the Analog Buses prior to the scan, the instrument will open all ABus1 relays (applies to all banks in all slots). In banks that contain channels in the scan list, the instrument will also open all ABus2 relays (regardless of whether 4-wire measurements are involved). If no channels configured for 4-wire measurements are included in the scan list, the state of the ABus2 relays in the non-scanned banks is not altered.
 - c. The state of the ABus3 and ABus4 relays is not altered and these relays remain available for use during the scan. However, be sure to use *CAUTION* when closing these relays on banks involved in the scan. While the scan is running, any signals present on ABus3 and/or ABus4 will be joined with the scanned measurement on ABus1 and ABus2. If you have any doubt regarding the state of the ABus3 and ABus4 relays, it is recommended that you send a **ROUTE:OPEN:ABUS ALL** command prior to scanning operations.
 - d. While the scan is running, the instrument prevents use of all channels in banks that contain one or more channels in the specified scan list (these channels are dedicated to the scan). In addition, the instrument prevents use of all ABus1 and ABus2 relays on banks containing channels in the scan list. If one or more channels configured for 4-wire measurements are included in the scan list, then the rules for ABus2 relay operations are extended to the non-scanned banks as well.
 - e. If the ABus1 relay used for current measurements (channel 931 on 34921A only) is *not* closed prior to the initiation of the scan, the four current channels (channels 41 through 44) are not affected by the scan. However, if the ABus1 relay is closed, the instrument will open the ABus1 relay as well as the four associated current channels in a *make-before-break* fashion.
 - f. At the end of the scan, the last channel that was scanned will be opened (as well as any Analog Bus relays used during the scan). Any channels that were opened during the scan will remain open at the completion of the scan.
- If you specify a <ch_list>, regardless of whether a scan list is currently defined, the READ? command performs a "temporary" scan of the specified channels (independent of the present scan list). The following rules apply while the temporary scan is running (these rules supersede the rules for the pre-existing scan list, but the present scan list is not modified).
 - a. When the temporary scan is initiated, the instrument will open all channels in banks that contain one or more channels in the specified <ch_list>. The instrument will also open all ABus1 relays (applies to all banks in all slots). In addition, if one or more channels configured for 4-wire measurements are included in the specified <ch_list>, the instrument will also open all ABus2 relays (applies to all banks in all slots). The state of the ABus3 and ABus4 relays is not altered.

- b. While the temporary scan is running, the instrument prohibits use of all channels in banks that contain one or more channels in the specified <ch_list>. In addition, the instrument prohibits use of all ABus1 relays (and ABus2 relays if applicable) while the temporary scan is running.
 - c. At the end of the temporary scan, the last channel that was scanned will be opened (as well as any Analog Bus relays used during the scan). Any channels that were opened during the scan will remain opened at the completion of the scan.
- By default, the instrument scans the list of channels in ascending order from slot 1 through slot 8 (channels are reordered as needed). If your application requires non-ordered scanning of the channels in the present scan list, you can use the **ROUTe:SCAN:ORDeRed** command to enable the non-sequential scanning mode. In either mode, channels which are not in the scan list are skipped during the scan.
 - a. For *sequential* scanning (default, **ROUT:SCAN:ORDERED ON**), the channels in the scan list are reordered as needed and duplicate channels are eliminated. For example, (@2001,1003,1001,1003) will be interpreted as (@1001,1003,2001).
 - b. For *non-sequential* scanning (**ROUT:SCAN:ORDERED OFF**), the channels remain in the order presented in the scan list (see exception below). Multiple occurrences of the same channel are allowed. For example, (@2001,2001,2001) and (@3010,1003,1001,1005) are valid and the channels will be scanned in the order presented.
 - c. When you specify a *range* of channels in the scan list, the channels are always sorted in ascending order, regardless of the **ROUTe:SCAN:ORDERed** setting. Therefore, (@1009:1001) will always be interpreted as 1001, 1002, 1003, etc.
- Once you initiate a scan, an error will be generated if you attempt to change any measurement parameters (**CONFigure** and **SENSe** commands) or the triggering configuration (**TRIGger** commands). To abort a scan in progress, send the **ABORt** command.
- The 34923A, 34924A, and 34933A modules use *non-latching* reed relays. Due to power dissipation issues, there is a limit to the number of relays that can be closed at a time on these modules (you cannot close all channels simultaneously). See the **ROUTe:CLOSe** command for details.
- The *Safety Interlock* feature prevents connections to the Analog Buses if no terminal block or properly-wired cable is connected to the module. An error will be generated if scanning is performed on banks without a terminal block or properly-wired cable. See the **SYSTem:ABUS:INTerlock:SIMulate** command to *temporarily* disable errors generated by the Safety Interlock feature.
- The output from this command is affected by the settings of the **FORMat:READing** commands. Depending on the formats selected, each reading may or may not be stored with measurement units, time stamp, channel number, and alarm status information. If readings are acquired using the internal DMM independently (without a multiplexer scan), the channel number will be logged as channel "0".
- The **READ?** command is not valid with the ***TRG** command (used with **TRIGger:SOURce BUS** command for software triggering).
- The instrument clears all readings from memory after a Factory Reset (***RST** command), after an Instrument Preset (**SYSTem:PRESet** command), or when mainframe power is cycled.

Return Format

The command sends readings directly to reading memory and the instrument's output buffer (with formatting as set by the **FORMat:READing** commands). Multiple responses are separated by commas.

Examples

The following program segment shows how to use the READ? command to make a dc voltage measurement using the internal DMM. The CONFigure command configures the internal DMM for a dc voltage measurement (no <ch_list> is specified). The ROUTe:SCAN command is included to clear the scan list. The READ? command (with no <ch_list>) places the internal DMM in the "wait-for-trigger" state and then sends the reading to memory and the instrument's output buffer.

```
CONF:VOLT:DC      !Applies to the internal DMM
ROUT:SCAN (@)     !Clear the scan list
READ?           !Applies to the internal DMM
```

Typical Response: **+1.26360000E-02**

The following program segment shows how to use the READ? command with the CONFigure command. The ROUTe:SCAN command puts the two channels into the scan list (and redefines the scan list). The READ? command (with no <ch_list>) places the instrument in the "wait-for-trigger" state, scans the specified channels when the rear-panel **Ext Trig Input** line is pulsed low, sends the readings to reading memory and the instrument's output buffer. In this case, the READ? command applies to the two channels in the present scan list.

```
CONF:VOLT:DC 10,0.003,(@1003,1008) !Configure channels
ROUT:SCAN (@1003,1008) !Define the scan list
TRIG:SOUR EXT
READ? !Applies to the present scan list
```

Typical Response: **+4.27150000E-03,+1.32130000E-03**

The following program segment shows how to use the READ? command with a <ch_list> parameter. The ROUTe:SCAN command puts two channels into the scan list (and redefines the scan list). The READ? command creates a temporary scan (independent of the present scan list) with three channels, places the instrument in the "wait-for-trigger" state, and then transfers the readings to reading memory and the instrument's output buffer.

```
CONF:VOLT:DC (@2001:2010) !Configure channels
ROUT:SCAN (@2001,2002) !Define the scan list
READ? (@2005:2007) !Create temporary scan list, doesn't modify present scan list
```

Typical Response: **+2.73630000E+00,+1.73730000E-03,+5.00930000E-03**

See Also

FETCh?

INITiate

ROUTe:SCAN

ROUTe:SCAN:ORDered

CALCulate Subsystem Introduction

The internal DMM is required to store readings in memory and perform calculations. Readings can be acquired during a scan using the 34980A multiplexer modules listed below or by the internal DMM independently.

34921A	40-Channel Armature Multiplexer (including temperature and current)
34922A	70-Channel Armature Multiplexer
34923A	40/80-Channel Reed Multiplexer
34924A	70-Channel Reed Multiplexer
34925A	40/80-Channel FET Multiplexer

Command Summary

NOTE

Hold the mouse cursor over a command to view the full syntax statement.

Alarm Limits

CALCulate:LIMit:LOWer
CALCulate:LIMit:LOWer?
CALCulate:LIMit:LOWer:STATe
CALCulate:LIMit:LOWer:STATe?
CALCulate:LIMit:UPPer
CALCulate:LIMit:UPPer?
CALCulate:LIMit:UPPer:STATe
CALCulate:LIMit:UPPer:STATe?

Mx+B Scaling

CALCulate:SCALe:GAIN
CALCulate:SCALe:GAIN?
CALCulate:SCALe:OFFSet
CALCulate:SCALe:OFFSet?
CALCulate:SCALe:STATe
CALCulate:SCALe:STATe?
CALCulate:SCALe:UNIT
CALCulate:SCALe:UNIT?

Measurement Statistics

CALCulate:AVERage:AVERage?
CALCulate:AVERage:CLEar
CALCulate:AVERage:COUNt?
CALCulate:AVERage:MAXimum:TIME?

CALCulate:AVERage:MAXimum?
CALCulate:AVERage:MINimum:TIME?
CALCulate:AVERage:MINimum?
CALCulate:AVERage:PTPeak?

Digital Input Pattern Comparison

CALCulate:COMPare:DATA[:<width>]
CALCulate:COMPare:DATA?
CALCulate:COMPare:MASK[:<width>]
CALCulate:COMPare:MASK?
CALCulate:COMPare:STATe
CALCulate:COMPare:STATe?
CALCulate:COMPare:TYPE
CALCulate:COMPare:TYPE?

CALCulate:LIMit:LOWer

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Syntax

CALCulate:LIMit:LOWer {<value>|MIN|MAX|DEF}, (@<ch_list>)

CALCulate:LIMit:LOWer? [{MIN|MAX},] (@<ch_list>)

Description

The instrument has four alarms which you can configure to alert you when a reading exceeds specified limits on a multiplexer channel during a scan. This command sets the *lower* limit for alarms on the specified channels.

Used With:

- 34921A through 34925A Multiplexer Modules

Parameters

Name	Type	Range of Values	Default Value
<value>	Numeric	Any value between -120% and +120% of the highest range, for the present function.	-1.0E+15
<ch_list>	Numeric	One or more channels in the form (@sccc) .	This is a required parameter.

Remarks

- Alarms are evaluated during a scan using the multiplexer modules. For scanning using a multiplexer module, an error is generated if the internal DMM is disabled (see [INSTrument:DMM\[:STATe\]](#) command) or not installed in the mainframe.
- You can assign a lower limit, an upper limit (see [CALCulate:LIMit:UPPer](#) command), or both to any configured channel in the scan list. The lower limit *must always* be less than or equal to the upper limit.
- Once you have defined the lower limits, use the [CALCulate:LIMit:LOWer:STATe](#) command to enable alarms on the specified channels.
- The alarms are evaluated by the internal DMM from the time the CALCulate:LIMit:LOWer:STATe ON command is executed.
- You must configure the channel (function, transducer type, etc.) before setting any alarm limits. If you change the measurement configuration, alarms are turned off and the limit values are cleared. Alarms are also turned off when you change the temperature probe type, temperature units, or disable the internal DMM.

- You can assign multiple channels to any of the four available alarms (numbered 1 through 4, see **OUTPut:ALARm<n>:SOURce** command). For example, you can configure the instrument to generate an alarm on the Alarm 1 output when a limit is exceeded on any of channels 1003, 2005, or 3010. You cannot, however, assign alarms on a specific channel to more than one alarm number.
- If you plan to use alarms on a channel which will also use Mx+B scaling, be sure to *configure the scaling values first*. If you attempt to assign the alarm limits first, the instrument will turn off alarms and clear the limit values when you enable scaling on that channel. If you specify a custom measurement label with scaling, it is automatically used when alarms are logged on that channel.
- If you redefine the scan list, alarms are no longer evaluated on those channels (during a scan) but the limit values are not cleared. If you decide to add a channel back to the scan list (without changing the function), the original limit values are restored and alarms are turned back on. This makes it easy to temporarily remove a channel from the scan list without entering the alarm values again.
- To generate an alarm when a specific count is reached on a totalizer channel (34950A and 34952A), see the **CALCulate:LIMit:UPPer** command. To generate an alarm when a specific bit pattern or bit pattern change is detected on a digital input channel, see the **CALCulate:COMPar** commands.
- The instrument clears all alarm limits and turns off all alarms after a Factory Reset (***RST** command), Instrument Preset (**SYSTem:PRESet** command), or Card Reset (**SYSTem:CPON** command).

Return Format

The query command returns the lower limit in the form "-1.00000000E+15" for each channel specified. Multiple responses are separated by commas.

Examples

The following command sets the lower limit to -0.25 on channels 3 and 13 in slot 1.

```
CALC:LIM:LOW -0.25, (@1003,1013)
```

The following query returns the limit settings on channels 3 and 13 in slot 1.

```
CALC:LIM:LOW? (@1003,1013)
```

Typical Response: -2.50000000E-01,-2.50000000E-01

See Also

CALCulate:LIMit:LOWer:STATe

CALCulate:LIMit:UPPer

OUTPut:ALARm<n>:SOURce

CALCulate:LIMit:LOWer:STATe

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

CALCulate:LIMit:LOWer:STATe <mode>, (@<ch_list>)

CALCulate:LIMit:LOWer:STATe? (@<ch_list>)

Description

This command disables or enables the *lower* alarm limits on the specified multiplexer channels.

Used With:

- 34921A through 34925A Multiplexer Modules

Parameters

Name	Type	Range of Values	Default Value
<mode>	Boolean	{OFF 0 ON 1}	Limit OFF
<ch_list>	Numeric	One or more channels in the form (@sccc) .	This is a required parameter.

Remarks

- Alarm data can be stored in one of two locations depending on whether a scan list is running when the alarm occurs.
 - a. If an alarm event occurs on a channel as it is being scanned, then that channel's alarm status is stored in *reading memory* as the readings are taken. Each reading that is outside the specified alarm limit is logged in memory. You can store at least 500,000 readings in memory during a scan.
 - b. As alarm events are generated, they are also logged in an *alarm queue*, which is separate from reading memory. This is the only place that non-scanned alarms get logged (alarms during a channel monitor, alarms generated by the digital modules, etc.). Up to 20 alarms can be logged in the alarm queue. If more than 20 alarm events are generated, they will be lost (only the first 20 alarms are saved). Even if the alarm queue is full, the alarm status is stored in reading memory during a scan.
- Alarms are evaluated during a scan using the multiplexer modules. For scanning using a multiplexer module, an error is generated if the internal DMM is disabled (see [INSTrument:DMM\[:STATe\]](#) command) or not installed in the mainframe.

- When an alarm occurs, the instrument stores relevant information about the alarm in the queue. This includes the reading that caused the alarm, the time of day and date of the alarm, and the channel number on which the alarm occurred. The information stored in the alarm queue is always in **absolute time** and is *not* affected by the **FORMat:READing:TIME:TYPE** command setting.
- Alarms are logged in the alarm queue only when a reading crosses a limit, not while it remains outside the limit and not when it returns to within limits.
- In addition to being stored in reading memory, alarms are also recorded in their own SCPI Status System. You can configure the instrument to use the status register to generate a Service Request (SRQ) when alarms are generated. For more information on the SCPI Status System for the Keysight 34980A, see **Status System Introduction**.
- To generate an alarm when a specific count is reached on a totalizer channel (34950A and 34952A), see the **CALCulate:LIMit:UPPer** command. To generate an alarm when a specific bit pattern or bit pattern change is detected on a digital input channel, see the **CALCulate:COMPar** commands.
- The instrument clears all alarm limits and turns off all alarms after a Factory Reset (***RST** command), Instrument Preset (**SYSTem:PRESet** command), or Card Reset (**SYSTem:CPON** command).

Return Format

The query command returns "0" (OFF) or "1" (ON) for each channel specified. Multiple responses are separated by commas.

Examples

The following program segment sets a lower limit on channels 3 and 13 in slot 1 and then enables alarms on these channels.

```
CALC:LIM:LOW -0.25, (@1003,1013)
CALC:LIM:LOW:STAT ON, (@1003,1013)
```

The following query returns the state of lower limits on channels 3 and 13 in slot 1.

```
CALC:LIM:LOW:STAT? (@1003,1013)
```

Typical Response: **1,1**

See Also

CALCulate:LIMit:LOWer

OUTPut:ALARm<n>:SOURce

SYSTem:ALARm?

CALCulate:LIMit:UPPer

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

CALCulate:LIMit:UPPer {<value>|MIN|MAX|DEF}, (@<ch_list>)

CALCulate:LIMit:UPPer? [{MIN|MAX},] (@<ch_list>)

Description

The instrument has four alarms which you can configure to alert you when a reading exceeds specified limits on a multiplexer channel during a scan. This command sets the *upper* limit for alarms on the specified channels.

Used With:

- 34921A through 34925A Multiplexer Modules
- 34950A Digital I/O Module (counter channels only)
- 34952A Multifunction Module (totalizer channels only)

Parameters

Name	Type	Range of Values	Default Value
<value>	Numeric	Multiplexers: Any value between -120% and +120% of the highest range, for the present function. Totalizer Channels: Any value between 0 and 4,294,967,295 (32-bit totalizers).	Multiplexers: +1.0E+15 Totalizer Channels: 0
<ch_list>	Numeric	One or more channels in the form (@sccc) . 34950A: s301, s302 34952A: s005	This is a required parameter.

Remarks

- Alarms are evaluated during a scan using the multiplexer modules. For scanning using a multiplexer module, an error is generated if the internal DMM is disabled (see [INSTrument:DMM\[:STATe\]](#) command) or not installed in the mainframe. The internal DMM is *not* required for operations on the digital modules and the specified channels do *not* have to be part of the active scan list to generate an alarm.

- You can assign an upper limit, a lower limit (see **CALCulate:LIMit:LOWer** command), or both to any configured channel in the scan list. The lower limit *must always* be less than or equal to the upper limit.
- Once you have defined the upper limits, use the **CALCulate:LIMit:UPPer:STATe** command to enable alarms on the specified channels.
- The alarms are evaluated by the internal DMM from the time the **CALCulate:LIMit:UPPer:STATe ON** command is executed.
- You must configure the channel (function, transducer type, etc.) before setting any alarm limits. If you change the measurement configuration, alarms are turned off and the limit values are cleared. Alarms are also turned off when you change the temperature probe type, temperature units, or disable the internal DMM.
- You can assign multiple channels to any of the four available alarms (numbered 1 through 4, see **OUTPut:ALARm<n>:SOURce** command). For example, you can configure the instrument to generate an alarm on the Alarm 1 output when a limit is exceeded on any of channels 1003, 2005, or 3010. You cannot, however, assign alarms on a specific channel to more than one alarm number.
- If you plan to use alarms on a channel which will also use Mx+B scaling, be sure to *configure the scaling values first*. If you attempt to assign the alarm limits first, the instrument will turn off alarms and clear the limit values when you enable scaling on that channel. If you specify a custom measurement label with scaling, it is automatically used when alarms are logged on that channel.
- If you redefine the scan list, alarms are no longer evaluated on those channels (during a scan) but the limit values are not cleared. If you decide to add a channel back to the scan list (without changing the function), the original limit values are restored and alarms are turned back on. This makes it easy to temporarily remove a channel from the scan list without entering the alarm values again.
- On the digital modules, you can set an upper limit for the totalizer channels (no lower limit is allowed). These channels *do not* have to be part of the active scan list to generate an alarm, but alarm data is stored in reading memory *only* during a scan.
- To generate an alarm when a specific bit pattern or bit pattern change is detected on a digital input channel (34950A and 34952A), see the **CALCulate:COMParE** commands.
- A Factory Reset (***RST** command) clears all alarm limits and turns off all alarms. An Instrument Preset (**SYSTem:PRESet** command) or Card Reset (**SYSTem:CPON** command) does *not* clear the alarm limits and does *not* turn off alarms.
- The instrument clears all alarm limits and turns off all alarms after a Factory Reset (***RST** command), Instrument Preset (**SYSTem:PRESet** command), or Card Reset (**SYSTem:CPON** command).

Return Format

The query command returns the upper limit in the form "+1.00000000E+15" for each channel specified. Multiple responses are separated by commas.

Examples

The following command sets the upper limit to 10.25 on channels 3 and 13 in slot 1.

```
CALC:LIM:UPP 10.25, (@1003,1013)
```

The following query returns the limit settings on channels 3 and 13 in slot 1.

```
CALC:LIM:UPP? (@1003,1013)
```

Typical Response: **+1.02500000E+01,+1.02500000E+01**

To ensure that an error is not generated when using only an upper or lower limit, execute the following command sequence (this example assumes that you are setting only an upper limit).

```
CALC:LIM:LOW MIN, (@1003,1013); UPP 10.25, (@1003,1013); UPP:STAT ON,  
(@1003,1013)
```

The following command sets the upper limit to 4095 on totalizer channels 301 and 302 in slot 5 (assumes 34950A).

```
CALC:LIM:UPP 4.095E+03, (@5301,5302)
```

See Also

CALCulate:LIMit:LOWer

CALCulate:LIMit:UPPer:STATe

OUTPut:ALARm<n>:SOURce

CALCulate:LIMit:UPPer:STATe

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

CALCulate:LIMit:UPPer:STATe <mode>, (@<ch_list>)

CALCulate:LIMit:UPPer:STATe? (@<ch_list>)

Description

This command disables or enables the *upper* alarm limits on the specified multiplexer channels.

Used With:

- 34921A through 34925A Multiplexer Modules
- 34950A Digital I/O Module (counter channels only)
- 34952A Multifunction Module (totalizer channels only)

Parameters

Name	Type	Range of Values	Default Value
<mode>	Boolean	{OFF 0 ON 1}	Limit OFF
<ch_list>	Numeric	One or more channels in the form (@sccc). 34950A: s301, s302 34952A: s005	This is a required parameter.

Remarks

- Alarm data can be stored in one of two locations depending on whether a scan list is running when the alarm occurs.
 - a. If an alarm event occurs on a channel as it is being scanned, then that channel's alarm status is stored in *reading memory* as the readings are taken. Each reading that is outside the specified alarm limit is logged in memory. You can store at least 500,000 readings in memory during a scan.
 - b. As alarm events are generated, they are also logged in an *alarm queue*, which is separate from reading memory. This is the only place that non-scanned alarms get logged (alarms during a channel monitor, alarms generated by the digital modules, etc.). Up to 20 alarms can be logged in the alarm queue. If more than 20 alarm events are generated, they will be lost (only the first 20 alarms are saved). Even if the alarm queue is full, the alarm status is stored in reading memory during a scan.

- Alarms are evaluated during a scan using the multiplexer modules. For scanning using a multiplexer module, an error is generated if the internal DMM is disabled (see **INSTrument:DMM[:STATe]** command) or not installed in the mainframe. The internal DMM is *not* required for operations on the digital modules and the specified channels do *not* have to be part of the active scan list to generate an alarm.
- When an alarm occurs, the instrument stores relevant information about the alarm in the queue. This includes the reading that caused the alarm, the time of day and date of the alarm, and the channel number on which the alarm occurred. The information stored in the alarm queue is always in **absolute time** and is *not* affected by the **FORMat:READing:TIME:TYPE** command setting.
- Alarms are logged in the alarm queue only when a reading crosses a limit, not while it remains outside the limit and not when it returns to within limits.
- In addition to being stored in reading memory, alarms are also recorded in their own SCPI Status System. You can configure the instrument to use the status register to generate a Service Request (SRQ) when alarms are generated. For more information on the SCPI Status System for the Keysight 34980A, see **Status System Introduction**.
- On the digital modules, you can set an upper limit for the totalizer channels (no lower limit is allowed). These channels do *not* have to be part of the active scan list to generate an alarm, but alarm data is stored in reading memory *only* during a scan.
- To generate an alarm when a specific bit pattern or bit pattern change is detected on a digital input channel (34950A and 34952A), see the **CALCulate:COMParE** commands.
- The instrument clears all alarm limits and turns off all alarms after a Factory Reset (***RST** command), Instrument Preset (**SYSTem:PRESet** command), or Card Reset (**SYSTem:CPON** command).

Return Format

The query command returns "0" (OFF) or "1" (ON) for each channel specified. Multiple responses are separated by commas.

Examples

The following program segment sets an upper limit on channels 3 and 13 in slot 1 and then enables alarms on these channels.

```
CALC:LIM:UPP 10.25, (@1003,1013)
CALC:LIM:UPP:STAT ON, (@1003,1013)
```

The following query returns the state of upper limits on channels 3 and 13 in slot 1.

```
CALC:LIM:UPP:STAT? (@1003,1013)
```

Typical Response: **1,1**

The following command sets the upper limit to 4095 on totalizer channels 301 and 302 in slot 5 (assumes 34950A) and then enables alarms on these channels.

```
CALC:LIM:UPP 4.095E+03, (@5301, 5302)  
CALC:LIM:UPP:STAT ON, (@5301, 5302)
```

See Also

[CALCulate:LIMit:UPPer](#)

[OUTPut:ALARm<n>:SOURce](#)

[SYSTem:ALARm?](#)

CALCulate:SCALE:GAIN

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

CALCulate:SCALE:GAIN <gain> [, (@<ch_list>)]

CALCulate:SCALE:GAIN? (@<ch_list>)

Description

This command sets the gain ("M") for scaled readings on the specified multiplexer channels. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

Used With:

- 34921A through 34925A Multiplexer Modules

Parameters

Name	Type	Range of Values	Default Value
<gain>	Numeric	Any value between -1E+15 and +1E+15.	M = 1
<ch_list>	Numeric	One or more channels in the form (@sccc) .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- Scaling is applied using the following equation:

$$\text{Scaled Reading} = (\text{Gain} \times \text{Measurement}) + \text{Offset}$$

- After setting the gain and offset values, use the **CALCulate:SCALE:STATe** command to enable the scaling function.
- If you omit the optional <ch_list> parameter, this command sets the gain for the internal DMM. The gain is applied to the internal DMM from the time the CALCulate:SCALE:STATe ON command is executed.
- Readings can be acquired during a scan using the multiplexer or by the internal DMM independently (when a channel list is not specified). For scanning measurements using the multiplexer modules, an error is generated if the internal DMM is disabled (see **INSTRument:DMM[:STATe]** command) or not installed in the main-frame.

- If you change the measurement configuration (function, transducer type, etc.) on a channel or the internal DMM, scaling is turned off on those channels but the gain and offset values are not cleared.
- If you plan to use scaling on a channel which will also use alarms, *be sure to configure the scaling values first*. If you attempt to assign the alarm limits first, the instrument will turn off alarms and clear the limit values when you enable scaling on that channel. If you specify a custom measurement label with scaling, it is automatically used when alarms are logged on that channel.
- If you redefine the scan list, no change will be made to the scaling state or the gain and offset values. If you decide to add a channel back to the scan list, the original gain and offset values are restored.
- The CONFIGure and MEASure? commands automatically set the gain ("M") to 1 and offset ("B") to 0.
- A Factory Reset (*RST command) turns off scaling and clears the scaling values on all channels (gain = 1, offset = 0). An Instrument Preset (SYSTem:PRESet command) *does not* clear the scaling values and *does not* turn off scaling.

Return Format

The query command returns the gain value for each channel specified. Multiple responses are separated by commas.

Examples

The following command sets the gain to +1.25 on channels 3 and 13 in slot 1.

```
CALC:SCAL:GAIN 1.25, (@1003, 1013)
```

The following query returns the gain settings on channels 3 and 13 in slot 1.

```
CALC:SCAL:GAIN? (@1003, 1013)
```

Typical Response: +1.25000000E+00,+1.25000000E+00

See Also

CALCulate:SCALE:OFFSet

CALCulate:SCALE:STATe

CALCulate:SCALE:UNIT

CALCulate:SCALE:OFFSet

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

CALCulate:SCALE:OFFSet <offset> [, (@<ch_list>)]

CALCulate:SCALE:OFFSet? (@<ch_list>)

Description

This command sets the offset ("B") for scaled readings on the specified multiplexer channels. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

Used With:

- 34921A through 34925A Multiplexer Modules

Parameters

Name	Type	Range of Values	Default Value
<offset>	Numeric	Any value between -1E+15 and +1E+15.	B = 0
<ch_list>	Numeric	One or more channels in the form (@sccc) .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- Scaling is applied using the following equation:

$$\text{Scaled Reading} = (\text{Gain} \times \text{Measurement}) + \text{Offset}$$

- After setting the gain and offset values, use the **CALCulate:SCALE:STATe** command to enable the scaling function.
- If you omit the optional <ch_list> parameter, this command sets the offset for the internal DMM. The offset is applied to the internal DMM from the time the CALCulate:SCALE:STATe ON command is executed.
- Readings can be acquired during a scan using the multiplexer or by the internal DMM independently (when a channel list is not specified). For scanning measurements using the multiplexer modules, an error is generated if the internal DMM is disabled (see **INSTRument:DMM[:STATe]** command) or not installed in the main-frame.

- You must configure the channel (function, transducer type, etc.) before applying any scaling values. If you change the measurement configuration, scaling is turned off on that channel and the gain and offset values are reset (M=1 and B=0). Scaling is also turned off when you change the temperature probe type, temperature units, or disable the internal DMM.
- If you change the measurement configuration (function, transducer type, etc.) on a channel or the internal DMM, scaling is turned off on those channels but the gain and offset values are not cleared.
- If you plan to use scaling on a channel which will also use alarms, *be sure to configure the scaling values first*. If you attempt to assign the alarm limits first, the instrument will turn off alarms and clear the limit values when you enable scaling on that channel. If you specify a custom measurement label with scaling, it is automatically used when alarms are logged on that channel.
- If you redefine the scan list, no change will be made to the scaling state or the gain and offset values. If you decide to add a channel back to the scan list, the original gain and offset values are restored.
- You can use scaling to make a "null" measurement on a channel and store it as the offset ("B") for subsequent measurements. This allows you to adjust for voltage or resistive offsets through your wiring to the point of the measurement.
- The CONFigure and MEASure? commands automatically set the gain ("M") to 1 and offset ("B") to 0.
- A Factory Reset (*RST command) turns off scaling and clears the scaling values on all channels (gain = 1, offset = 0). An Instrument Preset (SYSTem:PRESet command) *does not* clear the scaling values and *does not* turn off scaling.

Return Format

The query command returns the offset value for each channel specified. Multiple responses are separated by commas.

Examples

The following command sets the offset to +10.125 on channels 3 and 13 in slot 1.

```
CALC:SCAL:OFFS 10.125, (@1003,1013)
```

The following query returns the offset values on channels 3 and 13 in slot 1.

```
CALC:SCAL:OFFS? (@1003,1013)
```

Typical Response: +1.01250000E+01,+1.01250000E+01

See Also

CALCulate:SCALE:GAIN

CALCulate:SCALE:STATe

CALCulate:SCALE:UNIT

CALCulate:SCALe:STATe

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

CALCulate:SCALe:STATe <mode> [, (@<ch_list>)]

CALCulate:SCALe:STATe? [(@<ch_list>)]

Description

This command disables or enables Mx+B scaling on the specified channels. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

Used With:

- 34921A through 34925A Multiplexer Modules

Parameters

Name	Type	Range of Values	Default Value
<mode>	Boolean	{OFF 0 ON 1}	Scaling OFF
<ch_list>	Numeric	One or more channels in the form <u>(@sccc)</u> .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- Scaling is applied using the following equation:

$$\text{Scaled Reading} = (\text{Gain} \times \text{Measurement}) + \text{Offset}$$

- Readings can be acquired during a scan using the multiplexer or by the internal DMM independently (when a channel list is not specified). For scanning measurements using the multiplexer modules, an error is generated if the internal DMM is disabled (see **INSTrument:DMM[:STATe]** command) or not installed in the main-frame.
- If you omit the optional <ch_list> parameter, this command enables scaling on the internal DMM. The scaling is applied to the internal DMM from the time the CALCulate:SCALe:STATe ON command is executed.
- You must configure the channel (function, transducer type, etc.) before applying any scaling values. If you change the measurement configuration, scaling is turned off on that channel and the gain and offset values are reset (M=1 and B=0). Scaling is also turned off when you change the temperature probe type, temperature units, or disable the internal DMM.

- If you change the measurement configuration (function, transducer type, etc.) on a channel or the internal DMM, scaling is turned off on those channels but the gain and offset values are not cleared.
- If you plan to use scaling on a channel which will also use alarms, *be sure to configure the scaling values first*. If you attempt to assign the alarm limits first, the instrument will turn off alarms and clear the limit values when you enable scaling on that channel. If you specify a custom measurement label with scaling, it is automatically used when alarms are logged on that channel.
- If you redefine the scan list, no change will be made to the scaling state or the gain and offset values. If you decide to add a channel back to the scan list, the original gain and offset values are restored.
- The CONFigure and MEASure? commands automatically disable scaling on the specified channels.
- A Factory Reset (***RST** command) turns off scaling and clears the scaling values on all channels (gain = 1, offset = 0). An Instrument Preset (**SYSTem:PRESet** command) *does not* clear the scaling values and *does not* turn off scaling.

Return Format

The query command returns "0" (OFF) or "1" (ON) for each channel specified. Multiple responses are separated by commas.

Examples

The following program segment sets gain and offset values on channels 3 and 13 in slot 1 and then enables scaling on these channels.

```
CALC:SCAL:GAIN 1.25, (@1003,1013)
CALC:SCAL:OFFS 10.125, (@1003,1013)
CALC:SCAL:STAT ON, (@1003,1013)
```

The following query returns the scaling settings on channels 3 and 13 in slot 1.

```
CALC:SCAL:STAT? (@1003,1013)
```

Typical Response: 1,1

See Also

CALCulate:SCALE:GAIN

CALCulate:SCALE:OFFSet

CALCulate:SCALE:UNIT

CALCulate:SCALE:UNIT

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

```
CALCulate:SCALE:UNIT "<units>" [, (@<ch_list>)]
```

```
CALCulate:SCALE:UNIT? [(@<ch_list>)]
```

Description

This command assigns a custom measurement label (e.g., RPM, PSI, etc.) to scaled measurements on the specified multiplexer channels. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

Used With:

- 34921A through 34925A Multiplexer Modules

Parameters

Name	Type	Range of Values	Default Value
<units>	Quoted ASCII String	A string containing up to 3 characters enclosed in quotes. You can use letters (A-Z), numbers (0-9), an underscore (_), blank spaces, or the "#" character which displays a degree symbol (°) on the front panel (displayed as a "#" in an output string from the remote interface).	Null String (" ")
<ch_list>	Numeric	One or more channels in the form <u>(@sccc)</u> .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- Readings can be acquired during a scan using the multiplexer or by the internal DMM independently (when a channel list is not specified). For scanning measurements using the multiplexer modules, an error is generated if the internal DMM is disabled (see **INSTrument:DMM[:STATe]** command) or not installed in the main-frame.
- If you omit the optional <ch_list> parameter, assigns a label for the internal DMM. The label is applied to the internal DMM from the time the CALCulate:SCALE:STATe command is executed.
- If you set the measurement label to °C, °F, or K, note that this has no effect the temperature units set using the **UNIT:TEMPerature** command.

- The CONFigure and MEASure? commands automatically reset the measurement labels on the specified channels to a null string (" ").
- A Factory Reset (***RST** command) turns off scaling, clears the scaling values (gain = 1, offset = 0), and sets the measurement labels to a null string (" ") on all channels. An Instrument Preset (**SYSTem:PRESet** command) *does not* clear the scaling values or measurement labels and *does not* turn off scaling.

Return Format

The query command reads the measurement label for each channel specified and returns an ASCII string enclosed in double quotes. Multiple responses are separated by commas.

Examples

The following command adds the measurement label "RPM" (Revolutions Per Minute) to channels 3 and 13 in slot 1.

```
CALC:SCAL:UNIT "RPM", (@1003,1013) or CALC:SCAL:UNIT 'RPM', (@1003,1013)
```

The following query returns the measurement labels assigned to channels 3 and 13 in slot 1.

```
CALC:SCAL:UNIT? (@1003,1013)
```

Typical Response: "RPM","RPM"

See Also

CALCulate:SCALe:GAIN

CALCulate:SCALe:OFFSet

CALCulate:SCALe:STATe

CALCulate:COMPare:DATA[:<width>]

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

CALCulate:COMPare:DATA[:<width>] <data>, (@<ch_list>)

CALCulate:COMPare:DATA? (@<ch_list>)

Description

This command sets the digital data for pattern comparisons on the specified digital input channels. You can use the pattern comparison feature to generate an alarm or hardware interrupt condition (34950A only) when a specific digital pattern is detected. Pattern comparisons always start on the lowest-numbered channel in the bank and extend to all channels involved in the channel width (see [CONFigure:DIGital:WIDTh](#) command).

Used With:

- 34950A Digital I/O Module (digital input channels only)
- 34952A Multifunction Module (digital input channels only)

Parameters

Name	Type	Range of Values	Default Value
<width>	Discrete	{BYTE 1 WORD 2 LWORD 4} BYTE (or "1" byte): 8 bits WORD (or "2" bytes): 16 bits LWORD (or "4" bytes): 32 bits	BYTE (8 bits)
<data>	Numeric	Specify the bit pattern as a decimal, binary, or hexadecimal value. For binary, "#B" must be added as a prefix (e.g., #B11001100). For hex, "#H" must be added as a prefix (e.g., #HCC).	This is a required parameter
<ch_list>	Numeric	One or more digital input channels in the form (@sccc). 34950A: s101 through s104, s201 through s204 34952A: s001 through s004	This is a required parameter

Remarks

- Depending on the width specified, the channel numbering is modified as shown below. For example, if you specify the width as a 16-bit WORD on the 34950A, channels 101 and 102 are combined and addressed collectively as channel 101.

34950A	Bank 2				Bank 1			
BYTE (8 Bits):	Ch 204	Ch 203	Ch 202	Ch 201	Ch 104	Ch 103	Ch 102	Ch 101
WORD (16 Bits):	Ch 203		Ch 201		Ch 103		Ch 101	
LWORD (32 Bits):	Ch 201				Ch 101			

34952A	Bank 1			
BYTE (8 Bits):	Ch 4	Ch 3	Ch 2	Ch 1
WORD (16 Bits):	Ch 3		Ch 1	
LWORD (32 Bits):	Ch 1			

- The channel width takes precedence over the specified digital pattern. If the specified pattern is greater than the channel width, additional bits will be ignored. For example, if you set the channel width to "BYTE" and then specify a pattern of "256" (1 0000 0000), the pattern will be truncated to "0000 0000" (the leading "1" will be ignored).
- Pattern comparisons are performed on a per-bank basis (i.e., the entire bank is reserved for the pattern comparison). For example, if you are using channels 101 and 102 for pattern comparison (assumes 34950A) and then perform a static read of channel 103, the module will perform a pattern comparison on channels 101 and 102.
- After specifying the desired digital pattern, use the **CALCulate:COMParE:STATe** command to enable pattern comparisons on the specified channels. If you want to monitor the state of specific bits, use the **CALCulate:COMParE:DATA** command in conjunction with the **CALCulate:COMParE:MASK** command to specify a *mask* pattern.
- Use the **CALCulate:COMParE:TYPE** command to specify whether an alarm or hardware interrupt condition is generated when a specific bit pattern or bit pattern change is detected.
- For the 34950A only, pattern comparisons can be performed with or without handshaking (see **CONFigure:DIGital:HANDshake** command). If you are using handshaking, the specified digital pattern is evaluated with each handshaking operation. If you are not using handshaking, the specified digital pattern is evaluated continuously as soon as you enable the pattern comparison mode.

- For the 34950A only, hardware interrupts are reported on the INTR line (one line is available per bank). See the **[SENSe:]DIGital:INTerrupt[:ENABle]** command to enable interrupts to be reported.
- You can use a pattern comparison to start or stop a buffered (memory) transfer. See the **[SENSe:]DIGital:MEMory:COMParE:ACTion** command for additional information.
- A Factory Reset (***RST** command) clears the digital pattern and turns off the pattern comparison mode. An Instrument Preset (**SYSTem:PRESet** command) or Card Reset (**SYSTem:CPON** command) does *not* clear the data and does *not* turn off the pattern comparison mode.

Return Format

The query command returns the comparison pattern as a decimal value (binary and hexadecimal values are converted to their decimal equivalents). Multiple responses are separated by commas.

Examples

The following program segment sets the digital pattern for the **34950A** in slot 3 and then enables the pattern comparison mode. When the data read from the bank is equal to the comparison pattern, a hardware interrupt will be generated on the INTR line. In this example, handshaking is not used.

```
CALC:COMP:DATA:BYTE 140, (@3101) !Set comparison pattern (1000 1100)
DIG:INT:MODE COMPARE, (@3101) !Interrupt on pattern match
DIG:INT:ENAB ON, (@3101) !Enables interrupts on channel 101
CALC:COMP:STAT ON, (@3101) !Enable pattern comparison mode
```

The following query returns the comparison pattern selected for the 34950A in slot 3.

```
CALC:COMP:DATA? (@3101) !Always returns decimal equivalent
```

Typical Response: **140**

The following program segment sets the digital pattern for the **34952A** in slot 5 and then enables the pattern comparison mode. When the data read from the bank is equal to the comparison pattern, an alarm will be generated on Alarm 2.

```
CALC:COMP:DATA:WORD #HF6, (@5001) !Set comparison pattern (1111 0110)
CALC:COMP:TYPE EQUAL, (@5001) !Generate alarm on pattern match
OUTP:ALARM2:SOUR (@5001) !Enable alarms
CALC:COMP:STAT ON, (@5001) !Enable pattern comparison mode
```

The following query returns the comparison pattern selected for the 34952A in slot 5.

```
CALC:COMP:DATA? (@5001) !Always returns decimal equivalent
```

Typical Response: **246**

See Also

CALCulate:COMPare:MASK

CALCulate:COMPare:STATe

CALCulate:COMPare:TYPE

CONFigure:DIGital:HANDshake

OUTPut:ALARm<*n*>:SOURce

[SENSe:]DIGital:INTerrupt[:ENABLe]

[SENSe:]DIGital:MEMory:COMPare:ACTion

STATus:MODule:SLOT[*n*]:ENABLe

CALCulate:COMPare:MASK[:<width>]

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

CALCulate:COMPare:MASK[:<width>] <data>, (@<ch_list>)

CALCulate:COMPare:MASK? (@<ch_list>)

Description

This command is used in conjunction with the **CALCulate:COMPare:DATA** command to set the digital *mask* data for pattern comparisons on the specified digital input channels. You can use the pattern comparison feature to generate an alarm or hardware interrupt condition (34950A only) when a specific digital pattern is detected. Pattern comparisons always start on the lowest-numbered channel in the bank and extend to all channels involved in the channel width (see **CONFigure:DIGital:WIDTh** command).

Used With:

- 34950A Digital I/O Module (digital input channels only)
- 34952A Multifunction Module (digital input channels only)

Parameters

Name	Type	Range of Values	Default Value
<width>	Discrete	{BYTE 1 WORD 2 LWORD 4} BYTE (or "1" byte): 8 bits WORD (or "2" bytes): 16 bits LWORD (or "4" bytes): 32 bits	BYTE (8 bits)
<data>	Numeric	Specify the bit pattern as a decimal, binary, or hexadecimal value. Specify 1's for active bits or 0's for "don't care" bits. For binary, "#B" must be added as a prefix (e.g., #B11001100). For hex, "#H" must be added as a prefix (e.g., #HCC).	This is a required parameter
<ch_list>	Numeric	One or more digital input channels in the form (@sccc). 34950A: s101 through s104, s201 through s204 34952A: s001 through s004	This is a required parameter

Remarks

- Depending on the width specified, the channel numbering is modified as shown below. For example, if you specify the width as a 16-bit WORD on the 34950A, channels 101 and 102 are combined and addressed collectively as channel 101.

34950A	Bank 2				Bank 1			
BYTE (8 Bits):	Ch 204	Ch 203	Ch 202	Ch 201	Ch 104	Ch 103	Ch 102	Ch 101
WORD (16 Bits):	Ch 203		Ch 201		Ch 103		Ch 101	
LWORD (32 Bits):	Ch 201				Ch 101			

34952A	Bank 1			
BYTE (8 Bits):	Ch 4	Ch 3	Ch 2	Ch 1
WORD (16 Bits):	Ch 3		Ch 1	
LWORD (32 Bits):	Ch 1			

- The channel width takes precedence over the specified digital pattern. If the specified pattern is greater than the channel width, additional bits will be ignored. For example, if you set the channel width to "BYTE" and then specify a pattern of "256" (1 0000 0000), the pattern will be truncated to "0000 0000" (the leading "1" will be ignored).
- Pattern comparisons are performed on a per-bank basis (i.e., the entire bank is reserved for the pattern comparison). For example, if you are using channels 101 and 102 for pattern comparison (assumes 34950A) and then perform a static read of channel 103, the module will perform a pattern comparison on channels 101 and 102.
- After specifying the desired digital pattern and mask, use the **CALCulate:COMParE:STATe** command to enable pattern comparisons on the specified channels.
- For the 34950A only, pattern comparisons can be performed with or without handshaking (see **CONFigure:DIGital:HANDShake** command). If you are using handshaking, the specified digital pattern is evaluated with each handshaking operation. If you are not using handshaking, the specified digital pattern is evaluated continuously as soon as you enable the pattern comparison mode.
- For the 34950A only, hardware interrupts are reported on the INTR line (one line is available per bank). See the **[SENSe:]DIGital:INTerrupt[:ENABLE]** command to enable interrupts to be reported.

- A Factory Reset (***RST** command) clears the mask and turns off the pattern comparison mode. An Instrument Preset (**SYSTem:PRESet** command) or Card Reset (**SYSTem:CPON** command) does *not* clear the mask and does *not* turn off the pattern comparison mode.

Return Format

The query command returns the mask as a decimal value (binary and hexadecimal values are converted to their decimal equivalents). Multiple responses are separated by commas.

Examples

The following program segment sets the digital pattern for the **34950A** in slot 3, applies a mask to the upper four bits, and then enables the pattern comparison mode. When the data read from the upper four bits is equal to the comparison pattern, a hardware interrupt will be generated. In this example, handshaking is not used.

```
CALC:COMP:DATA:BYTE 140, (@3101) !Set comparison pattern (1000 1100)
CALC:COMP:MASK 240, (@3101) !Set mask pattern (1111 0000)
DIG:INT:MODE COMPARE, (@3101) !Interrupt on pattern match
DIG:INT:ENAB ON, (@3101) !Enables interrupts on channel 101
CALC:COMP:STAT ON, (@3101) !Enable pattern comparison mode
```

To illustrate how the calculations are performed, see the example below which assumes that a decimal 146 was read from the channel. Since the calculations produce a non-zero result (decimal 16), an interrupt is not generated.

MSB	LSB	
1001 0010		Data read from port (decimal 146)
<u>1000 1100</u>		CALC:COMP:DATA command (decimal 140)
0001 1110		X-OR result
<u>1111 0000</u>		CALC:COMP:MASK command (decimal 240)
0001 0000		AND result (decimal 16, no interrupt generated)

The following query returns the comparison pattern selected for the **34950A** in slot 3.

```
CALC:COMP:MASK? (@3101) !Always returns decimal equivalent
```

Typical Response: **240**

The following program segment sets the digital pattern for the **34952A** in slot 5, applies a mask to the lower byte, and then enables the pattern comparison mode. When the data read from the lower byte is equal to the comparison pattern, an alarm will be generated on Alarm 2.

```
CALC:COMP:DATA:WORD #HF6F6, (@5001) !Set comparison pattern (1111 0110 1111 0110)
CALC:COMP:MASK #H00FF, (@5001) !Set mask pattern (0000 0000 1111 1111)
CALC:COMP:TYPE EQUAL, (@5001) !Generate alarm on pattern match
```

```
OUTP:ALARM2:SOUR (@5001) !Enable alarms
CALC:COMP:STAT ON, (@5001) !Enable pattern comparison mode
```

To illustrate how the calculations are performed, see the example below which assumes that a decimal 37595 was read from the channel. Since the calculations produce a non-zero result (decimal 13), an alarm is not generated.

MSB	LSB	
1001 0010 1101 1011		Data read from port (decimal 37595)
<u>1111 0110 1111 0110</u>		CALC:COMP:DATA command (decimal 63222)
0110 0100 0010 1101		X-OR result
<u>0000 0000 1111 1111</u>		CALC:COMP:MASK command (decimal 255)
0000 0000 0000 1101		AND result (decimal 13, no alarm generated)

The following query returns the comparison pattern selected for the **34952A** in slot 5.

```
CALC:COMP:MASK? (@5001) !Always returns decimal equivalent
```

Typical Response: **255**

See Also

CALCulate:COMPare:DATA

CALCulate:COMPare:STATe

CALCulate:COMPare:TYPE

CONFigure:DIGital:HANDshake

OUTPut:ALARm<n>:SOURce

[SENSe:]DIGital:INTerrupt[:ENABLE]

CALCulate:COMPare:STATe

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

CALCulate:COMPare:STATe <mode>, (@<ch_list>)

CALCulate:COMPare:STATe? (@<ch_list>)

Description

This command disables or enables the pattern comparison mode on the specified digital input channels. You can use the pattern comparison feature to generate an alarm or hardware interrupt condition (34950A only) when a specific digital pattern is detected. Pattern comparisons always start on the lowest-numbered channel in the bank and extend to all channels involved in the channel width (see [CONFigure:DIGital:WIDTh](#) command).

Used With:

- 34950A Digital I/O Module (digital input channels only)
- 34952A Multifunction Module (digital input channels only)

Parameters

Name	Type	Range of Values	Default Value
<mode>	Boolean	{OFF 0 ON 1}	This is a required parameter
<ch_list>	Numeric	One or more digital input channels in the form (@sccc). 34950A: s101 through s104, s201 through s204 34952A: s001 through s004	This is a required parameter

Remarks

- Pattern comparisons are performed on a per-bank basis (i.e., the entire bank is reserved for the pattern comparison). For example, if you are using channels 101 and 102 for pattern comparison (assumes 34950A) and then perform a static read of channel 103, the module will perform a pattern comparison on channels 101 and 102.
- For the 34950A only, pattern comparisons can be performed with or without handshaking (see [CONFigure:DIGital:HANDshake](#) command). If you are using handshaking, the specified digital pattern is evaluated with each handshaking operation. If you are not using handshaking, the specified digital pattern is evaluated continuously as soon as you enable the pattern comparison mode.

- For the 34950A only, hardware interrupts are reported on the INTR line (one line is available per bank). See the **[SENSe:]DIGital:INTerrupt[:ENABle]** command to enable interrupts to be reported.
- You can use a pattern comparison to start or stop a buffered (memory) transfer. See the **[SENSe:]DIGital:MEMory:COMParE:ACTion** command for additional information.
- A Factory Reset (***RST** command) turns off the pattern comparison mode. An Instrument Preset (**SYSTem:PRESet** command) or Card Reset (**SYSTem:CPON** command) does *not* turn off the pattern comparison mode.

Return Format

The query command returns "0" (OFF) or "1" (ON) for the specified bank. Multiple responses are separated by commas.

Examples

The following program segment sets the digital pattern for the 34950A in slot 3 and then enables the pattern comparison mode. When the data read from the bank is equal to the comparison pattern, a hardware interrupt will be generated. In this example, handshaking is not used.

```
CALC:COMP:DATA:BYTE 140, (@3101) !Set comparison pattern (1000 1100)
DIG:INT:MODE COMPARE, (@3101) !Interrupt on pattern match
DIG:INT:ENAB ON, (@3101) !Enables interrupts on channel 101
CALC:COMP:STAT ON, (@3101) !Enable pattern comparison mode
```

The following query returns the state of the pattern comparison mode for Channel 101 on the module in slot 3.

```
CALC:COMP:STAT? (@3101)
```

Typical Response: 1

See Also

CALCulate:COMParE:DATA

CALCulate:COMParE:MASK

CALCulate:COMParE:TYPE

CONFigure:DIGital:HANDshake

OUTPut:ALARm<n>:SOURce

[SENSe:]DIGital:INTerrupt[:ENABle]

[SENSe:]DIGital:MEMory:COMParE:ACTion

STATus:MODule:SLOT[n]:ENABle

CALCulate:COMPare:TYPE

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

CALCulate:COMPare:TYPE <mode>, (@<ch_list>)

CALCulate:COMPare:TYPE? (@<ch_list>)

Description

This command configures the specified digital input channels to generate an alarm or hardware interrupt condition (34950A only) when a specific bit pattern or bit pattern change is detected. This command is used in conjunction with the **CALCulate:COMPare:DATA** command which sets the *data* bit pattern and the **CALCulate:COMPare:MASK** command which sets the *mask* bit pattern. Pattern comparisons always start on the lowest-numbered channel in the bank and extend to all channels involved in the channel width (see **CONFigure:DIgital:WIDTh** command).

Used With:

- 34950A Digital I/O Module (digital input channels only)
- 34952A Multifunction Module (digital input channels only)

Parameters

Name	Type	Range of Values	Default Value
<mode>	Discrete	{EQual NEQual}	NEQual ("not equal")
<ch_list>	Numeric	One or more digital input channels in the form (@sccc). 34950A: s101 through s104, s201 through s204 34952A: s001 through s004	This is a required parameter

Remarks

- Select *EQual* to generate an alarm or interrupt when the data read from the specified channel is *equal* to **CALCulate:COMPare:DATA**, after being masked by **CALCulate:COMPare:MASK**.
- Select *NEQual* ("not equal") to generate an alarm or interrupt when the data read from the bank is *not* equal to **CALCulate:COMPare:DATA** after being masked by **CALCulate:COMPare:MASK**.

- The channel width takes precedence over the specified digital pattern. If the specified pattern is greater than the channel width, additional bits will be ignored. For example, if you set the channel width to "BYTE" and then specify a pattern of "256" (1 0000 0000), the pattern will be truncated to "0000 0000" (the leading "1" will be ignored).
- Pattern comparisons are performed on a per-bank basis (i.e., the entire bank is reserved for the pattern comparison). For example, if you are using channels 101 and 102 for pattern comparison (assumes 34950A) and then perform a static read of channel 103, the module will perform a pattern comparison on channels 101 and 102.
- For the 34950A only, pattern comparisons can be performed with or without handshaking (see **CONFigure:DIGital:HANDshake** command). If you are using handshaking, the specified digital pattern is evaluated with each handshaking operation. If you are not using handshaking, the specified digital pattern is evaluated continuously as soon as you enable the pattern comparison mode.
- For the 34950A only, hardware interrupts are reported on the INTR line (one line is available per bank). See the **[SENSe:]DIGital:INTerrupt[:ENABLE]** command to enable interrupts to be reported.
- You can use a pattern comparison to start or stop a buffered (memory) transfer. See the **[SENSe:]DIGital:MEMory:COMParE:ACTion** command for additional information.
- A Factory Reset (***RST** command) clears the pattern compare setting and turns off the pattern comparison mode. An Instrument Preset (**SYSTem:PRESet** command) or Card Reset (**SYSTem:CPON** command) does *not* clear the pattern compare setting and does *not* turn off the pattern comparison mode.

Return Format

The query command returns "EQU" or "NEQ" for the specified bank. Multiple responses are separated by commas.

Examples

The following program segment sets the digital pattern for the 34952A in slot 5 and then enables the pattern comparison mode. When the data read from the bank is equal to the comparison pattern, an alarm will be generated on Alarm 2.

```
CALC:COMP:DATA:WORD #HF6, (@5001) !Set comparison pattern (1111 0110)
CALC:COMP:TYPE EQUAL, (@5001) !Generate alarm on pattern match
OUTP:ALARM2:SOUR (@5001) !Enable alarms
CALC:COMP:STAT ON, (@5001) !Enable pattern comparison mode
```

The following query returns the pattern compare settings on Channel 1 on the module in slot 5.

```
CALC:COMP:TYPE? (@5001)
```

Typical Response: **EQU**

See Also

CALCulate:COMParE:DATA

CALCulate:COMPare:MASK
CALCulate:COMPare:STATe
CONFigure:DIGital:HANDshake
OUTPut:ALARm<*n*>:SOURce
[SENSe:]DIGital:INTerrupt[:ENABle]
[SENSe:]DIGital:MEMory:COMPare:ACTion
STATus:MODule:SLOT[*n*]:ENABle

CALCulate:AVERage:AVERage?

Syntax | Description | Parameters | Remarks | Return Format | Example

Syntax

CALCulate:AVERage:AVERage? [(@<ch_list>)]

Description

This command calculates the mathematical average of all readings taken on each of the specified channels since the start of the scan. Each channel must be a channel that has been configured to be part of the active scan list. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

Used With:

- 34921A through 34925A Multiplexer Modules
- 34950A Digital I/O Module (digital input and counter channels only)
- 34952A Multifunction Module (digital input and totalizer channels only)

Parameters

Name	Type	Range of Values	Default Value
<ch_list>	Numeric	One or more channels in the form <u>(@sccc)</u> .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- You can read the values at any time, even during a scan. An error is generated if the internal DMM is disabled (see **INSTrument:DMM[:STATe]** command) or not installed in the mainframe.
- If you omit the optional <ch_list> parameter, this command calculates the average of readings taken by the internal DMM, independent of any channels or a scan list. The calculation starts when the internal DMM is triggered.
- The instrument clears the stored statistical data on all channels when a new scan is started, when the **CALCu-late:AVERage:CLEar** command is executed, after a Factory Reset (***RST** command), or after an Instrument Preset (**SYSTem:PRESet** command).

Return Format

The command returns one value for each channel specified. Multiple responses are separated by commas. If no data is available for the specified channels, "0" is returned.

Example

The following query returns the average of the readings taken on channels 1 and 3 in slot 1.

```
CALC:AVER:AVER? (@1001,1003)
```

Typical Response: +2.61920000E+01,+1.63540000E+01

See Also

[CALCulate:AVERage:CLEar](#)

[CALCulate:AVERage:COUNt?](#)

CALCulate:AVERage:CLEar

Syntax | Description | Parameters | Remarks | Return Format | Example

Syntax

CALCulate:AVERage:CLEar [(@<ch_list>)]

Description

This command clears all values from the statistics registers for each the specified channels. Each channel must be a channel that has been configured to be part of the scan list. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

Used With:

- 34921A through 34925A Multiplexer Modules
- 34950A Digital I/O Module (digital input and counter channels only)
- 34952A Multifunction Module (digital input and totalizer channels only)

Parameters

Name	Type	Range of Values	Default Value
<ch_list>	Numeric	One or more channels in the form <u>(@sccc)</u> .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- This command clears the minimum, maximum, average, count, and peak-to-peak values (but no readings are cleared from memory).
- An error is generated if the internal DMM is disabled (see **INSTrument:DMM[:STATe]** command) or not installed in the mainframe.
- The instrument clears the stored statistical data on all channels when a new scan is started, after a Factory Reset (***RST** command), or after an Instrument Preset (**SYSTem:PRESet** command).

Return Format

This command has no query form.

Example

The following command clears the stored statistical data on channels 1 and 3 in slot 1.

```
CALC:AVER:CLE (@1001,1003)
```


CALCulate:AVERage:COUNT?

Syntax | Description | Parameters | Remarks | Return Format | Example

Syntax

CALCulate:AVERage:COUNT? [(@<ch_list>)]

Description

This command returns the number of readings taken on each of the specified channels since the start of the scan. Each channel must be a channel that has been configured to be part of the scan list. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

Used With:

- 34921A through 34925A Multiplexer Modules
- 34950A Digital I/O Module (digital input and counter channels only)
- 34952A Multifunction Module (digital input and totalizer channels only)

Parameters

Name	Type	Range of Values	Default Value
<ch_list>	Numeric	One or more channels in the form <u>(@sccc)</u> .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- You can read the values at any time, even during a scan. An error is generated if the internal DMM is disabled (see **INSTrument:DMM[:STATe]** command) or not installed in the mainframe.
- If you omit the optional <ch_list> parameter, this command reads the count on the internal DMM, independent of any channels or a scan list. The calculation starts when the internal DMM is triggered.
- The instrument clears the stored statistical data on all channels when a new scan is started, when the **CALCulate:AVERage:CLEar** command is executed, after a Factory Reset (***RST** command), or after an Instrument Preset (**SYSTem:PRESet** command).

Return Format

The command returns one value for each channel specified. Multiple responses are separated by commas. If no data is available for the specified channels, "0" is returned.

Example

The following query returns the number of readings taken on channels 1 and 3 in slot 1.

```
CALC:AVER:COUN? (@1001,1003)
```

Typical Response: +2.0000000E+01,+1.20000000E+02

See Also

CALCulate:AVERage:CLEar

CALCulate:AVERage:MAXimum?

Syntax | Description | Parameters | Remarks | Return Format | Example

Syntax

CALCulate:AVERage:MAXimum? [(@<ch_list>)]

Description

This command returns the maximum value found on each of the specified channels during the scan. Each channel must be a channel that has been configured to be part of the scan list. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

Used With:

- 34921A through 34925A Multiplexer Modules
- 34950A Digital I/O Module (digital input and counter channels only)
- 34952A Multifunction Module (digital input and totalizer channels only)

Parameters

Name	Type	Range of Values	Default Value
<ch_list>	Numeric	One or more channels in the form <u>(@sccc)</u> .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- You can read the values at any time, even during a scan. An error is generated if the internal DMM is disabled (see **INSTRument:DMM[:STATe]** command) or not installed in the mainframe.
- If you omit the optional <ch_list> parameter, this command returns the maximum reading taken by the internal DMM, independent of any channels or a scan list. The calculation starts when the internal DMM is triggered.
- The instrument clears the stored statistical data on all channels when a new scan is started, when the **CALCulate:AVERage:CLEar** command is executed, after a Factory Reset (***RST** command), or after an Instrument Preset (**SYSTem:PRESet** command).

Return Format

The command returns one value for each channel specified. Multiple responses are separated by commas. If no data is available for the specified channels, "0" is returned.

Example

The following query returns the maximum values found on channels 1 and 3 in slot 1.

```
CALC:AVER:MAX? (@1001,1003)
```

Typical Response: +1.37370000E+03,+5.28380000E+03

See Also

[CALCulate:AVERage:CLEar](#)

[CALCulate:AVERage:MAXimum:TIME?](#)

CALCulate:AVERage:MAXimum:TIME?

Syntax | Description | Parameters | Remarks | Return Format | Example

Syntax

CALCulate:AVERage:MAXimum:TIME? [(@<ch_list>)]

Description

This command returns the time (in full time and date format) when the maximum reading was taken on each of the specified channels during the scan. Each channel must be a channel that has been configured to be part of the scan list. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

Used With:

- 34921A through 34925A Multiplexer Modules
- 34950A Digital I/O Module (digital input and counter channels only)
- 34952A Multifunction Module (digital input and totalizer channels only)

Parameters

Name	Type	Range of Values	Default Value
<ch_list>	Numeric	One or more channels in the form <u>(@sccc)</u> .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- You can read the values at any time, even during a scan. An error is generated if the internal DMM is disabled (see **INSTrument:DMM[:STATe]** command) or not installed in the mainframe.
- This command is not affected by the **FORMat:READIng:TIME:TYPE** command which selects the time format for storing scanned data in memory (absolute time versus relative time).
- If you omit the optional <ch_list> parameter, this command returns the time of the maximum reading was taken by the internal DMM, independent of any channels or a scan list. The calculation starts when the internal DMM is triggered.
- The instrument clears the stored statistical data on all channels when a new scan is started, when the **CALCu-late:AVERage:CLEar** command is executed, after a Factory Reset (***RST** command), or after an Instrument Preset (**SYSTem:PRESet** command).

Return Format

The command returns one string for each channel specified indicating the time and date when the maximum reading was taken. Multiple responses are separated by commas. If no data is available for the specified channels, zeros are returned for each field.

The string returned has the form **yyyy,mm,dd,hh,mm,ss.sss**:

yyyy	is the year
mm	is the month
dd	is the day of the month
hh	is the hour in 24-hour format
mm	is the minutes
ss.sss	is the seconds (with 1 ms resolution)

For example:

<u>2004,11,21</u>	<u>10,07,11.364</u>
November 21, 2004	10:07:11.364 AM

Example

The following query returns the time when the maximum readings were taken on channels 1 and 3 in slot 1.

```
CALC:AVER:MAX:TIME? (@1001,1003)
```

Typical Response: 2004,11,21,10,03,10.314,2004,11,21,10,07,11.364

See Also

[CALCulate:AVERage:CLEar](#)

[CALCulate:AVERage:MINimum?](#)

CALCulate:AVERage:MINimum?

Syntax | Description | Parameters | Remarks | Return Format | Example

Syntax

CALCulate:AVERage:MINimum? [(@<ch_list>)]

Description

This command returns the minimum value found on each of the specified channels during the scan. Each channel must be a channel that has been configured to be part of the scan list. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

Used With:

- 34921A through 34925A Multiplexer Modules
- 34950A Digital I/O Module (digital input and counter channels only)
- 34952A Multifunction Module (digital input and totalizer channels only)

Parameters

Name	Type	Range of Values	Default Value
<ch_list>	Numeric	One or more channels in the form <u>(@sccc)</u> .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- You can read the values at any time, even during a scan. An error is generated if the internal DMM is disabled (see **INSTRument:DMM[:STATe]** command) or not installed in the mainframe.
- If you omit the optional <ch_list> parameter, this command returns the minimum reading taken by the internal DMM, independent of any channels or a scan list. The calculation starts when the internal DMM is triggered.
- The instrument clears the stored statistical data on all channels when a new scan is started, when the **CALCulate:AVERage:CLEar** command is executed, after a Factory Reset (***RST** command), or after an Instrument Preset (**SYSTem:PRESet** command).

Return Format

The command returns one value for each channel specified. Multiple responses are separated by commas. If no data is available for the specified channels, "0" is returned.

Example

The following query returns the minimum values found on channels 1 and 3 in slot 1.

```
CALC:AVER:MIN? (@1001,1003)
```

Typical Response: +4.27150000E-03,+1.32130000E-03

See Also

[CALCulate:AVERage:CLEar](#)

[CALCulate:AVERage:MINimum:TIME?](#)

CALCulate:AVERage:MINimum:TIME?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

CALCulate:AVERage:MINimum:TIME? [(@<ch_list>)]

Description

This command returns the time (in full time and date format) when the minimum reading was taken on each of the specified channels during the scan. Each channel must be a channel that has been configured to be part of the scan list. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

Used With:

- 34921A through 34925A Multiplexer Modules
- 34950A Digital I/O Module (digital input and counter channels only)
- 34952A Multifunction Module (digital input and totalizer channels only)

Parameters

Name	Type	Range of Values	Default Value
<ch_list>	Numeric	One or more channels in the form (@sccc) .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- You can read the values at any time, even during a scan. An error is generated if the internal DMM is disabled (see [INSTrument:DMM\[:STATe\]](#) command) or not installed in the mainframe.
- This command is not affected by the [FORMat:READIng:TIME:TYPE](#) command which selects the time format for storing scanned data in memory (absolute time versus relative time).
- If you omit the optional <ch_list> parameter, this command returns the time of the minimum reading was taken by the internal DMM, independent of any channels or a scan list. The calculation starts when the internal DMM is triggered.
- The instrument clears the stored statistical data on all channels when a new scan is started, when the [CALCu-late:AVERage:CLEar](#) command is executed, after a Factory Reset ([*RST](#) command), or after an Instrument Preset ([SYSTem:PRESet](#) command).

Return Format

The command returns one string for each channel specified indicating the time and date when the minimum reading was taken. Multiple responses are separated by commas. If no data is available for the specified channels, zeroes are returned for each field.

The string returned has the form **yyyy,mm,dd,hh,mm,ss.sss**:

yyyy	is the year
mm	is the month
dd	is the day of the month
hh	is the hour in 24-hour format
mm	is the minutes
ss.sss	is the seconds (with 1 ms resolution)

For example:

<u>2004,11,21,10,07,11.364</u>
November 21, 2004 10:07:11.364 AM

Example

The following query returns the time when the minimum readings were taken on channels 1 and 3 in slot 1.

```
CALC:AVER:MIN:TIME? (@1001,1003)
```

Typical Response: 2004,11,21,10,03,10.314,2004,11,21,10,07,11.364

See Also

[CALCulate:AVERage:CLEar](#)

[CALCulate:AVERage:MINimum?](#)

CALCulate:AVERage:PTPeak?

Syntax | Description | Parameters | Remarks | Return Format | Example

Syntax

CALCulate:AVERage:PTPeak? [(@<ch_list>)]

Description

This command calculates the peak-to-peak value of all readings taken on each of the specified channels since the start of the scan (the difference between the maximum and minimum reading). Each channel must be a channel that has been configured to be part of the scan list. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

Used With:

- 34921A through 34925A Multiplexer Modules
- 34950A Digital I/O Module (digital input and counter channels only)
- 34952A Multifunction Module (digital input and totalizer channels only)

Parameters

Name	Type	Range of Values	Default Value
<ch_list>	Numeric	One or more channels in the form <u>(@sccc)</u> .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- You can read the values at any time, even during a scan. An error is generated if the internal DMM is disabled (see **INSTrument:DMM[:STATe]** command) or not installed in the mainframe.
- If you omit the optional <ch_list> parameter, this command returns the peak-to-peak value taken by the internal DMM, independent of any channels or a scan list. The calculation starts when the internal DMM is triggered.
- The instrument clears the stored statistical data on all channels when a new scan is started, when the **CALCu-late:AVERage:CLEar** command is executed, after a Factory Reset (*RST command), or after an Instrument Preset (**SYSTem:PRESet** command).

Return Format

The command returns one value for each channel specified. Multiple responses are separated by commas. If no data is available for the specified channels, "0" is returned.

Example

The following query returns the peak-to-peak value of the readings taken on channels 1 and 3 in slot 1.

```
CALC:AVER:PTP? (@1001,1003)
```

Typical Response: +1.34560000E+00,+1.98750000E+00

See Also

CALCulate:AVERage:CLEar

CALibration Subsystem Introduction

The CALibration commands are used to calibrate the Keysight 34980A. Please note that the use of these commands requires a detailed knowledge of the appropriate calibration procedures, which are described in the Keysight 34980A *Service Guide*. Please refer to that guide before attempting to calibrate the instrument as improper use of the CALibration commands can adversely affect the accuracy and reliability of the instrument.

Command Summary

NOTE

Hold the mouse cursor over a command to view the full syntax statement.

CALibration?

CALibration:ABORt

CALibration:BEGin[:VOLTage]

CALibration:COUNt?

CALibration:LFRequency

CALibration:LFRequency?

CALibration:MODule?

CALibration:POINt?

CALibration:SECure:CODE

CALibration:SECure:STATe

CALibration:SECure:STATe?

CALibration:STRing

CALibration:STRing?

CALibration:VALue

CALibration:VALue?

CALibration?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

CALibration?

Description

This command performs a calibration of the internal DMM using the specified calibration value (**CALibration:VALue** command). Before you can calibrate the instrument, you must unsecure it by entering the correct security code.

NOTE

For a more detailed discussion of the calibration procedures, see the Keysight 34980A *Service Guide*. Please refer to that guide before attempting to calibrate the instrument as improper use of the CALibration commands can adversely affect the accuracy and reliability of the instrument.

Remarks

- If a calibration fails, "+1" is returned and an error is stored in the error queue. For a complete listing of the error messages related to calibration failures, see [SCPI Error Messages](#).
- The internal DMM is an optional assembly for the Keysight 34980A. An error is generated if the internal DMM is disabled (see **INSTrument:DMM[:STATe]** command) or not installed in the mainframe.
- To calibrate the 34951A Isolated DAC Module, use the **CALibration:MODule?** command.
- To calibrate the DAC channels on the 34952A Multifunction Module, use the **CALibration:BEGin[:VOLTage]** and **CALibration:POINt?** commands.
- This command increments the calibration count on the internal DMM (see **CALibration:COUNt?** command).

Return Format

The command returns "+0" (calibration passed) or "+1" (calibration failed).

Example

The following command performs a calibration and returns a pass/fail indication.

```
CAL?
```

Typical Response: +0

See Also

[CALibration:SECure:STATe](#)

CALibration:VALue

CALibration:ABORt

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

CALibration:ABORt

Description

This command aborts a calibration in progress on the 34952A Multifunction Module without storing any of the calibration constants. This command aborts a calibration initiated by the **CALibration:BEGin[:VOLTage]** and **CALibration:POINt?** commands.

Example

The following command aborts a calibration in progress on the 34952A.

```
CAL:ABOR
```

See Also

[CALibration:BEGin\[:VOLTage\]](#)

[CALibration:POINt?](#)

CALibration:BEGin[:VOLTage]

Syntax | **Description** | **Parameters** | **Remarks** | **Return Format** | **Example**

Syntax

CALibration:BEGin[:VOLTage] [<setup_#>,] (@<channel>)

Description

This command initiates a voltage calibration (adjustment) sequence for the specified DAC channel on the 34952A Multifunction Module. This sequence sets a zero adjustment and a gain adjustment constant for each DAC output. You must perform all of the adjustments on one DAC channel before adjusting the other DAC channel.

NOTE

For a more detailed discussion of the calibration procedures, see the Keysight 34980A *Service Guide*. Please refer to that guide before attempting to calibrate the instrument as improper use of the CALibration commands can adversely affect the accuracy and reliability of the instrument.

Parameters

Name	Type	Range of Values	Default Value
<setup_#>	Discrete	Calibration setup number. Since the 34952A requires only one calibration setup, always specify "1" for this parameter.	Setup "1"
<channel>	Numeric	One channel in the form (@sccc) . Select from s006 or s007 (valid only on DAC channels).	This is a required parameter

Remarks

- This command is used in conjunction with the **CALibration:POINt?** command to calibrate the specified DAC channel. After executing the CALibration:BEGin[:VOLTage] command for the desired DAC channel, send the CALibration:POINt? command *twice*, once for the zero adjustment and once for the gain adjustment.
- Before you can begin calibrating the specified DAC channel, you must unsecure the instrument by entering the correct security **CALibration:SECure:STATe** command).
- You can calibrate only one DAC channel at a time.
- Use the **CALibration:ABORt** command to abort a calibration in progress.

Example

The following command initiates a voltage calibration on the specified DAC channel.

```
CAL:BEGIN:VOLT 1,(@5006) !Begin adjustment  
<measure DAC output for zero adjustment>  
CAL:POIN? <value> !Should return "+1"  
<measure DAC output for gain adjustment>  
CAL:POIN? <value> !Should return "+0"
```

See Also

[CALibration:ABORT](#)

[CALibration:POINT?](#)

[CALibration:SECure:STATe](#)

CALibration:COUNT?

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

CALibration:COUNT? [{<slot>|MAINframe|DMM}]

Description

This command queries the instrument to determine how many calibrations have been performed on the entire mainframe, the digital modules, or the internal DMM. Note that your instrument was calibrated before it left the factory. When you receive your instrument, be sure to read the various counts to determine the initial values.

NOTE

For a more detailed discussion of the calibration procedures, see the Keysight 34980A *Service Guide*. Please refer to that guide before attempting to calibrate the instrument as improper use of the CALibration commands can adversely affect the accuracy and reliability of the instrument.

Used With:

- 34951A Isolated DAC Module
- 34952A Multifunction Module (DAC channels only)
- Internal DMM

Parameters

Name	Type	Range of Values	Default Value
<slot>	Discrete	{1-8 SLOT1-SLOT8 MAINframe DMM}	MAINframe

Remarks

- The calibration counts increment up to a maximum of 4,294,967,295 after which they roll over to "0". Since the value increments by one for each calibration point, a complete calibration may increase the value by many counts.
- The mainframe calibration count is incremented by the CALibration?, CALibration:MODule? (the mainframe must be unsecured; see CALibration:SECure:STATe OFF command) and CALibration:POINt? commands. You can read the calibration count whether the instrument is secured or unsecured.
- The internal DMM calibration count is incremented by the CALibration? command. You can read the calibration count whether the instrument is secured or unsecured.

- The 34951A calibration count is incremented by the **CALibration:MODUle?** command (the mainframe must be unsecured). If the mainframe is secured, the calibration count will *not* be incremented.
- The 34952A calibration count is incremented by the **CALibration:POINt?** command. If the mainframe is secured, the calibration count will *not* be incremented.
- If the specified slot (CALibration:COUNt? <slot>) does not contain either a 34951A or 34952A module, an error is generated.
- The calibration count is stored in **non-volatile** memory, and does not change when power has been off, after a Factory Reset (***RST** command), or after an Instrument Preset (**SYSTem:PRESet** command).

Return Format

The command returns the calibration count indicating how many calibrations have been performed.

Examples

The following command returns the calibration count on the entire mainframe.

```
CAL:COUN? MAIN
```

Typical Response: **+1048592**

The following command returns the calibration count on the module in slot 3.

```
CAL:COUN? 3
```

Typical Response: **+39391**

See Also

CALibration:MODUle?

CALibration?

CALibration:POINt?

CALibration:SECure:STATe

CALibration:LFRrequency

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

CALibration:LFRrequency <line_frequency>

CALibration:LFRrequency?

Description

This command sets the power-line reference frequency used by the internal DMM's analog-to-digital converter. Normally, when you apply power to the instrument, the internal DMM automatically measures the power-line frequency (50 Hz, 60 Hz, or 400 Hz) and uses this measurement to determine the integration time used.

Parameters

Name	Type	Range of Values	Default Value
<line_frequency>	Discrete	{50 60 400}	This is a required parameter

Remarks

- The internal DMM is an optional assembly for the Keysight 34980A. An error is generated if the internal DMM is disabled (see **INSTrument:DMM[:STATe]** command) or not installed in the mainframe.
- If you set the reference frequency to 400 Hz, the 50 Hz reference value is actually used (a subharmonic of 400 Hz).
- The internal DMM multiplies the period of the reference frequency by the specified number of power line cycles (**[SENSe:]<function>:NPLC** commands) to determine the actual integration time.
- The reference frequency setting is stored in **volatile** memory and will be reset to the measured power-line frequency when power is turned off.

Return Format

The command returns "50" (for 50 Hz or 400 Hz) or "60" indicating the present reference frequency setting.

Examples

The following command sets the reference frequency setting to 50 Hz.

```
CAL:LFR 50
```

The following command returns the reference frequency setting.

CAL:LFR?

Typical Response: **+60**

See Also

[SENSe:]<*function*>:NPLC

CALibration:LFRrequency

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

CALibration:LFRrequency <line_frequency>

CALibration:LFRrequency?

Description

This command sets the power-line reference frequency used by the internal DMM's analog-to-digital converter. Normally, when you apply power to the instrument, the internal DMM automatically measures the power-line frequency (50 Hz, 60 Hz, or 400 Hz) and uses this measurement to determine the integration time used.

Parameters

Name	Type	Range of Values	Default Value
<line_frequency>	Discrete	{50 60 400}	This is a required parameter

Remarks

- The internal DMM is an optional assembly for the Keysight 34980A. An error is generated if the internal DMM is disabled (see **INSTrument:DMM[:STATe]** command) or not installed in the mainframe.
- If you set the reference frequency to 400 Hz, the 50 Hz reference value is actually used (a subharmonic of 400 Hz).
- The internal DMM multiplies the period of the reference frequency by the specified number of power line cycles (**[SENSe:]<function>:NPLC** commands) to determine the actual integration time.
- The reference frequency setting is stored in **volatile** memory and will be reset to the measured power-line frequency when power is turned off.

Return Format

The command returns "50" (for 50 Hz or 400 Hz) or "60" indicating the present reference frequency setting.

Examples

The following command sets the reference frequency setting to 50 Hz.

```
CAL:LFR 50
```

The following command returns the reference frequency setting.

CAL:LFR?

Typical Response: **+60**

See Also

[SENSe:]<*function*>:NPLC

CALibration:MODule?

Syntax | Description | Parameters | Remarks | Return Format | Example

Syntax

CALibration:MODule? [{<slot>|ALL}]

Description

This command performs an auto-calibration of all four channels on the 34951A Isolated DAC Module in the specified slot. Since the calibration will take several seconds to complete, you may want to increase the timeout value of your programming application prior to sending this command.

NOTE

For a more detailed discussion of the calibration procedures, see the Keysight 34980A *Service Guide*. Please refer to that guide before attempting to calibrate the instrument as improper use of the CALibration commands can adversely affect the accuracy and reliability of the instrument.

NOTE

Because the calibration uses the internal DMM, the calibration will abort if any signals are connected to ABus1 via the rear-panel **Analog Bus** connector (pins 4, 5, and 9). Be sure to disconnect any signals from ABus1 prior to running the calibration.

Parameters

Name	Type	Range of Values	Default Value
<slot>	Discrete	{1-8 SLOT1-SLOT8 ALL}	ALL (calibrate all installed 34951A modules)

Remarks

- If the instrument is unsecured (**CALibration:SECure:STATe** command), the calibration constants are stored in **non-volatile** memory on the module. If the module is secured, the calibration constants are stored in volatile memory and are lost when power is turned off (a ***RST** command will not erase the calibration constants).
- The internal DMM is an optional assembly for the Keysight 34980A. An error is generated if the internal DMM is disabled (see **INSTrument:DMM[:STATe]** command) or not installed in the mainframe.
- If a calibration fails, "+1" is returned and an error is stored in the error queue. For a complete listing of the error messages related to calibration failures, see **SCPI Error Messages**.
- To calibrate the internal DMM, use the **CALibration?** command.
- To calibrate the DAC channels on the 34952A Multifunction Module, use the **CALibration:BEGin[:VOLTage]** and **CALibration:POINT?** commands.

- This command increments the calibration count (see **CALibration:COUNT?** command) on the mainframe and the 34951A *only* if the instrument is unsecured.

Return Format

The command returns "+0" (calibration passed) or "+1" (calibration failed).

Example

The following command performs a calibration of the 34951A installed in slot 5 and returns a pass/fail indication.

```
CAL:MOD? 5
```

Typical Response: **+0**

See Also

CALibration:SECure:STATe

CALibration:POINt?

Syntax | Description | Parameters | Remarks | Return Format | Example

Syntax

CALibration:POINt? <value>

Description

This command follows the **CALibration:BEGin[:VOLTage]** command in the voltage calibration sequence for the specified DAC channel on the 34952A Multifunction Module. To complete the voltage calibration sequence, you will send the CALibration:POINt? command *twice*, once for the zero adjustment and once for the gain adjustment.

NOTE

For a more detailed discussion of the calibration procedures, see the Keysight 34980A *Service Guide*. Please refer to that guide before attempting to calibrate the instrument as improper use of the CALibration commands can adversely affect the accuracy and reliability of the instrument.

Parameters

Name	Type	Range of Values	Default Value
<value>	Numeric	Measured voltage output from the DAC channel specified in CALibration:BEGin[:VOLTage] command.	This is a required parameter

Remarks

- Before you can calibrate the specified DAC channel, you must unsecure the instrument by entering the correct security (see **CALibration:SECure:STATe** command).
- You can calibration only one DAC channel at a time.
- Use the **CALibration:ABORt** command to abort a calibration in progress.
- This command increments the calibration count on the 34952A (see **CALibration:COUNt?** command).

Return Format

As part of the voltage calibration sequence, you will execute the CALibration:POINt? command *twice* (following the CALibration:BEGin[:VOLTage] command). After the first time (zero adjustment), the command returns "+1" indicating that one calibration point remains. After the second time (gain adjustment), the command returns "+0" indicating that the adjustment is complete on this DAC channel.

Example

The following command initiates a voltage calibration on the specified DAC channel and then computes the corresponding calibration constants.

```
CAL:BEGIN:VOLT 1, (@5006)  !Begin adjustment
<measure DAC output for zero adjustment>
CAL:POIN? <value>  !Should return "+1"
<measure DAC output for gain adjustment>
CAL:POIN? <value>  !Should return "+0"
```

See Also

[CALibration:ABORt](#)

[CALibration:BEGin\[:VOLTage\]](#)

[CALibration:SECure:STATe](#)

CALibration:SECure:CODE

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

CALibration:SECure:CODE <new_code>

Description

This command allows you to enter a new security code to prevent accidental or unauthorized calibrations. The specified code is used to unsecure the mainframe and all installed modules. To change the security code, you must first unsecure the instrument using the old security code, and then enter a new code.

NOTE

For a more detailed discussion of the calibration procedures, see the Keysight 34980A *Service Guide*. Please refer to that guide before attempting to calibrate the instrument as improper use of the CALibration commands can adversely affect the accuracy and reliability of the instrument.

Used With:

- 34951A Isolated DAC Module
- 34952A Multifunction Module (DAC channels only)
- Internal DMM

Parameters

Name	Type	Range of Values	Default Value
<new_code>	ASCII String	A string of up to 12 characters. You do not have to use all 12 characters but the first character must always be a letter (A-Z). The remaining 11 characters can be letters, numbers (0-9), or the underscore character ("_"). Blank spaces are not allowed.	This is a required parameter

Remarks

- The security code is set to "AT34980" when the instrument is shipped from the factory.
- If you forget your security code, you can override the security feature. See the Keysight 34980A *Service Guide* for more information.
- The security code is stored in **non-volatile** memory in the mainframe, and does not change when power has been off, after a Factory Reset (*RST command), or after an Instrument Preset (SYSTem:PRESet command).

Example

The following command sets a new calibration security code (the instrument must be unsecured).

```
CAL:SEC:CODE T3ST_DUT165
```

See Also

CALibration:SECure:STATe

CALibration:SECure:STATe

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

CALibration:SECure:STATe <mode>, <code>

CALibration:SECure:STATe?

Description

This command unsecures or secures the instrument for calibration. This feature allows you to enter a security code to prevent accidental or unauthorized calibrations of the instrument. Before you can calibrate the instrument, you must unsecure it by entering the correct security code.

NOTE

For a more detailed discussion of the calibration procedures, see the Keysight 34980A *Service Guide*. Please refer to that guide before attempting to calibrate the instrument as improper use of the CALibration commands can adversely affect the accuracy and reliability of the instrument.

Used With:

- 34951A Isolated DAC Module
- 34952A Multifunction Module (DAC channels only)
- Internal DMM

Parameters

Name	Type	Range of Values	Default Value
<mode>	Boolean	{OFF 0 ON 1}	This is a required parameter
<code>	ASCII String	A string of up to 12 characters. You do not have to use all 12 characters but the first character must always be a letter (A-Z). The remaining 11 characters can be letters, numbers (0-9), or the underscore character ("_"). Blank spaces are not allowed.	This is a required parameter

Remarks

- When you first receive your instrument, it is secured. The security code is set to "AT34980" when the instrument is shipped from the factory.

- Once you enter a security code, that code must be used for both front-panel and remote operation. For example, if you secure the instrument from the front panel, you must use that same code to unsecure it from the remote interface.
- Unsecuring the instrument using this command enables all installed modules and the internal DMM to be calibrated.
- To calibrate the internal DMM, use the **CALibration?** command.
- To calibrate the 34951A Isolated DAC Module, use the **CALibration:MODule?** command.
- To calibrate the DAC channels on the 34952A Multifunction Module, use the **CALibration:BEGin[:VOLTage]** and **CALibration:POINt?** commands.
- The calibration security setting is stored in **non-volatile** memory, and does not change when power has been off, after a Factory Reset (***RST** command), or after an Instrument Preset (**SYSTem:PRESet** command).

Return Format

The query command returns "0" (OFF) or "1" (ON) indicating the current calibration security setting.

Examples

The following command unsecures the instrument.

```
CAL:SEC:STAT OFF,AT34980
```

The following query returns the current calibration security setting.

```
CAL:SEC:STAT?
```

Typical Response: **0**

See Also

CALibration:SECure:CODE

CALibration:STRing

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

CALibration:STRing "<string>" [, {<slot>|MAINframe|DMM}]

CALibration:STRing? [{<slot>|MAINframe|DMM}]

Description

This command allows you to store one message in calibration memory in the mainframe, a digital module, or the internal DMM. For example, you can store such information as the date when the last calibration was performed, the date when the next calibration is due, the instrument's serial number, or even the name and phone number of the person to contact for a new calibration.

NOTE

For a more detailed discussion of the calibration procedures, see the Keysight 34980A *Service Guide*. Please refer to that guide before attempting to calibrate the instrument as improper use of the CALibration commands can adversely affect the accuracy and reliability of the instrument.

Used With:

- 34951A Isolated DAC Module
- 34952A Multifunction Module
- Internal DMM

Parameters

Name	Type	Range of Values	Default Value
<string>	Quoted ASCII String	A string of up to 40 characters enclosed in quotes. You can use letters (A-Z), numbers (0-9), and special characters like "@", "%", "*", etc.	This is a required parameter
<slot>	Discrete	{1-8 SLOT1-SLOT8 MAINframe DMM}	MAINframe

Remarks

- You can record a calibration message *only* from the remote interface and *only* when the instrument is unsecured (see **CALibration:SECure:STATe OFF** command). You can read the message from either the front-panel or over the remote interface. You can read the calibration message whether the instrument is secured or unsecured.

- The calibration message may contain up to 40 characters. From the front panel, you can view only 18 characters of the message at a time. Press [>] to scroll through the text of the message. Press [>] again to increase the scrolling speed.
- From the front panel, commas, periods, and semicolons share a display space with the preceding character, and are not considered individual characters.
- Storing a calibration message will overwrite any message previously stored in memory.
- If the specified slot (CALibration:STRing "<string>", <slot>) does not contain either a 34951A or 34952A module, an error is generated.
- The calibration message is stored in **non-volatile** calibration memory, and does not change when power has been off, after a Factory Reset (***RST** command), or after an Instrument Preset (**SYSTem:PRESet** command).

Return Format

The query command returns an ASCII string enclosed in double quotes. If no calibration message has been specified, an empty quoted string ("") is returned.

Examples

The following commands store a message in calibration memory in the mainframe.

```
CAL:STR "CAL: 21 Nov 2005",MAIN or CAL:STR 'CAL: 21 Nov 2005',MAIN
```

The following commands store a message in calibration memory on the module in slot 3.

```
CAL:STR "CAL: 21 Nov 2005",3 or CAL:STR 'CAL: 21 Nov 2005',3
```

The following query returns the message currently stored in calibration memory in the mainframe (the quotes are also returned).

```
CAL:STR?
```

Typical Response: "CAL: 21 Nov 2005"

See Also

CALibration:SECure:STATe

CALibration:VALue

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

CALibration:VALue <value>

CALibration:VALue?

Description

This command specifies the value of the known calibration signal as outlined in the calibration procedures in the Keysight 34980A *Service Guide*. This command is used for internal DMM calibrations.

NOTE

For a more detailed discussion of the calibration procedures, see the Keysight 34980A *Service Guide*. Please refer to that guide before attempting to calibrate the instrument as improper use of the CALibration commands can adversely affect the accuracy and reliability of the instrument.

Parameters

Name	Type	Range of Values	Default Value
<value>	Numeric	Desired calibration signal in the units specified by the present measurement function.	This is a required parameter

Remarks

- The internal DMM is an optional assembly for the Keysight 34980A. An error is generated if the internal DMM is disabled (see **INSTrument:DMM[:STATe]** command) or not installed in the mainframe.
- To calibrate the 34951A Isolated DAC Module, use the **CALibration:MODUle?** command.
- To calibrate the DAC channels on the 34952A Multifunction Module, use the **CALibration:BEGin[:VOLTage]** and **CALibration:POINt?** commands.

Return Format

The query command returns the calibration value in the form "+1.00000000E-01".

Examples

The following command sets calibration value to +10.001010 volts.

```
CAL:VAL 10.001010
```

The following query returns the present calibration value.

```
CAL:VAL?
```

Typical Response: **+1.00010100E+01**

See Also

CALibration?

CONFigure Subsystem Introduction

The CONFigure command provides the most flexible way to program the instrument for measurements. When you execute this command, the instrument uses default values for the requested measurement configuration (like the **MEASure?** command). However, the measurement *is not* automatically started and you can change some measurement attributes before actually initiating the measurement. This allows you to incrementally change the instrument's configuration from the default conditions.

NOTE

Use the **INITiate** or **READ?** command to initiate the measurement.

NOTE

For a comparison of the MEASure? and CONFigure commands, see **MEASure? Versus CONFigure**.

The CONFigure commands are valid only with the following Keysight 34980A plug-in modules which can be configured to be part of a scan. If the internal DMM is not installed or is disabled, then no DMM-related configurations are allowed. However, scanning is allowed on the digital input and totalizer channels even without the internal DMM.

34921A	40-Channel Armature Multiplexer (including temperature and current)
34922A	70-Channel Armature Multiplexer
34923A	40/80-Channel Reed Multiplexer
34924A	70-Channel Reed Multiplexer
34925A	40/80-Channel FET Multiplexer
34950A	64-Bit Digital I/O Module (digital input and counter channels only)
34952A	Multifunction Module (digital input and totalizer channels only)

Command Summary

NOTE

Hold the mouse cursor over a command to view the full syntax statement.

CONFigure:COUNter:DCYcle
CONFigure:COUNter:FREQuency
CONFigure:COUNter:PERiod
CONFigure:COUNter:PWIDth
CONFigure:COUNter:TOTalize
CONFigure:CURREnt:AC
CONFigure:CURREnt[:DC]
CONFigure:DIGital
CONFigure:DIGital:DIRection
CONFigure:DIGital:DIRection?
CONFigure:DIGital:HANDshake
CONFigure:DIGital:HANDshake:CTIME
CONFigure:DIGital:HANDshake:CTIME?
CONFigure:DIGital:HANDshake:DRIVE

CONFigure:DiGital:HANDshake:DRIVE?
 CONFigure:DiGital:HANDshake:POLarity
 CONFigure:DiGital:HANDshake:POLarity?
 CONFigure:DiGital:HANDshake:RATE
 CONFigure:DiGital:HANDshake:RATE?
 CONFigure:DiGital:HANDshake:STaTe
 CONFigure:DiGital:HANDshake:STaTe?
 CONFigure:DiGital:HANDshake:SYNChronous:STRobe[:SOURce]
 CONFigure:DiGital:HANDshake:SYNChronous:STRobe[:SOURce]?
 CONFigure:DiGital:INTerrupt:POLarity
 CONFigure:DiGital:INTerrupt:POLarity?
 CONFigure:DiGital:POLarity
 CONFigure:DiGital:POLarity?
 CONFigure:DiGital:WIDTh
 CONFigure:DiGital:WIDTh?
 CONFigure:FREQuency
 CONFigure:FRESistance
 CONFigure:PERiod
 CONFigure:RESistance
 CONFigure:TEMPerature
 CONFigure:TOTalize
 CONFigure[:VOLTage]:AC
 CONFigure[:VOLTage][:DC]
 CONFigure?

Default Settings for the CONFigure Command

With the CONFigure command, you can select the function, range, and resolution all in one command. All other measurement parameters are set to their default values as shown below. The CONFigure command does not redefine the scan list as set by the **ROUTe:SCAN** command.

Measurement Parameter	CONFigure Setting
Integration Time	1 PLC
Input Resistance	10 M Ω (fixed for all DCV ranges)
AC Filter / Frequency Timeout	20 Hz (medium filter)
Range	Autorange Enabled
Autozero	Enabled
Offset Compensation	Disabled
Channel Delay	Automatic Delay
Sample Count	1 Sample per Trigger
Sweep Count	1 Scan Sweep

Trigger Count	1 Trigger
Trigger Delay	Automatic Delay
Trigger Source	Immediate

Using the CONFigure Command

The following program segment shows how to use the CONFigure command with the **READ?** command to make externally-triggered measurements on two channels. The ROUTe:SCAN command adds the channels to the active scan list. Note that if ROUTe:SCAN was omitted, the program below would return a single internal DMM reading (no automatic channel switching would be involved). The CONFigure command configures the instrument for dc voltage measurements on two channels on the module in slot 3. Note that the CONFigure command does *not* place the instrument in the "wait-for-trigger" state.

The READ? command places the instrument in the "wait-for-trigger" state, scans the specified channels once when the rear-panel **Ext Trig Input** line is pulsed low, and then transfers the readings to reading memory and the instrument's output buffer. The default range (autorange) and resolution (1 PLC) are used for the measurements.

```
CONF:VOLT:DC (@3010,3011)
ROUT:SCAN (@3010,3011)
TRIG:SOUR EXT
READ?
```

Typical Response: **+4.27150000E-03**

The following program segment is similar to the previous example but it uses the **INITiate** command to place the instrument in the "wait-for-trigger" state. The INITiate command places the instrument in the "wait-for-trigger" state, scans the specified channels immediately (internal triggering), and sends the readings to reading memory. The **FETCh?** command transfers the readings from reading memory to the instrument's output buffer.

```
CONF:VOLT:DC (@3010,3011)
ROUT:SCAN (@3010,3011)
TRIG:SOUR IMM
INIT
FETC?
```

Typical Response: **+5.34250000E-03**

Storing readings in memory using the INITiate command is generally faster than sending readings to memory using the READ? command. The INITiate command is also an "overlapped" command. This means that after executing the INITiate command, you can send other commands that do not affect the scan. Note that the FETCh? command will wait until the scan is complete to terminate. The instrument can store at least 500,000 readings in internal reading memory.

NOTE

To stop a scan that has been started using the INITiate command, send an **ABORT** command or Device Clear.

The following program segment configures the instrument for 2-wire resistance measurements, triggers the internal DMM to scan two channels using the READ? command (channels 3 and 8 in slot 1), and then transfers

the readings to reading memory and the instrument's output buffer. The 1 k Ω range is selected with 1 Ω resolution.

```
CONF:RES 1000,1,(@1003,1008)
ROUT:SCAN (@1003,1008)
READ?
```

Typical Response: **+3.27150000E+02,+1.32130000E+02**

If you omit the <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (the scan list is not redefined). The following program segment configures the instrument for 2-wire resistance measurements, triggers the internal DMM to make one measurement using the INITiate, and then stores the reading in memory. The 10 k Ω range is selected with 100 Ω resolution.

```
CONF:RES 10000,100
INIT
FETC?
```

Typical Response: **+5.95850000E+03**

CONFigure:COUNTer:DCYClE

Syntax | **Description** | **Parameters** | **Remarks** | Return Format | **Example**

Syntax

CONFigure:COUNTer:DCYClE [{<gate_time>|MIN|MAX|DEF},] (@<ch_list>)

Description

This command configures the specified counter channels on the 34950A Digital I/O Module to measure the duty cycle of the incoming signal. For duty cycle measurements, you must send the **[SENSe:]COUNTer:INITiate** command to initiate the measurement. The specified gate time is the measurement aperture during which the signal data is gathered. For repetitive signals, longer gate times will lead to increased resolution for frequency, period, pulse width, and duty cycle measurements.

The CONFigure command sets the counter parameters to their default values as shown below.

Parameter	CONFigure Settings
Slope	POSitive (rising edge)
Input Threshold Voltage	2.5V
Gate Source	INTernal
Gate Polarity	NORMal (active high)

Used With:

- 34950A Digital I/O Module

Parameters

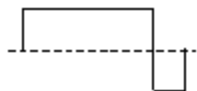
Name	Type	Range of Values	Default Value
<gate_time>	Numeric	Desired gate time between 100 ns and 10 seconds, with 50 ns resolution. MIN = 100 ns, MAX = 100 seconds	1 ms
<ch_list>	Numeric	One or more counter channels in the form (@sccc) . Select from s301 or s302.	This is a required parameter

Remarks

- The duty cycle represents the amount of time per cycle that the input signal is at a high level (assuming that the polarity is not reversed) and is expressed as a percentage. The specified counter channels must detect at least two edges for a valid duty cycle measurement.



20% Duty Cycle



80% Duty Cycle

- To read the duty cycle, use the **[SENSe:]COUNter:DATA?** or **[SENSe:]COUNter:DCYCLE[:DATA]?** command.
- Sending the **CONFigure** command clears reading memory and resets the triggering system.

Example

The following command configures counter channels 301 and 302 on the module in slot 3 to measure duty cycle. The gate time is set to 1 ms.

```
CONF:COUN:DCYC 1E-3, (@3301,3302)
COUN:INIT (@3301,3302)
COUN:DCYC? (@3301,3302)
```

Typical Response: +5.00000000E+01,+5.00000000E+01

See Also

CONFigure:COUNter:PWIDth

CONFigure?

MEASure:COUNter:DCYCLE?

[SENSe:]COUNter:ABORt

[SENSe:]COUNter:DATA?

[SENSe:]COUNter:DCYCLE[:DATA]?

[SENSe:]COUNter:INITiate

CONFigure:COUNter:FREQuency

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

CONFigure:COUNter:FREQuency [{<gate_time>|MIN|MAX|DEF},] (@<ch_list>)

Description

This command configures the specified counter channels on the 34950A Digital I/O Module to measure the frequency of the incoming signal. For frequency measurements, you must send the **[SENSe:]COUNter:INITiate** command to initiate the measurement. The specified gate time is the measurement aperture during which the signal data is gathered. For repetitive signals, longer gate times will lead to increased resolution for frequency, period, pulse width, and duty cycle measurements.

The CONFigure command sets the counter parameters to their default values as shown below.

Parameter	CONFigure Settings
Slope	POSitive (rising edge)
Input Threshold Voltage	2.5V
Gate Source	INTernal
Gate Polarity	NORMal (active high)

Used With:

- 34950A Digital I/O Module

Parameters

Name	Type	Range of Values	Default Value
<gate_time>	Numeric	Desired gate time between 100 ns and 10 seconds, with 50 ns resolution. MIN = 100 ns, MAX = 100 seconds	1 ms
<ch_list>	Numeric	One or more counter channels in the form (@sccc) . Select from s301 or s302.	This is a required parameter

Remarks

- The frequency is measured as: $(NumberRisingEdges - 1) / GateTime$. The specified counter channels must detect at least two edges for a valid frequency measurement. The maximum input frequency allowed is 10 MHz.
- To read the frequency, use the **[SENSe:]COUNter:DATA?** or **[SENSe:]COUNter:FREQuency[:DATA]?** command.
- Sending the CONFigure command clears reading memory and resets the triggering system.

Example

The following command configures counter channels 301 and 302 on the module in slot 3 to measure frequency. The gate time is set to 1 ms.

```
CONF:COUN:FREQ 1E-3, (@3301, 3302)
COUN:INIT (@3301, 3302)
COUN:FREQ? (@3301, 3302)
```

Typical Response: +3.45600000E+05,+3.31300000E+05

See Also

CONFigure:COUNter:PERiod

CONFigure?

MEASure:COUNter:FREQuency?

[SENSe:]COUNter:ABORt

[SENSe:]COUNter:DATA?

[SENSe:]COUNter:FREQuency[:DATA]?

[SENSe:]COUNter:INITiate

CONFigure:COUNter:PERiod

Syntax | **Description** | **Parameters** | **Remarks** | **Return Format** | **Example**

Syntax

CONFigure:COUNter:PERiod [{<gate_time>|MIN|MAX|DEF},] (@<ch_list>)

Description

This command configures the specified counter channels on the 34950A Digital I/O Module to measure the period of the incoming signal (this is the reciprocal of the frequency). For period measurements, you must send the **[SENSe:]COUNter:INITiate** command to initiate the measurement. The specified gate time is the measurement aperture during which the signal data is gathered. For repetitive signals, longer gate times will lead to increased resolution for frequency, period, pulse width, and duty cycle measurements.

The CONFigure command sets the counter parameters to their default values as shown below.

Parameter	CONFigure Settings
Slope	POSitive (rising edge)
Input Threshold Voltage	2.5V
Gate Source	INTernal
Gate Polarity	NORMal (active high)

Used With:

- 34950A Digital I/O Module

Parameters

Name	Type	Range of Values	Default Value
<gate_time>	Numeric	Desired gate time between 100 ns and 10 seconds, with 50 ns resolution. MIN = 100 ns, MAX = 100 seconds	1 ms
<ch_list>	Numeric	One or more counter channels in the form (@sccc) . Select from s301 or s302.	This is a required parameter

Remarks

- The specified counter channels must detect at least two edges for a valid period measurement.

- To read the period, use the **[SENSe:]COUNter:DATA?** or **[SENSe:]COUNter:PERiod[:DATA]?** command.
- Sending the **CONFigure** command clears reading memory and resets the triggering system.

Example

The following command configures counter channels 301 and 302 on the module in slot 3 to measure period. The gate time is set to 1 ms.

```
CONF:COUN:PER 1E-3, (@3301,3302)  
COUN:INIT (@3301,3302)  
COUN:PER? (@3301,3302)
```

Typical Response: **+2.89400000E-06,+4.83700000E-06**

See Also

CONFigure:COUNter:FREQuency

CONFigure?

MEASure:COUNter:PERiod?

[SENSe:]COUNter:ABORt

[SENSe:]COUNter:DATA?

[SENSe:]COUNter:INITiate

[SENSe:]COUNter:PERiod[:DATA]?

CONFigure:COUNter:PWIDth

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

CONFigure:COUNter:PWIDth [{<gate_time>|MIN|MAX|DEF},] (@<ch_list>)

Description

This command configures the specified counter channels on the 34950A Digital I/O Module to measure the pulse width of the incoming signal. For pulse width measurements, you must send the [\[SENSe:\]COUNter:INITiate](#) command to initiate the measurement. The specified gate time is the measurement aperture during which the signal data is gathered. For repetitive signals, longer gate times will lead to increased resolution for frequency, period, pulse width, and duty cycle measurements.

The CONFigure command sets the counter parameters to their default values as shown below.

Parameter	CONFigure Settings
Slope	POSitive (rising edge)
Input Threshold Voltage	2.5V
Gate Source	INTernal
Gate Polarity	NORMal (active high)

Used With:

- 34950A Digital I/O Module

Parameters

Name	Type	Range of Values	Default Value
<gate_time>	Numeric	Desired gate time between 100 ns and 10 seconds, with 50 ns resolution. MIN = 100 ns, MAX = 100 seconds	1 ms
<ch_list>	Numeric	One or more counter channels in the form (@sccc) . Select from s301 or s302.	This is a required parameter

Remarks

- The pulse width represents the amount of time per cycle that the input signal is at a high level (assuming that the polarity is not reversed) and is expressed in seconds. If multiple pulses occur during the specified gate time, the result will be the average width of all pulses.
- To read the pulse width, use the **[SENSe:]COUNter:DATA?** or **[SENSe:]COUNter:PWIDth[:DATA]?** command.
- Sending the **CONFigure** command clears reading memory and resets the triggering system.

Example

The following command configures counter channels 301 and 302 on the module in slot 3 to measure pulse width. The gate time is set to 1 ms.

```
CONF:COUN:PWID 1E-3, (@3301,3302)  
COUN:INIT (@3301,3302)  
COUN:PWID? (@3301,3302)
```

Typical Response: **+1.44700000E-06,+3.98300000E-06**

See Also

CONFigure:COUNter:DCYCLE

CONFigure?

MEASure:COUNter:PWIDth?

[SENSe:]COUNter:ABORt

[SENSe:]COUNter:DATA?

[SENSe:]COUNter:INITiate

[SENSe:]COUNter:PWIDth[:DATA]?

CONFigure:COUNter:TOTalize

Syntax | Description | Parameters | Remarks | Return Format | Example

Syntax

CONFigure:COUNter:TOTalize [<mode>,@<ch_list>]

Description

This command enables or disables an automatic reset of the count on the specified counter channels on the 34950A Digital I/O Module. To read the totalizer without resetting the count, select the READ parameter. To read the totalizer and reset the count to "0" after it is read, select the RRESet parameter (this means "read and reset").

Since the totalizer count is *not* an initiated measurement, configuring the specified channels will automatically start the totalize operation (an internal gate is not required). You can, however, use the [SENSe:]COUNter:INITiate and [SENSe:]COUNter:ABORt commands to start and stop the totalize operation.

The CONFigure command sets the counter parameters to their default values as shown below.

Parameter	CONFigure Settings
Slope	POSitive (rising edge)
Input Threshold Voltage	2.5 V

Used With:

- 34950A Digital I/O Module

Parameters

Name	Type	Range of Values	Default Value
<mode>	Discrete	{READ RRESet}	READ (read without resetting the count)
<ch_list>	Numeric	One or more counter channels in the form (@sccc). Select from s301 or s302.	This is a required parameter

Remarks

- To read the count (measured in counts), use the [SENSe:]COUNter:DATA? or [SENSe:]COUNter:TOTalize [:DATA]? command.
- The maximum count is 4,294,967,295 ($2^{32} - 1$). The count rolls over to "0" after reaching the maximum allowed value.

- If the count rolls over to "0", the "Totalizer Overflow" bit is set in the Slot Event Registers group (see **STATus:MODule:SLOT[n]:CONDition?** and **STATus:MODule:SLOT[n]:EVENT?** commands). For more information on the SCPI Status System for the Keysight 34980A, see **Status System Introduction**.
- Sending the CONFigure command clears reading memory and resets the triggering system.

Example

The following command configures counter channels 301 and 302 on the module in slot 3 to be read without resetting their count.

```
CONF:COUN:TOT READ, (@3301,3302)  
COUN:TOT:DATA? (@3301,3302)
```

Typical Response: 1.321300000E+03,4.762300000E+03

See Also

CONFigure?

MEASure:COUNter:TOTalize?

[SENSe:]COUNter:ABORt

[SENSe:]COUNter:DATA?

[SENSe:]COUNter:INITiate

[SENSe:]COUNter:TOTalize[:DATA]?

STATus:MODule:SLOT[n]:CONDition?

STATus:MODule:SLOT[n]:EVENT?

CONFigure:CURRent:AC

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

CONFigure:CURRent:AC [{<range>|AUTO|MIN|MAX|DEF} [{<resolution>|MIN|MAX|DEF}] ,] [(@<ch_list>)]

Description

First, this command resets all measurement parameters on the specified channels to their [default values](#). Then, configures the channels for ac current measurements but *does not* initiate the scan. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

The CONFigure command does *not* place the instrument in the "wait-for-trigger" state. Use the [INITiate](#) or [READ?](#) command in conjunction with CONFigure to place the instrument in the "wait-for-trigger" state.

Used With:

- 34921A Armature Multiplexer (channels 41 through 44 only)

Parameters

Name	Type	Range of Values	Default Value
<range>	Numeric	Expected value in amps (ranges shown below). 10 mA (MIN) 100 mA 1 A (MAX)	AUTO (autorange)
<resolution>	Numeric	Desired resolution in amps.	Fixed at 6½ digits
<ch_list>	Numeric	One or more channels in the form (@sccc). Current measurements are allowed only on channels 41 through 44 of the 34921A.	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.

- When you specify a range of channels with this command, any channels that are invalid will be ignored (no error will be generated) but the first and last channel in the range must be valid for the selected function. The Analog Bus relays (numbered **s911**, **s912**, **s913**, etc.) on the multiplexer and matrix modules are ignored if they are included in a range of channels. An error will be generated if an Analog Bus relay is specified as the first or last channel in a range of channels.
- You can allow the instrument to automatically select the measurement range using *autoranging* or you can select a fixed range using manual ranging. Autoranging is convenient because the instrument decides which range to use for each measurement based on the input signal. For fastest scanning operation, use manual ranging on each measurement (some additional time is required for autoranging since the instrument has to make a range selection).
- If you select autoranging (by specifying "AUTO" or "DEF"), an error will be generated if you specify a discrete value for the `<resolution>` parameter. When autoranging is combined with a discrete resolution, the instrument cannot accurately resolve the integration time (especially if the input signal is continuously changing). If your application requires autoranging, be sure to specify "DEF" for the `<resolution>` parameter or omit the parameter from the command.
- Autorange thresholds:

Down range at: <10% of range
Up range at: >120% of range

- Since this command resets all measurement parameters on the specified channels to their default values, be sure to send the **CONF**igure command *before* setting any other measurement parameters. For example, to change the sample count, first send the **CONF**igure command (sets the sample count to "1") and then change the sample count to the desired value (see **SAMPLE:COUNT** command).
- If the input signal is greater than can be measured on the selected range (manual ranging), the instrument gives an *overload indication*: "±OVLD" from the front panel or "±9.9E+37" from the remote interface.
- For ac measurements, the resolution is fixed at 6½ digits. The only way to control the reading rate for ac measurements is by changing the **channel delay** or by setting the **ac filter** to the highest frequency limit. The `<resolution>` parameter only affects the number of digits shown on the front panel.
- The ***RST** command will clear the scan list and set all measurement parameters to their factory settings. The Instrument Preset (**SYSTem:PRESet** command) will not clear the scan list; however, this command will clear reading memory and all stored statistical data.

Examples

The following program segment configures the instrument for ac current measurements on channel 41 in slot 1. The **READ?** command places the instrument in the "wait-for-trigger" state, scans the channel once, and then sends the reading to reading memory and the instrument's output buffer. The default range (autorange) and resolution (fixed at 6½ digits) are used for the measurement.

```
CONF:CURR:AC (@1041)
ROUT:SCAN (@1041)
READ? (@1041)
```

Typical Response: **+8.54530000E-02**

The following program segment configures the instrument for an ac current measurement on channels 41 and 42 in slot 1. The INITiate command places the instrument in the "wait-for-trigger" state, scans the channels once, and stores the readings in memory. The FETCh? command transfers the readings from reading memory to the instrument's output buffer. The 1 A range is selected with 200 mA resolution.

```
CONF:CURR:AC 1,0.2,(@1041,1042)  
ROUT:SCAN (@1041,1042)  
INIT  
FETC?
```

Typical Response: **+4.27150000E-02,+1.32130000E-03**

The following program segment configures the internal DMM for a ac current measurement (no <ch_list> is specified). The READ? command places the internal DMM in the "wait-for-trigger" state, initiates a trigger, and then sends the reading to reading memory and the instrument's output buffer. The default range (autorange) and resolution (fixed at 6½ digits) are used for the measurement.

```
CONF:CURR:AC !Applies to the internal DMM  
READ?
```

Typical Response: **+3.73620000E-02**

See Also

CONFigure?

FETCh?

INITiate

READ?

MEASure:CURRent:AC?

ROUTe:CHANnel:DELay

ROUTe:SCAN

[SENSe:]CURRent:AC:BANDwidth

SWEep:COUNt

CONFigure:CURRent[:DC]

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

```
CONFigure:CURRent[:DC] [{<range>|AUTO|MIN|MAX|DEF} [, {<resolution>|MIN|MAX|DEF}] , ] [(@<ch_list>)]
```

Description

First, this command resets all measurement parameters on the specified channels to their **default values**. Then, configures the channels for dc current measurements but *does not* initiate the scan. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

The CONFigure command does *not* place the instrument in the "wait-for-trigger" state. Use the **INITiate** or **READ?** command in conjunction with CONFigure to place the instrument in the "wait-for-trigger" state.

Used With:

- 34921A Armature Multiplexer (channels 41 through 44 only)

Parameters

Name	Type	Range of Values	Default Value
<range>	Numeric	Expected value in amps (ranges shown below). 10 mA (MIN) 100 mA 1 A (MAX)	AUTO (autorange)
<resolution>	Numeric	Desired resolution in amps.	0.000003 x Range (1 PLC)
<ch_list>	Numeric	One or more channels in the form (@sccc). Current measurements are allowed only on channels 41 through 44 of the 34921A.	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.

- When you specify a range of channels with this command, any channels that are invalid will be ignored (no error will be generated) but the first and last channel in the range must be valid for the selected function. The Analog Bus relays (numbered **s911**, **s912**, **s913**, etc.) on the multiplexer and matrix modules are ignored if they are included in a range of channels. An error will be generated if an Analog Bus relay is specified as the first or last channel in a range of channels.
- You can allow the instrument to automatically select the measurement range using *autoranging* or you can select a fixed range using manual ranging. Autoranging is convenient because the instrument decides which range to use for each measurement based on the input signal. For fastest scanning operation, use manual ranging on each measurement (some additional time is required for autoranging since the instrument has to make a range selection).
- If you select autoranging (by specifying "AUTO" or "DEF"), an error will be generated if you specify a discrete value for the <resolution> parameter. When autoranging is combined with a discrete resolution, the instrument cannot accurately resolve the integration time (especially if the input signal is continuously changing). If your application requires autoranging, be sure to specify "DEF" for the <resolution> parameter, or omit the parameter from the command and use the **[SENSe:]CURRent[:DC]:NPLC** command to specify the desired integration time.
- Autorange thresholds:

Down range <10% of range
at:
Up range at: >120% of range

- Since this command resets all measurement parameters on the specified channels to their default values, be sure to send the CONFigure command *before* setting any other measurement parameters. For example, to change the sample count, first send the CONFigure command (sets the sample count to "1") and then change the sample count to the desired value (see **SAMPlE:COUNt** command).
- If the input signal is greater than can be measured on the selected range (manual ranging), the instrument gives an *overload indication*: "±OVLd" from the front panel or "±9.9E+37" from the remote interface.
- The ***RST** command will clear the scan list and set all measurement parameters to their factory settings. The Instrument Preset (**SYSTem:PRESet** command) will not clear the scan list; however, this command will clear reading memory and all stored statistical data.

Examples

The following program segment configures the instrument for dc current measurements on channel 41 in slot 1. The READ? command places the instrument in the "wait-for-trigger" state, scans the channel once, and then sends the reading to reading memory and the instrument's output buffer. The default range (autorange) and resolution (1 PLC) are used for the measurement.

```
CONF:CURR:DC (@1041)
ROUT:SCAN (@1041)
READ? (@1041)
```

Typical Response: **+8.54530000E-03**

The following program segment configures the instrument for dc current measurements on channels 41 and 42 in slot 1. The INITiate command places the instrument in the "wait-for-trigger" state, scans the channels once, and stores the readings in memory. The FETCh? command transfers the readings from reading memory to the instrument's output buffer. The 1 A range is selected with 200 mA resolution.

```
CONF:CURR:DC 1,0.2,(@1041,1042)
ROUT:SCAN (@1041,1042)
INIT
FETC?
```

Typical Response: +4.27150000E-02,+1.32130000E-03

The following program segment configures the internal DMM for a dc current measurement (no <ch_list> is specified). The READ? command places the internal DMM in the "wait-for-trigger" state, initiates a trigger, and then sends the reading to reading memory and the instrument's output buffer. The default range (autorange) and resolution (1 PLC) are used for the measurement.

```
CONF:CURR:DC !Applies to the internal DMM
READ?
```

Typical Response: +3.73620000E-02

See Also

CONFigure?

FETCh?

INITiate

MEASure:CURRent[:DC]?

READ?

ROUTe:SCAN

[SENSe:]CURRent[:DC]:ZERO:AUTO

SWEEp:COUNt

CONFigure:DIGital

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

CONFigure:DIGital <width>, [<voltage>,<polarity>] (@<ch_list>)

Description

This command configures the specified channels for unbuffered (no memory) input operations but *does not* initiate the scan. This command allows you to set the desired channel width, threshold voltage (34950A only), and logic polarity (34950A and 34952A only) for scanning. The channels associated with the specified operation are automatically reconfigured as input channels.

The CONFigure command does *not* place the module in the "wait-for-trigger" state. Use the **INITiate** or **READ?** command in conjunction with CONFigure to place the instrument in the "wait-for-trigger" state.

Used With:

- 34950A Digital I/O Module (digital input channels only)
- 34952A Multifunction Module (digital input channels only)
- 34959A Breadboard Module (digital input channels only)

Parameters

Name	Type	Range of Values	Default Value
<width>	Discrete	{BYTE 1 WORD 2 LWORD 4} BYTE (or "1" byte): 8 bits WORD (or "2" bytes): 16 bits LWORD (or "4" bytes): 32 bits 34959A: <i>Only valid configurations are BYTE/WORD.</i>	This is a required parameter
<voltage> ¹	Numeric	Desired threshold voltage between 0V and 5V, with 20 mV resolution. MIN = 0V, MAX = 5V	0.8V (TTL)
<polarity> ²	Discrete	{NORMal INVerted}	NORMal (active high)
<ch_list>	Numeric	One or more digital input or output channels in the form (@sccc). 34950A: s101 through s104, s201 through s204 34952A: s001 through s004 34959A: s001 or s002	This is a required parameter

¹ Variable threshold voltage is available only on the 34950A.

² Variable polarity is available only on the 34950A and 34952A.

Remarks

- If this command is directed to the first channel on a bank on the 34950A (i.e., channel 101 or 201) this command will reset all handshaking parameters (see **CONF:Figure:DiGital:HANDshake** command) and the buffered memory mode will be aborted and disabled.
- When you specify a range of channels with this command, any channels that are invalid will be ignored (no error will be generated) but the first and last channel in the range must be valid for the selected function.
- Changing the channel width will disable buffered (memory) operations and clear memory on the specified digital channels (see **[SENSe:]DiGital:MEMory:ENABle** command).
- To set the threshold voltage independently (34950A only), you can use the **[SENSe:]DiGital:THReshold** command.
- To set the logic polarity independently, you can use the **CONF:Figure:DiGital:POLarity** command.
- The ***RST** command will clear the scan list and set all measurement parameters to their factory settings. The Instrument Preset (**SYSTem:PRESet** command) will not clear the scan list; however, this command will clear reading memory.

Examples

The following program segment configures the **34950A** in slot 3 for two 16-bit words and then selects an "active low" polarity (the optional threshold voltage parameter is omitted in this example). The **READ?** command places the module in the "wait-for-trigger" state, scans the channels once, and then sends the results to reading memory and the instrument's output buffer.

```
CONF:DiG WORD,INV,(@3101,3103) !Width = 16 bits, Polarity = active low
ROUT:SCAN (@3101,3103) !Add channels to scan list
READ? (@3101,3103)
```

Typical Response: **65487,64972**

The following program segment configures the **34952A** in slot 5 for one 32-bit word and then selects an "active high" polarity. The **INITiate** command places the module in the "wait-for-trigger" state, scans the channel once, and stores the reading in memory. The **FETCh?** command transfers the reading from reading memory to the instrument's output buffer.

```
CONF:DiG LWORD,NORM,(@5001) !Width = 32 bits, Polarity = active high
ROUT:SCAN (@5001) !Add channels to the scan list
INIT
FETCh?
```

Typical Response: **529755**

See Also

[CONFigure:DIGital:POLarity](#)

[CONFigure:DIGital:WIDTH](#)

[CONFigure?](#)

[FETCh?](#)

[INITiate](#)

[MEASure:DIGital?](#)

[READ?](#)

[\[SENSe:\]DIGital:THReshold](#)

CONFigure:DIGital:DIRection

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

CONFigure:DIGital:DIRection <direction>, (@<ch_list>)

CONFigure:DIGital:DIRection? (@<ch_list>)

Description

This command configures the specified digital channels for input or output operations.

Used With:

- 34950A Digital I/O Module (digital input/output channels only)
- 34952A Multifunction Module (digital input/output channels only)
- 34959A Breadboard Module

Parameters

Name	Type	Range of Values	Default Value
<direction>	Discrete	{INPut O OUTPut 1}	INPut (0)
<ch_list>	Numeric	One or more digital input or output channels in the form (@sccc). 34950A: s101 through s104, s201 through s204 34952A: s001 through s004	This is a required parameter

Remarks

- The selected direction applies to the channel width on the specified channels. Use the **CONFigure:DIGital:WIDTh** command to set the desired width. Depending on the width specified, the channel numbering is modified as shown below. For example, if you specify the width as a 16-bit WORD on the 34950A, channels 101 and 102 are combined and addressed collectively as channel 101.

34950A	Bank 2				Bank 1			
BYTE (8 Bits):	Ch 204	Ch 203	Ch 202	Ch 201	Ch 104	Ch 103	Ch 102	Ch 101
WORD (16 Bits):	Ch 203		Ch 201		Ch 103		Ch 101	
LWORD (32 Bits):	Ch 201				Ch 101			

34952A	Bank 1			
BYTE (8 Bits):	Ch 4	Ch 3	Ch 2	Ch 1
WORD (16 Bits):	Ch 3		Ch 1	
LWORD (32 Bits):	Ch 1			

- If the specified channels are part of a scan list (see **ROUTe:SCAN** command), changing the direction will to an output will clear the scan list.
- Changing the direction will disable buffered (memory) operations on the specified digital channels (see **[SENSe:]DIGital:MEMory:ENABLE** and **SOURce:DIGital:MEMory:ENABLE** commands).
- The selected direction is stored in **volatile** memory and will be set to "INP" when power is turned off or after a Factory Reset (***RST** command).

Return Format

The query command returns "INP" or "OUTP" for the specified channels. Multiple responses are separated by commas.

Examples

The following program segment configures the **34950A** in slot 3 for two 16-bit words and then configures the channels for output operations.

```
CONF:DIG:WIDTH WORD, (@3101, 3103)
CONF:DIG:DIR OUTP, (@3101, 3103)
```

The following query returns the state of channels 101 and 103 on the **34950A** in slot 3.

```
CONF:DIG:DIR? (@3101, 3103)
```

Typical Response: **OUTP,OUTP**

The following program segment configures the **34952A** in slot 5 for one 32-bit word and then configures the channel for input operations.

```
CONF:DIG:WIDTH LWORD, (@5001)
CONF:DIG:DIR INP, (@5001)
```

The following query returns the state of channel 1 on the **34952A** in slot 3.

```
CONF:DIG:DIR? (@5001)
```

Typical Response: **INP**

See Also

[CONFigure:DIGital:POLarity](#)

[CONFigure:DIGital:WIDTH](#)

[CONFigure?](#)

CONFigure:DIGital:HANDshake

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

CONFigure:DIGital:HANDshake SYNChronous, [<thresh_voltage>, [<level_voltage>, [<polarity>,]]] (@<ch_list>)

Description

This command configures all of the handshaking parameters for the specified bank on the 34950A Digital I/O Module. Use the *thresh_voltage* parameter to set the input threshold voltage for the H2 handshake line and INTR line. Use the *level_voltage* parameter to set the logic "1" voltage level for the H0 and H1 handshake lines and INTR line. Use the *polarity* parameter to set the logic polarity of one or all of the three handshake lines (H0, H1, and H2) and INTR line.

Since handshaking is used for transfers involving the first channel on a bank only, this command must be directed to the first channel (i.e., channel 101 or 201 only), and extends to all channels involved in the channel width (see [CONFigure:DIGital:WIDTH](#) command).

This command sets the following handshaking parameters to their default values:

- Handshake Drive = ACTive (see [CONFigure:DIGital:HANDshake:DRIVE](#) command)
- Handshake Line State = ON (see [CONFigure:DIGital:HANDshake:STATe](#) command)
- Handshake Cycle Time = 1 ms (see [CONFigure:DIGital:HANDshake:CTIME](#) command)
- Handshake Rate = 1 kHz (see [CONFigure:DIGital:HANDshake:RATE](#) command)
- Synchronous Clock Source = INTernal (see [CONFigure:DIGital:HANDshake:SYNChronous:STRobe\[:SOURce\]](#) command)

Used With:

- 34950A Digital I/O Module

Parameters

Name	Type	Range of Values	Default Value
<thresh_voltage>	Numeric	Desired threshold voltage between 0V and 5V, with 20 mV resolution. MIN = 0V, MAX = 5V	0.8V (TTL)

<level_voltage>	Numeric	Desired voltage level between 1.66V and 5V, with 20 mV resolution. MIN = 1.66V, MAX = 5V	5V
<polarity>	Discrete	{NORMa INVerted}	NORMa (active high)
<ch_list>	Numeric	One or more digital input or output channels in the form (@sccc). Select from s101 through s104, s201 through s204	This is a required parameter

Remarks

- Handshaking can be used with buffered or unbuffered memory operations (see [SENSe:]DIGIt-al:MEMory:ENABle and SOURce:DIGital:MEMory:ENABle commands).
- To set the threshold voltage independently, you can use the [SENSe:]DIGital:HANDshake:THReshold command.
- To set the logic "1" voltage level independently, you can use the SOURce:DIGital:HANDshake:LEVel command.
- To set the logic polarity independently, you can use the CONFigure:DIGital:HANDshake:POLarity command.
- The *RST command will clear the scan list and set all measurement parameters to their factory settings. The Instrument Preset (SYSTem:PRESet command) will not clear the scan list; however, this command will clear reading memory.

Examples

The following program segment configures the handshaking parameters for the module in slot 3 (Bank 1). The bank is configured for synchronous output transfers, with an input threshold voltage of 1.2V, an output voltage level of 2.4V, and normal logic polarity (active high).

```
CONF:DIG:WIDTH WORD, (@3101) !Width = 16 bits
CONF:DIG:DIR OUTP, (@3101) !Direction = Output
CONF:DIG:HAND SYNC, 1.2, 2.4, NORM, (@3101) !Select synchronous transfer mode
```

The following program segment configures the handshaking parameters for the module in slot 3 (Bank 2). The bank is configured for synchronous input transfers, with a threshold voltage to 1.8V (the output voltage level and polarity parameters are omitted).

```
CONF:DIG:WIDTH WORD, (@3201) !Width = 16 bits
CONF:DIG:DIR INP, (@3201) !Direction = Input
CONF:DIG:HAND SYNC, 1.8, (@3201) !Select synchronous transfer mode
```


See Also

CONFigure:DiGital:HANDshake:CTIME

CONFigure:DiGital:HANDshake:DRIVE

CONFigure:DiGital:HANDshake:POLarity

CONFigure:DiGital:HANDshake:RATE

CONFigure:DiGital:HANDshake:STATe

CONFigure:DiGital:HANDshake:SYNChronous:STRobe[:SOURce]

CONFigure:DiGital:WIDTh

[SENSe:]DiGital:HANDshake:THReshold

[SENSe:]DiGital:MEMory:ENABle

SOURce:DiGital:HANDshake:LEVel

SOURce:DiGital:MEMory:ENABle

CONFigure:DIGital:HANDshake:CTIME

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

CONFigure:DIGital:HANDshake:CTIME {<seconds>|MIN|MAX|DEF}, (@<ch_list>)

CONFigure:DIGital:HANDshake:CTIME? [{MIN|MAX},] (@<ch_list>)

Description

This command sets the *cycle time*, which controls the pacing of handshaking operations on the 34950A Digital I/O Module. Based on the specified cycle time, the module derives the clock rate for the handshaking operation. The specified cycle time can be used with buffered or unbuffered memory operations (see [\[SENSe:\]DIGital:MEMory:ENABle](#) and [SOURce:DIGital:MEMory:ENABle](#) commands).

Since handshaking is used for transfers involving the first channel on a bank only, this command must be directed to the first channel (i.e., channel 101 or 201 only), and extends to all channels involved in the channel width (see [CONFigure:DIGital:WIDTh](#) command).

NOTE

This command is the reciprocal of the [CONFigure:DIGital:HANDshake:RATE](#) command, which controls the pacing of the handshaking operations by specifying a frequency in hertz.

Used With:

- 34950A Digital I/O Module

Parameters

Name	Type	Range of Values	Default Value
<seconds>	Numeric	100 ns to 100 ms. MIN = 100 ns, MAX = 100 ms	1 ms
<ch_list>	Numeric	The first channel on a bank in the form (@sccc). Select from s101 or s201.	This is a required parameter

Remarks

- For more information on the available handshake modes, with their corresponding timing diagrams, see the *Keysight 34980A User's Guide*.

- The behavior of the three handshake lines depends on whether buffered memory input/output operations are enabled (see [\[SENSe:\]DIGital:MEMory:ENABLE](#) and [SOURce:DIGital:MEMory:ENABLE](#) commands).

	H0 Line	H1 Line	H2 Line
Unbuffered Transfers	I/O Direction (output)	Strobe (output)	Not Used (Hi-Z)
Buffered Transfers	Start/Stop (output)	Strobe (output)	Input Strobe (input)

- The cycle time is stored in **volatile** memory and will be set to 1 ms when power is turned off or after a Factory Reset (***RST** command).

Return Format

The query command returns the cycle time in seconds in the form "+1.00000000E+00". Multiple responses are separated by commas.

Examples

The following program segment sets the cycle time to 500 ns on the module in slot 3.

```
CONF:DIG:WIDTH WORD, (@3101) !Width = 16 bits
CONF:DIG:DIR OUTP, (@3101) !Direction = Output
CONF:DIG:HAND:MODE SYNC, (@3101) !Select synchronous transfer mode
CONF:DIG:HAND:CTIME 500E-9, (@3101) !Set timeout to 500 ns
```

The following query returns the cycle time selected on the module in slot 3.

```
CONF:DIG:HAND:CTIME? (@3101)
```

Typical Response: +5.00000000E-07

See Also

[CONFigure:DIGital:HANDshake](#)

[CONFigure:DIGital:HANDshake:DRIVE](#)

[CONFigure:DIGital:HANDshake:POLarity](#)

[CONFigure:DIGital:HANDshake:RATE](#)

[CONFigure:DIGital:WIDTH](#)

[\[SENSe:\]DIGital:HANDshake:THReshold](#)

[\[SENSe:\]DIGital:MEMory:ENABLE](#)

[SOURce:DIGital:HANDshake:LEVel](#)

[SOURce:DIGital:MEMory:ENABLE](#)

CONFigure:DIgital:HANDshake:DRIVE

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

CONFigure:DIgital:HANDshake:DRIVE <mode>, (@<ch_list>)

CONFigure:DIgital:HANDshake:DRIVE? (@<ch_list>)

Description

This command selects the drive mode for any handshake lines that are outputs on the 34950A Digital I/O Module. In the "active" drive mode, the output handshake lines are driven directly by the module. In the "open collector" drive mode, the output handshake lines are driven low by the module, but will go to a high-impedance state when asserted (external pullup resistors are required). Since handshaking is used for transfers involving the first channel on a bank only, this command must be directed to the first channel (i.e., channel 101 or 201 only) and extends to all channels involved in the channel width (see [CONFigure:DIgital:WIDTH](#) command).

NOTE

The handshake lines and the INTR (interrupt) lines on each bank share their drive mode.

Used With:

- 34950A Digital I/O Module

Parameters

Name	Type	Range of Values	Default Value
<mode>	Discrete	{ACTive OCOLlector}	ACTive
<ch_list>	Numeric	The first channel on a bank in the form (@sccc). Select from s101 or s201.	This is a required parameter

Remarks

- The behavior of the handshake lines depends on whether buffered memory input/output operations are enabled (see [\[SENSe:\]DIGital:MEMory:ENABLE](#) and [SOURce:DIgital:MEMory:ENABLE](#) commands).

	H0 Line	H1 Line	H2 Line
Unbuffered Transfers	I/O Direction (output)	Strobe (output)	Not Used (Hi-Z)
Buffered Transfers	Start/Stop (output)	Strobe (output)	Input Strobe (input)

- When using the "open collector" drive mode, note that handshaking operations will be somewhat slower than when using the "active" mode.
- The selected drive mode is stored in **volatile** memory and will be set to "ACT" when power is turned off or after a Factory Reset (***RST** command).

Return Format

The query command returns "ACT" or "OCOL" for the specified channels. Multiple responses are separated by commas.

Examples

The following program segment selects the open collector drive mode on channel 101 on the module in slot 3.

```
CONF:DIG:WIDTH WORD, (@3101) !Width = 16 bits
CONF:DIG:HAND:DRIV OCOL, (@3101)
```

The following query returns the drive mode for channel 101 on the module in slot 3.

```
CONF:DIG:HAND:DRIV? (@3101)
```

Typical Response: **OCOL**

See Also

CONFigure:DIGital:HANDshake

CONFigure:DIGital:WIDTh

[SENSe:]DIGital:HANDshake:THReshold

[SENSe:]DIGital:MEMory:ENABle

SOURce:DIGital:HANDshake:LEVel

SOURce:DIGital:MEMory:ENABle

CONFigure:DiGital:HANDshake:POLarity

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

CONFigure:DiGital:HANDshake:POLarity <polarity>, [{<line>|ALL},] (@<ch_list>)

CONFigure:DiGital:HANDshake:POLarity? <line>, (@<ch_list>)

Description

This command sets the logic polarity of one or all of the three handshake lines (H0, H1, and H2) on the 34950A Digital I/O Module. You can specify the polarity as "normal" (active high, default) or "inverted" (active low). The specified setting affects the polarity for *both* input and output modes of the INTR lines on the specified bank. Since handshaking is used for transfers involving the first channel on a bank only, this command must be directed to the first channel (i.e., channel 101 or 201 only), and extends to all channels involved in the channel width (see [CONFigure:DiGital:WiDTh](#) command).

NOTE

The handshake lines and the INTR (interrupt) lines on each bank share their polarity.

Used With:

- 34950A Digital I/O Module

Parameters

Name	Type	Range of Values	Default Value
<polarity>	Discrete	{NORMal INVerted}	NORMal (active high)
<line>	Discrete	{H0 0 H1 1 H2 2 ALL}	ALL
<ch_list>	Numeric	The first channel on a bank in the form (@sccc). Select from s101 or s201.	This is a required parameter

Remarks

- The behavior of the three handshake lines depends on whether buffered memory input/output operations are enabled (see **[SENSe:]DIGital:MEMory:ENABLE** and **SOURce:DIGital:MEMory:ENABLE** commands).

	H0 Line	H1 Line	H2 Line
Unbuffered Transfers	I/O Direction (output)	Strobe (output)	Not Used (Hi-Z)
Buffered Transfers	Start/Stop (output)	Strobe (output)	Input Strobe (input)

- If desired, you can use the **CONFigure:DIGital:HANDshake** command to select all of the handshake line parameters with one command. Use this command to select the input threshold voltage, output logic "1" voltage level, and logic polarity.
- The selected polarity is stored in **volatile** memory and will be set to "NORM" when power is turned off or after a Factory Reset (***RST** command).

Return Format

The query command returns "NORM" or "INV" for the specified channels. Multiple responses are separated by commas.

Examples

The following program segment selects an inverted polarity (active low) for handshake line H0 (Bank 1) on the module in slot 3.

```
CONF:DIG:WIDTH WORD, (@3101) !Width = 16 bits
CONF:DIG:HAND:POL INV, (@3101)
```

The following query returns the polarity of handshake line H0 (Bank 1) on the module in slot 3.

```
CONF:DIG:HAND:POL? (@3101)
```

Typical Response: **INV**

See Also

CONFigure:DIGital:HANDshake

CONFigure:DIGital:HANDshake:DRIVE

CONFigure:DIGital:WIDTH

[SENSe:]DIGital:HANDshake:THReshold

[SENSe:]DIGital:MEMory:ENABLE

SOURce:DIGital:HANDshake:LEVEl

SOURce:DIGital:MEMory:ENABle

CONFigure:DIGital:HANDshake:RATE

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

CONFigure:DIGital:HANDshake:RATE {<frequency>|MIN|MAX|DEF}, (@<ch_list>)

CONFigure:DIGital:HANDshake:RATE? [{MIN|MAX},] (@<ch_list>)

Description

This command sets the *handshake rate*, which controls the pacing of handshaking operations on the 34950A Digital I/O Module. Based on the specified rate, the module derives the clock rate for the handshaking operation. The specified rate can be used with buffered or unbuffered memory operations (see [\[SENSe:\]DIGital:MEMory:ENABLE](#) and [SOURce:DIGital:MEMory:ENABLE](#) commands).

Since handshaking is used for transfers involving the first channel on a bank only, this command must be directed to the first channel (i.e., channel 101 or 201 only), and extends to all channels involved in the channel width (see [CONFigure:DIGital:WIDTh](#) command).

NOTE

This command is the reciprocal of the [CONFigure:DIGital:HANDshake:CTIME](#) command, which controls the pacing of the handshaking operations by specifying a time in seconds.

Used With:

- 34950A Digital I/O Module

Parameters

Name	Type	Range of Values	Default Value
<frequency>	Numeric	10 Hz to 10 MHz. MIN = 10 Hz, MAX = 10 MHz	1 kHz
<ch_list>	Numeric	The first channel on a bank in the form (@sccc). Select from s101 or s201.	This is a required parameter

Remarks

- For more information on the available handshake modes, with their corresponding timing diagrams, see the *Keysight 34980A User's Guide*.

- The behavior of the three handshake lines depends on whether buffered memory input/output operations are enabled (see [\[SENSe:\]DIGital:MEMory:ENABle](#) and [SOURce:DIGital:MEMory:ENABle](#) commands).

	H0 Line	H1 Line	H2 Line
Unbuffered Transfers	I/O Direction (output)	Strobe (output)	Not Used (Hi-Z)
Buffered Transfers	Start/Stop (output)	Strobe (output)	Input Strobe (input)

- The handshake rate is stored in **volatile** memory and will be set to 1 kHz when power is turned off or after a Factory Reset (***RST** command).

Return Format

The query command returns the handshake rate in hertz in the form "+1.00000000E+00". Multiple responses are separated by commas.

Examples

The following program segment sets the handshake rate to 5 KHz on the module in slot 3.

```
CONF:DIG:WIDTH WORD, (@3101) !Width = 16 bits
CONF:DIG:DIR OUTP, (@3101) !Direction = Output
CONF:DIG:HAND:MODE SYNC, (@3101) !Select synchronous transfer mode
CONF:DIG:HAND:RATE 5E3, (@3101) !Set timeout to 5 kHz
```

The following query returns the handshake rate selected on the module in slot 3.

```
CONF:DIG:HAND:RATE? (@3101)
```

Typical Response: +5.00000000E+03

See Also

[CONFigure:DIGital:HANDshake](#)

[CONFigure:DIGital:HANDshake:CTIME](#)

[CONFigure:DIGital:HANDshake:DRIVE](#)

[CONFigure:DIGital:HANDshake:POLarity](#)

[CONFigure:DIGital:WIDTH](#)

[\[SENSe:\]DIGital:HANDshake:THReshold](#)

[\[SENSe:\]DIGital:MEMory:ENABle](#)

[SOURce:DIGital:HANDshake:LEVel](#)

[SOURce:DIGital:MEMory:ENABle](#)

CONFigure:DIGital:HANDshake:STATe

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

CONFigure:DIGital:HANDshake:STATe <mode>, (@<ch_list>)

CONFigure:DIGital:HANDshake:STATe? (@<ch_list>)

Description

This command controls the behavior of the handshake lines on the specified bank on the 34950A Digital I/O Module. In the "high impedance" state (default), the output handshake lines (H0 and H1) are in a disconnected state. In the "OFF" state, the handshake lines are driven, but they don't change state when input or output operations occur. In the "ON" state, handshaking operations are enabled and are fully operational.

Since handshaking is used only for transfers involving the first channel on a bank, this command must be directed to the first channel (i.e., channel 101 or 201 only), and extends to all channels involved in the channel width (see **CONFigure:DIGital:WIDTh** command).

Used With:

- 34950A Digital I/O Module

Parameters

Name	Type	Range of Values	Default Value
<mode>	Discrete	{HIMPedance OFF ON}	HIMPedance
<ch_list>	Numeric	The first channel on a bank in the form (@sccc). Select from s101 or s201.	This is a required parameter

Remarks

- When buffered memory input/output operations are enabled (see **[SENSe:]DIGital:MEMory:ENABle** and **SOURce:DIGital:MEMory:ENABle** commands), the handshake line are automatically set to the "ON" state.
- The handshake lines and the INTR (interrupt) lines on each bank share their drive mode, input threshold voltage, and output level settings. See the **CONFigure:DIGital:HANDshake:DRIVE** command to set the drive mode (active versus open collector). See the **[SENSe:]DIGital:HANDshake:THReshold** command to set the input threshold voltage. See the **SOURce:DIGital:HANDshake:LEVel** command to set the output voltage level.
- The selected configuration is stored in **volatile** memory and will be set to "HIMP" when power is turned off or after a Factory Reset (***RST** command).

Return Format

The query command returns "HIMP", "OFF", or "ON" for the specified channels. Multiple responses are separated by commas.

Examples

The following program segment enables the handshake lines on the module in slot 3.

```
CONF:DIG:WIDTH WORD, (@3101)    !Width = 16 bits
CONF:DIG:DIR OUTP, (@3101)    !Direction = Output
CONF:DIG:HAND:STAT ON, (@3101)    !Select enabled mode
```

The following query returns the handshake mode in use on the module in slot 3.

```
CONF:DIG:HAND:STAT? (@3101)
```

Typical Response: **ON**

See Also

[CONFigure:DIGital:HANDshake:DRIVE](#)

[CONFigure:DIGital:WIDTh](#)

[\[SENSe:\]DIGital:HANDshake:THReshold](#)

[\[SENSe:\]DIGital:MEMory:ENABle](#)

[SOURce:DIGital:HANDshake:LEVel](#)

[SOURce:DIGital:MEMory:ENABle](#)

CONFigure:DIGital:HANDshake:SYNChronous:STRobe[:SOURce]

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

CONFigure:DIGital:HANDshake:SYNChronous:STRobe[:SOURce] <source>, (@<ch_list>)

CONFigure:DIGital:HANDshake:SYNChronous:STRobe[:SOURce]? (@<ch_list>)

Description

This command selects an internal (default) or external clock source for *synchronous* handshaking buffered memory operations on the 34950A Digital I/O Module (valid for *output* operations only). If you select an external clock source, the specified bank will use handshake line H2 as the source to strobe data from memory.

Since handshaking is used for transfers involving the first channel on a bank only, this command must be directed to the first channel (i.e., channel 101 or 201 only), and extends to all channels involved in the channel width (see **CONFigure:DIGital:WIDTh** command). You can send this command at any time, but the setting applies only when buffered memory output operations are enabled (see **SOURce:DIGital:MEMory:ENABle** command).

Used With:

- 34950A Digital I/O Module

Parameters

Name	Type	Range of Values	Default Value
<source>	Discrete	{INTernal EXTernal}	INTernal
<ch_list>	Numeric	The first channel on a bank in the form (@sccc). Select from s101 or s201.	This is a required parameter

Remarks

- The strobe clock source is valid for synchronous buffered *output* operations only. For synchronous buffered *input* operations (see **[SENSe:]DIGital:MEMory:ENABle** command), the external strobe clock source is automatically selected.
- The selected clock source is stored in **volatile** memory and will be set to "INT" when power is turned off or after a Factory Reset (***RST** command).

Return Format

The query command returns "INT" or "EXT" for the specified channels. Multiple responses are separated by commas.

Examples

The following program segment selects the external clock source for synchronous output transfers on the module in slot 3.

```
CONF:DIG:WIDTH WORD, (@3101)  !Width = 16 bits
CONF:DIG:DIR OUTP, (@3101)  !Direction = Output
SOUR:DIG:MEM:ENAB ON, (@3101)  !Enable buffered outputs
CONF:DIG:HAND:MODE SYNC, (@3101)  !Select synchronous transfer mode
CONF:DIG:HAND:SYNC:STROBE EXT, (@3101) !Select external clock source
```

The following query returns the clock source in use on the module in slot 3.

```
CONF:DIG:HAND:SYNC:STROBE? (@3101)
```

Typical Response: **EXT**

See Also

CONFigure:DIGital:HANDshake

CONFigure:DIGital:WIDTh

SOURce:DIGital:MEMory:ENABLE

CONFigure:DIGital:INTerrupt:POLarity

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

CONFigure:DIGital:INTerrupt:POLarity <polarity>, (@<ch_list>)

CONFigure:DIGital:INTerrupt:POLarity? (@<ch_list>)

Description

This command sets the logic polarity of the hardware INTR (interrupt) line on the 34950A Digital I/O Module. You can specify the polarity as "normal" (active high, default) or "inverted" (active low). The specified setting affects the polarity for *both* input and output modes of the INTR lines.

Since interrupts are used for transfers involving the first channel on a bank only, this command must be directed to the first channel (i.e., channel 101 or 201 only), and extends to all channels involved in the channel width (see **CONFigure:DIGital:WIDTh** command). You can send this command at any time, but the setting applies only if buffered memory input/output operations are enabled (see **[SENSe:]DIGital:MEMory:ENABle** and **SOURce:DIGital:MEMory:ENABle** commands).

Used With:

- 34950A Digital I/O Module

Parameters

Name	Type	Range of Values	Default Value
<polarity>	Discrete	{NORMal INVerted}	NORMal (active high)
<ch_list>	Numeric	The first channel on a bank in the form (@sccc). Select from s101 or s201.	This is a required parameter

Remarks

- The selected polarity is stored in **volatile** memory and will be set to "NORM" when power is turned off or after a Factory Reset (***RST** command).

Return Format

The query command returns "NORM" or "INV" for the specified channels. Multiple responses are separated by commas.

Examples

The following program segment selects an inverted polarity (active low) for the INTR line (Bank 1) on the module in slot 3.

```
CONF:DIG:WIDTH WORD, (@3101)    !Width = 16 bits
CONF:DIG:INT:POL INV, (@3101)
```

The following query returns the polarity of the INTR line (Bank 1) on the module in slot 3.

```
CONF:DIG:INT:POL? (@3101)
```

Typical Response: **INV**

See Also

CONFigure:DIGital:WIDTH

[SENSe:]DIGital:INTerrupt[:ENABLE]

[SENSe:]DIGital:INTerrupt:MODE

[SENSe:]DIGital:MEMory:ENABLE

SOURce:DIGital:MEMory:ENABLE

CONFigure:DiGital:POLarity

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

CONFigure:DiGital:POLarity <polarity>, (@<ch_list>)

CONFigure:DiGital:POLarity? (@<ch_list>)

Description

This command sets the logic polarity for input or output operations on the specified digital channels on the 34950A Digital I/O Module. You can specify the polarity as "normal" (active high, default) or "inverted" (active low). You can send this command at any time, and the action takes effect immediately.

Used With:

- 34950A Digital I/O Module (digital input/output channels only)

Parameters

Name	Type	Range of Values	Default Value
<polarity>	Discrete	{NORMal INVerted}	NORMal (active high)
<ch_list>	Numeric	One or more digital input or output channels in the form (@sccc). 34950A: s101 through s104, s201 through s204	This is a required parameter

Remarks

- The selected polarity applies to the specified channel, independent of the current channel width (see [CONFigure:DiGital:WIDTh](#) command).
- The selected polarity is stored in **volatile** memory and will be set to "NORM" when power is turned off or after a Factory Reset (***RST** command).

Return Format

The query command returns "NORM" or "INV" for the specified channels. Multiple responses are separated by commas.

Examples

The following command selects an inverted polarity (active low) for channels 103 and 103 on the **34950A** in slot 3.

```
CONF:DIG:POL INV, (@3101, 3103)
```

The following query returns the polarity of channels 101 and 103 on the **34950A** in slot 3.

```
CONF:DIG:POL? (@3101, 3103)
```

Typical Response: **INV,INV**

See Also

[CONFigure:DIGital](#)

[CONFigure:DIGital:DIRection](#)

[CONFigure:DIGital:WIDTh](#)

[CONFigure?](#)

CONFigure:DIGital:WIDTh

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

CONFigure:DIGital:WIDTh <width>, (@<ch_list>)

CONFigure:DIGital:WIDTh? (@<ch_list>)

Description

This command configures the specified digital input or output channels for the desired width.

Used With:

- 34950A Digital I/O Module (digital input/output channels only)
- 34952A Multifunction Module (digital input/output channels only)
- 34959A Breadboard Module (digital input/output channels only)

Parameters

Name	Type	Range of Values	Default Value
<width>	Discrete	{BYTE 1 WORD 2 LWORD 4} BYTE (or "1" byte): 8 bits WORD (or "2" bytes): 16 bits LWORD (or "4" bytes): 32 bits	BYTE (8 bits)
<ch_list>	Numeric	One or more digital input or output channels in the form (@sccc). 34950A: s101 through s104, s201 through s204 34952A: s001 through s004 34959A: s001 through s002	This is a required parameter

Remarks

- Depending on the width specified, the channel numbering is modified as shown below. For example, if you specify the width as a 16-bit WORD on the 34950A, channels 101 and 102 are combined and addressed collectively as channel 101.

34950A	Bank 2				Bank 1			
BYTE (8 Bits):	Ch 204	Ch 203	Ch 202	Ch 201	Ch 104	Ch 103	Ch 102	Ch 101

WORD (16 Bits):	Ch 203	Ch 201	Ch 103	Ch 101
LWORD (32 Bits):	Ch 201		Ch 101	

34952A	Bank 1			
BYTE (8 Bits):	Ch 4	Ch 3	Ch 2	Ch1
WORD (16 Bits):	Ch 3		Ch 1	
LWORD (32 Bits):	Ch 1			

- The selected width applies to input or output operations on the specified channels. Use the **CONFig-ure:DIGital:DIRection** or **SOURce:DIGital:STATe** command to configure the specified channels for input or output operations.
- Changing the channel width will disable buffered (memory) operations and clear memory on the specified digital channels (see **[SENSe:]DIGital:MEMory:ENABLE** command).
- The selected width is stored in **volatile** memory and will be set to "BYTE" when power is turned off or after a Factory Reset (***RST** command).

Return Format

The query command returns the width in *bytes* for the specified channels: "1" for BYTE (8 bits), "2" for WORD (16 bits), or "4" for LWORD (32 bits). Multiple responses are separated by commas.

Examples

The following program segment configures the **34950A** in slot 3 for two 16-bit words and then configures the channels for output operations.

```
CONF:DIG:WIDTH WORD, (@3101, 3103)
CONF:DIG:DIR OUTP, (@3101, 3103)
```

The following query returns the width of channels 101 and 103 on the **34950A** in slot 3.

```
CONF:DIG:WIDTH? (@3101, 3103)
```

Typical Response: **2,2**

The following program segment configures the **34952A** in slot 5 for one 32-bit word and then configures the channel for output operations.

```
CONF:DIG:WIDTH LWORD, (@5001)
CONF:DIG:DIR OUTP, (@5001)
```

The following query returns the width of channel 1 on the **34952A** in slot 3.

```
CONF:DIG:WIDTH? (@5001)
```

Typical Response: **4**

See Also

[CONFigure:DIGital](#)

[CONFigure:DIGital:DIRection](#)

[CONFigure?](#)

[SOURce:DIGital:STATe](#)

CONFigure:FREQuency

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

CONFigure:FREQuency [{<range>|MIN|MAX|DEF} [, {<resolution>|MIN|MAX|DEF}] ,] [(@<ch_list>)]

Description

First, this command resets all measurement parameters on the specified channels to their **default values**. Then, configures the channels for frequency measurements but *does not* initiate the scan. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

The CONFigure command does *not* place the instrument in the "wait-for-trigger" state. Use the **INITiate** or **READ?** command in conjunction with CONFigure to place the instrument in the "wait-for-trigger" state.

Used With:

- 34921A through 34925A Multiplexer Modules

Parameters

Name	Type	Range of Values	Default Value
<range>	Numeric	Expected frequency of the input signal in hertz, between 3 Hz and 300 kHz.	20 Hz
<resolution>	Numeric	Desired resolution in hertz.	Fixed at 6½ digits
<ch_list>	Numeric	One or more channels in the form (@sccc) .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.
- When you specify a range of channels with this command, any channels that are invalid will be ignored (no error will be generated) but the first and last channel in the range must be valid for the selected function. The Analog Bus relays (numbered **s911**, **s912**, **s913**, etc.) on the multiplexer and matrix modules are ignored if they are included in a range of channels. An error will be generated if an Analog Bus relay is specified as the first or last channel in a range of channels.

- The *<range>* parameter is required only to specify the measurement resolution parameter. Therefore, it is not necessary to send a new command for each new frequency to be measured.
- If the input signal is greater than can be measured on the selected range (manual ranging), the instrument gives an *overload indication*: "±OVLD" from the front panel or "±9.9E+37" from the remote interface.
- The ***RST** command will clear the scan list and set all measurement parameters to their factory settings. The Instrument Preset (**SYSTem:PRESet** command) will not clear the scan list; however, this command will clear reading memory and all stored statistical data.

Examples

The following program segment configures the instrument for frequency measurements on channel 4 in slot 3. The READ? command places the instrument in the "wait-for-trigger" state, scans the channel once, and then sends the reading to reading memory and the instrument's output buffer. The default range (autorange) and resolution (fixed at 6½ digits) are used for the measurement.

```
CONF:FREQ (@3004)
ROUT:SCAN (@3004)
READ? (@3004)
```

Typical Response: **+1.32130000E+03**

The following program segment configures the instrument for frequency measurements on channels 3 and 8 in slot 1. The INITiate command places the instrument in the "wait-for-trigger" state, scans the channels once, and stores the readings in memory. The FETCh? command transfers the readings from reading memory to the instrument's output buffer. The 100 Hz range and the default resolution (fixed at 6½ digits) are used for the measurement.

```
CONF:FREQ 100, (@1003,1008)
ROUT:SCAN (@1003,1008)
INIT
FETC?
```

Typical Response: **+4.27150000E+03,+1.32130000E+03**

The following program segment configures the internal DMM for a frequency measurement (no *<ch_list>* is specified). The READ? command places the internal DMM in the "wait-for-trigger" state, initiates a trigger, and then sends the reading to reading memory and the instrument's output buffer. The default range (autorange) and resolution (fixed at 6½ digits) are used for the measurement.

```
CONF:FREQ !Applies to the internal DMM
READ?
```

Typical Response: **+10.13240000E+03**

See Also

[CONFigure?](#)

[FETCh?](#)

[INITiate](#)

[MEASure:FREQuency?](#)

[READ?](#)

[ROUTe:SCAN](#)

[\[SENSe:\]FREQuency:RANGe:LOWer](#)

[\[SENSe:\]FREQuency:VOLTage:RANGe](#)

[SWEep:COUNt](#)

CONFigure:FRESistance

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

```
CONFigure:FRESistance [{<range>|AUTO|MIN|MAX|DEF} [{<resolution>|MIN|MAX|DEF}] , ] [(@<ch_list>)]
```

Description

First, this command resets all measurement parameters on the specified channels to their **default values**. Then, configures the channels for 4-wire resistance measurements but *does not* initiate the scan (channels in Bank 1 are automatically paired with corresponding channels in Bank 2). If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

The CONFigure command does *not* place the instrument in the "wait-for-trigger" state. Use the **INITiate** or **READ?** command in conjunction with CONFigure to place the instrument in the "wait-for-trigger" state.

Used With:

- 34921A Armature Multiplexer
- 34922A Armature Multiplexer
- 34923A Reed Multiplexer (differential mode only) *
- 34924A Reed Multiplexer *
- 34925A FET Multiplexer (differential mode only) *

* Series channel resistance must be taken into account for resistance measurements on this module.

Parameters

Name	Type	Range of Values	Default Value
<range>	Numeric	Expected value in ohms (ranges shown below). 100Ω (MIN) 1 kΩ 10 kΩ 100 kΩ 1 MΩ 10 MΩ 100 MΩ (MAX)	AUTO (autorange)
<resolution>	Numeric	Desired resolution in ohms.	0.000003 x Range (1 PLC)

<ch_list>	Numeric	One or more channels in the form <u>(@sccc)</u> .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.
- When you specify a range of channels with this command, any channels that are invalid will be ignored (no error will be generated) but the first and last channel in the range must be valid for the selected function. The Analog Bus relays (numbered **s911**, **s912**, **s913**, etc.) on the multiplexer and matrix modules are ignored if they are included in a range of channels. An error will be generated if an Analog Bus relay is specified as the first or last channel in a range of channels.
- You can allow the instrument to automatically select the measurement range using *autoranging* or you can select a fixed range using manual ranging. Autoranging is convenient because the instrument decides which range to use for each measurement based on the input signal. For fastest scanning operation, use manual ranging on each measurement (some additional time is required for autoranging since the instrument has to make a range selection).
- If you select autoranging (by specifying "AUTO" or "DEF"), an error will be generated if you specify a discrete value for the <resolution> parameter. When autoranging is combined with a discrete resolution, the instrument cannot accurately resolve the integration time (especially if the input signal is continuously changing). If your application requires autoranging, be sure to specify "DEF" for the <resolution> parameter, or omit the parameter from the command and use the **[SENSe:]FRESistance:NPLC** command to specify the desired integration time.
- Autorange thresholds:

Down range <10% of range
at:
Up range at: >120% of range

- If the input signal is greater than can be measured on the selected range (manual ranging), the instrument gives an *overload indication*: "±OVLD" from the front panel or "±9.9E+37" from the remote interface.
- For 4-wire resistance measurements, the instrument automatically pairs channel **n** in Bank 1 with channel **n+20** in Bank 2 (34921A, 34923A, 34925A) or **n+35** (34922A, 34924A) to provide the source and sense connections. For example, make the source connections to the HI and LO terminals on channel 2 in Bank 1 and the sense connections to the HI and LO terminals on channel 22 (or 37) in Bank 2. Specify the paired channel in Bank 1 (source) as the <ch_list> channel (channels in Bank 2 are not allowed in the <ch_list>).

- Since channels are automatically paired for 4-wire resistance measurements (see previous Remark), attempts to re-configure the paired channel in Bank 2 will result in an error. In addition, if the Bank 2 channel was previously configured to be part of the active scan list (see **ROUTe:SCAN** command) and is then re-configured to be paired with a Bank 1 channel, an error will be generated and the previous scan list will be cleared. For example:

```
CONF:VOLT:DC (@1021) !Configure Bank 2 channel for dc voltage
measurements
ROUT:SCAN (@1001:1040) !Add channels to scan list
CONF:FRES (@1001) !Generates error and clears scan list
```

- Four-wire measurements are not allowed on the multiplexer modules configured for the single-ended mode (see **SYSTem:MODUle:WIRE:MODE** command).
- For 4-wire measurements, the instrument automatically enables the **autozero** function.
- The ***RST** command will clear the scan list and set all measurement parameters to their factory settings. The Instrument Preset (**SYSTem:PRESet** command) will not clear the scan list; however, this command will clear reading memory and all stored statistical data.

Examples

The following program segment configures the instrument for 4-wire measurements on channel 4 in slot 3. The READ? command places the instrument in the "wait-for-trigger" state, scans the channel once, and then sends the reading to reading memory and the instrument's output buffer. The default range (autorange) and resolution (1 PLC) are used for the measurement.

Note that for this 4-wire measurement, channel 4 in Bank 1 is automatically paired with channel 24 in Bank 2 (assumes 34921A).

```
CONF:FRES (@3004)
ROUT:SCAN (@3004)
READ? (@3004)
```

Typical Response: **+1.32130000E+03**

The following command generates an error since you must always specify the paired channel in Bank 1 as the <ch_list> channel for 4-wire measurements (channel 36 is in Bank 2).

```
CONF:FRES (@4036) !Generates an error
```

The following program segment configures the instrument for 4-wire resistance measurements on channels 3 and 8 in slot 1. The INITiate command places the instrument in the "wait-for-trigger" state, scans the channels once, and stores the readings in memory. The FETCh? command transfers the readings from reading memory to the instrument's output buffer. The 1 k Ω range is selected with 1 Ω resolution.

Note that for this 4-wire measurement, channel 3 is automatically paired with channel 23 and channel 8 is automatically paired with channel 28 (assumes 34921A).

```
CONF:FRES 1000,1,(@1003,1008)
ROUT:SCAN (@1003,1008)
INIT
FETC?
```

Typical Response: +4.27150000E+02,+1.32130000E+02

The following program segment configures the internal DMM for a 4-wire measurement (no <ch_list> is specified). The READ? command places the internal DMM in the "wait-for-trigger" state, initiates a trigger, and then sends the reading to reading memory and the instrument's output buffer. The default range (autorange) and resolution (fixed at 6½ digits) are used for the measurement.

```
CONF:FRES !Applies to the internal DMM
READ?
```

Typical Response: +2.93830000E+03

See Also

[CONFigure:RESistance](#)

[CONFigure?](#)

[FETCh?](#)

[INITiate](#)

[MEASure:FRESistance?](#)

[READ?](#)

[ROUTe:SCAN](#)

[\[SENSe:\]FRESistance:OCOMpensated](#)

[SWEep:COUNt](#)

CONFigure:PERiod

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

```
CONFigure:PERiod [{<range>|MIN|MAX|DEF} [{<resolution>|MIN|MAX|DEF}] , ] [(@<ch_list>)]
```

Description

First, this command resets all measurement parameters on the specified channels to their **default values**. Then, configures the channels for period measurements but *does not* initiate the scan. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

The CONFigure command does *not* place the instrument in the "wait-for-trigger" state. Use the **INITiate** or **READ?** command in conjunction with CONFigure to place the instrument in the "wait-for-trigger" state.

Used With:

- 34921A through 34925A Multiplexer Modules

Parameters

Name	Type	Range of Values	Default Value
<range>	Numeric	Expected period of the input signal in seconds, between 3.33 μ s and 333.33 ms.	3.33 μ s
<resolution>	Numeric	Desired resolution in seconds.	Fixed at 6½ digits
<ch_list>	Numeric	One or more channels in the form <u>(@sccc)</u> .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.
- When you specify a range of channels with this command, any channels that are invalid will be ignored (no error will be generated) but the first and last channel in the range must be valid for the selected function. The Analog Bus relays (numbered **s911**, **s912**, **s913**, etc.) on the multiplexer and matrix modules are ignored if they are included in a range of channels. An error will be generated if an Analog Bus relay is specified as the first or last channel in a range of channels.

- The *<range>* parameter is required only to specify the measurement resolution parameter. Therefore, it is not necessary to send a new command for each new period to be measured.
- If the input signal is greater than can be measured on the selected range (manual ranging), the instrument gives an *overload indication*: "±OVL" from the front panel or "±9.9E+37" from the remote interface.
- For period measurements, the resolution is fixed at 6½ digits. The only way to control the reading rate for period measurements is by changing the **channel delay**. The *<resolution>* parameter only affects the number of digits shown on the front panel.
- The ***RST** command will clear the scan list and set all measurement parameters to their factory settings. The Instrument Preset (**SYSTem:PRESet** command) will not clear the scan list; however, this command will clear reading memory and all stored statistical data.

Examples

The following program segment configures the instrument for period measurements on channel 4 in slot 3. The READ? command places the instrument in the "wait-for-trigger" state, scans the channel once, and then sends the reading to reading memory and the instrument's output buffer. The default range (autorange) and resolution (fixed at 6½ digits) are used for the measurement.

```
CONF:PER (@3004)
ROUT:SCAN (@3004)
READ? (@3004)
```

Typical Response: +1.32130000E-03

The following program segment configures the instrument for period measurements on channels 3 and 8 in slot 1. The INITiate command places the instrument in the "wait-for-trigger" state, scans the channels once, and stores the readings in memory. The FETCh? command transfers the readings from reading memory to the instrument's output buffer.

```
CONF:PER 1,0.001, (@1003,1008)
ROUT:SCAN (@1003,1008)
INIT
FETC?
```

Typical Response: +4.27150000E-04,+1.32130000E-04

The following program segment configures the internal DMM for a period measurement (no *<ch_list>* is specified). The READ? command places the internal DMM in the "wait-for-trigger" state, initiates a trigger, and then sends the reading to reading memory and the instrument's output buffer. The default range (autorange) and resolution (fixed at 6½ digits) are used for the measurement.

```
CONF:PER !Applies to the internal DMM
READ?
```

Typical Response: +2.93830000E-03

See Also

[CONFigure?](#)

[FETCh?](#)

[INITiate](#)

[MEASure:PERiod?](#)

[READ?](#)

[ROUTe:SCAN](#)

[\[SENSe:\]PERiod:VOLTage:RANGe](#)

[SWEep:COUNT](#)

CONFigure:RESistance

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

CONFigure:RESistance [{<range>|AUTO|MIN|MAX|DEF} [{<resolution>|MIN|MAX|DEF}] ,] [[@<ch_list>]]

Description

First, this command resets all measurement parameters on the specified channels to their **default values**. Then, configures the channels for 2-wire resistance measurements a but *does not* initiate the scan. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

The CONFigure command does *not* place the instrument in the "wait-for-trigger" state. Use the **INITiate** or **READ?** command in conjunction with CONFigure to place the instrument in the "wait-for-trigger" state.

Used With:

- 34921A Armature Multiplexer
- 34922A Armature Multiplexer
- 34923A Reed Multiplexer *
- 34924A Reed Multiplexer *
- 34925A FET Multiplexer *

* Series channel resistance must be taken into account for resistance measurements on this module.

Parameters

Name	Type	Range of Values	Default Value
<range>	Numeric	Expected value in ohms (ranges shown below). 100Ω (MIN) 1 kΩ 10 kΩ 100 kΩ 1 MΩ 10 MΩ 100 MΩ (MAX)	AUTO (autorange)
<resolution>	Numeric	Desired resolution in ohms.	0.000003 x Range (1 PLC)

<ch_list>	Numeric	One or more channels in the form <u>(@sccc)</u> .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.
- When you specify a range of channels with this command, any channels that are invalid will be ignored (no error will be generated) but the first and last channel in the range must be valid for the selected function. The Analog Bus relays (numbered **s911**, **s912**, **s913**, etc.) on the multiplexer and matrix modules are ignored if they are included in a range of channels. An error will be generated if an Analog Bus relay is specified as the first or last channel in a range of channels.
- You can allow the instrument to automatically select the measurement range using *autoranging* or you can select a fixed range using manual ranging. Autoranging is convenient because the instrument decides which range to use for each measurement based on the input signal. For fastest scanning operation, use manual ranging on each measurement (some additional time is required for autoranging since the instrument has to make a range selection).
- If you select autoranging (by specifying "AUTO" or "DEF"), an error will be generated if you specify a discrete value for the <resolution> parameter. When autoranging is combined with a discrete resolution, the instrument cannot accurately resolve the integration time (especially if the input signal is continuously changing). If your application requires autoranging, be sure to specify "DEF" for the <resolution> parameter, or omit the parameter from the command and use the **[SENSe:]RESistance:NPLC** command to specify the desired integration time.
- Autorange thresholds:

Down range <10% of range
at:
Up range at: >120% of range

- Since this command resets all measurement parameters on the specified channels to their **default values**, be sure to send the CONFigure command *before* setting any other measurement parameters. For example, to change the sample count, first send the CONFigure command (sets the sample count to "1") and then change the sample count to the desired value (see **SAMPlE:COUNT** command).
- If the input signal is greater than can be measured on the selected range (manual ranging), the instrument gives an *overload indication*: "±OVLD" from the front panel or "±9.9E+37" from the remote interface.
- The ***RST** command will clear the scan list and set all measurement parameters to their factory settings. The Instrument Preset (**SYSTem:PRESet** command) will not clear the scan list; however, this command will clear reading memory and all stored statistical data.

Examples

The following program segment configures the instrument for 2-wire resistance measurements on channel 4 in slot 3. The READ? command places the instrument in the "wait-for-trigger" state, scans the channel once, and then sends the reading to reading memory and the instrument's output buffer. The default range (autorange) and resolution (1 PLC) are used for the measurement.

```
CONF:RES (@3004)  
ROUT:SCAN (@3004)  
READ? (@3004)
```

Typical Response: **+1.32130000E+04**

The following program segment configures the instrument for 2-wire resistance measurements on channels 3 and 8 in slot 1. The INITiate command places the instrument in the "wait-for-trigger" state, scans the channels once, and stores the readings in memory. The FETCh? command transfers the readings from reading memory to the instrument's output buffer. The 1 k Ω range is selected with 1 Ω resolution.

```
CONF:RES 1000,1, (@1003,1008)  
ROUT:SCAN (@1003,1008)  
INIT  
FETCh?
```

Typical Response: **+4.27150000E+02,+1.32130000E+02**

The following program segment configures the internal DMM for a 2-wire resistance measurement (no <ch_list> is specified). The READ? command places the internal DMM in the "wait-for-trigger" state, initiates a trigger, and then sends the reading to reading memory and the instrument's output buffer. The default range (autorange) and resolution (1 PLC) are used for the measurement.

```
CONF:RES !Applies to the internal DMM  
READ?
```

Typical Response: **+2.93830000E+03**

See Also

[CONFigure:FRESistance](#)

[CONFigure?](#)

[FETCh?](#)

[INITiate](#)

[MEASure:RESistance?](#)

[READ?](#)

[ROUTe:SCAN](#)

[SENSe:]RESistance:OCOMpensated

[SENSe:]RESistance:ZERO:AUTO

SWEEp:COUNT

CONFigure:TEMPerature

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

```
CONFigure:TEMPerature {<probe_type>|DEF}, {<type>|DEF} [,1 [{<resolution>|MIN|MAX|DEF}] ] [, (@<ch_list>)]
```

Description

First, this command resets all measurement parameters on the specified channels to their **default values**. Then, configures the channels for temperature measurements but *does not* initiate the scan. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

The CONFigure command does *not* place the instrument in the "wait-for-trigger" state. Use the **INITiate** or **READ?** command in conjunction with CONFigure to place the instrument in the "wait-for-trigger" state.

The following table shows which temperature transducers are supported by each of the multiplexer modules.

	Thermocouple	RTD 2-Wire	RTD 4-Wire	Thermistor
34921A Armature Multiplexer	Yes ¹	Yes	Yes	Yes
34922A Armature Multiplexer	Yes ²	Yes	Yes	Yes
34923A Reed Multiplexer (2-Wire)	Yes ^{2,3}	Yes ⁴	Yes ⁴	Yes ⁵
34923A Reed Multiplexer (1-Wire)	Yes ^{2,3}	Yes ⁴	No	Yes ⁵
34924A Reed Multiplexer	Yes ^{2,3}	Yes ⁴	Yes ⁴	Yes ⁵
34925A FET Multiplexer (2-Wire)	Yes ²	No	Yes ⁵	No
34925A FET Multiplexer (1-Wire)	Yes ²	No	No	No

¹Optional 34921T Terminal Block is required for thermocouple measurements with built-in internal reference junction.

²A fixed or external reference junction temperature is required for thermocouple measurements with this module.

³Impact of higher offset voltage specification (< 50 μ V) must be taken into consideration.

⁴1 k Ω or higher range used unless 100 Ω series resistors are bypassed on module.

⁵10 k Ω or higher range used for loads over approximately 300 Ω due to series resistance of FET channels.

Parameters

Name	Type	Range of Values	Default Value
<probe_type>	Discrete	{TCouple RTD FRTD THERmistor}	TCouple
<type>	Discrete	For TC: {B E J K N R S T} ¹	J Type
		For RTD: {85 91} ²	85
		For FRTD: {85 91} ²	85
		For THER: { 2252 5000 10000}	5000
<resolution>	Numeric	Desired resolution in °C, °F, or K.	1 PLC
<ch_list>	Numeric	One or more channels in the form (@sccc).	If <ch_list> is omitted, this command applies to the internal DMM.

¹Using ITS-90 software conversions.

²Using IPTS-68 software conversions.

Remarks

- For temperature measurements, the instrument internally selects the range; you cannot select which range is used. In the command syntax, be sure to include "1" as shown for the <range> parameter (preceding the <resolution> parameter).
- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.
- When you specify a range of channels with this command, any channels that are invalid will be ignored (no error will be generated) but the first and last channel in the range must be valid for the selected function. The Analog Bus relays (numbered s911, s912, s913, etc.) on the multiplexer and matrix modules are ignored if they are included in a range of channels. An error will be generated if an Analog Bus relay is specified as the first or last channel in a range of channels.
- For thermocouple measurements, the instrument internally selects the 100 mV range. For thermistor and RTD measurements, the instrument autoranges to the correct range for the transducer resistance measurement. Specify the paired channel in the lower bank (source) as the <ch_list> channel.

- Thermocouple measurements require a reference junction temperature (see **[SENSe:]TEMPerature:TRANsducer:TCouple:RJUNction:TYPE** command). For the reference junction temperature, you can use an *internal* measurement on the module's terminal block (34921A only), an *external* thermistor or RTD measurement, or a known *fixed* junction temperature. If you select an *external* reference, the instrument makes thermocouple measurements relative to a previously-stored RTD or thermistor measurement stored in the reference register. For more information and examples, see the following commands:

[SENSe:]TEMPerature:TRANsducer:FRTD:REFerence
[SENSe:]TEMPerature:TRANsducer:RTD:REFerence
[SENSe:]TEMPerature:TRANsducer:THERmistor:REFerence

By default, a fixed reference junction temperature of 0.0 °C is used (see **[SENSe:]TEMPerature:TRANsducer:TCouple:RJUNction** command).

- If you select autoranging (by specifying "AUTO" or "DEF"), an error will be generated if you specify a discrete value for the <resolution> parameter. When autoranging is combined with a discrete resolution, the instrument cannot accurately resolve the integration time (especially if the input signal is continuously changing). If your application requires autoranging, be sure to specify "DEF" for the <resolution> parameter, or omit the parameter from the command and use the **[SENSe:]TEMPerature:NPLC** command to specify the desired integration time.
- Since this command resets all measurement parameters on the specified channels to their default values, be sure to send the CONFigure command *before* setting any other measurement parameters. For example, to change the sample count, first send the CONFigure command (sets the sample count to "1") and then change the sample count to the desired value (see **SAMPLE:COUNT** command).
- For 4-wire RTD measurements (FRTD), the instrument automatically pairs channel *n* in Bank 1 with channel *n+20* in Bank 2 (34921A, 34923A) or *n+35* (34922A, 34924A) to provide the source and sense connections. For example, make the source connections to the HI and LO terminals on channel 2 in Bank 1 and the sense connections to the HI and LO terminals on channel 22 (or 37) in Bank 2. Specify the paired channel in Bank 1 (source) as the <ch_list> channel (channels in Bank 2 are not allowed in the <ch_list>).
- Since channels are automatically paired for 4-wire resistance measurements (see previous Remark), attempts to re-configure the paired channel in Bank 2 will result in an error. In addition, if the Bank 2 channel was previously configured to be part of the active scan list (see **ROUTe:SCAN** command) and is then re-configured to be paired with a Bank 1 channel, an error will be generated and the previous scan list will be cleared. For example:

```
CONF:VOLT:DC (@1021) !Configure Bank 2 channel for dc voltage
measurements
ROUT:SCAN (@1001:1040) !Add channels to scan list
CONF:FRES (@1001) !Generates error and clears scan list
```

- Four-wire RTD measurements are not allowed on the multiplexer modules configured for the single-ended mode (see **SYSTem:MODule:WIRE:MODE** command).
- For 4-wire RTD measurements, the instrument automatically enables the **autozero** function.

- The ***RST** command will clear the scan list and set all measurement parameters to their factory settings. The Instrument Preset (**SYSTem:PRESet** command) will not clear the scan list; however, this command will clear reading memory and all stored statistical data.

Examples

The following program segment configures the instrument for B-type thermocouple measurements on channel 4 in slot 3. The READ? command places the instrument in the "wait-for-trigger" state, scans the channel once, and then sends the reading to reading memory and the instrument's output buffer. The default resolution (fixed at 6½ digits) is used for the measurement (assumes default temperature units).

```
CONF:TEMP TC,B,(@3004)
ROUT:SCAN (@3004)
READ? (@3004)
```

Typical Response: **+3.65640000E+01**

The following program segment configures the instrument for 5 kΩ thermistor measurements on channels 3 and 8 in slot 1. The INITiate command places the instrument in the "wait-for-trigger" state, scans the channels once, and stores the readings in memory. The FETCh? command transfers the readings from reading memory to the instrument's output buffer. This 2-wire measurement is made with 0.1 °C resolution (assumes default temperature units).

```
CONF:TEMP THER,5000,1,0.1,(@1003,1008)
ROUT:SCAN (@1003,1008)
INIT
FETC?
```

Typical Response: **+2.47150000E+01,+3.12130000E+01**

The following program segment configures the internal DMM for a 2-wire RTD measurement (no <ch_list> is specified). The READ? command places the internal DMM in the "wait-for-trigger" state, initiates a trigger, and then sends the reading to reading memory and the instrument's output buffer. The default resolution (fixed at 6½ digits) is used for the measurement (assumes default temperature units).

```
CONF:TEMP RTD,85 !Applies to the internal DMM
READ?
```

Typical Response: **+2.12320000E+01**

See Also

CONFigure?

FETCh?

INITiate

MEASure:TEMPerature?

READ?
ROUTe:SCAN
[SENSe:]TEMPerature:NPLC
[SENSe:]TEMPerature:TRANsducer:FRTD:REFerence
[SENSe:]TEMPerature:TRANsducer:RTD:REFerence
[SENSe:]TEMPerature:TRANsducer:TCouple:IMPedance:AUTO
[SENSe:]TEMPerature:TRANsducer:THERmistor:REFerence
[SENSe:]TEMPerature:ZERO:AUTO
SWEEp:COUNT
UNIT:TEMPerature

CONFigure:TOTalize

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

CONFigure:TOTalize [<mode>] (@<ch_list>)

Description

This command enables or disables an automatic reset of the count on the specified totalizer channels. To read the totalizer during a scan without resetting the count, select the READ parameter. To read the totalizer during a scan and reset the count to "0" after it is read, select the RRESet parameter (this means "read and reset").

The CONFigure command does *not* place the instrument in the "wait-for-trigger" state. Use the **INITiate** or **READ?** command in conjunction with CONFigure to place the instrument in the "wait-for-trigger" state.

Used With:

- 34950A Digital I/O Module (counter channels only)
- 34952A Multifunction Module (totalizer channels only)

Parameters

Name	Type	Range of Values	Default Value
<mode>	Discrete	{READ RRESet}	READ (read without resetting the count)
<ch_list>	Numeric	One or more totalizer channels in the form (@sccc) . 34950A: s301, s302 34952A: s005	This is a required parameter

Remarks

- The maximum count is 4,294,967,295 ($2^{32} - 1$). The count rolls over to "0" after reaching the maximum allowed value.
- If the count rolls over to "0", the "Totalizer Overflow" bit is set in the Slot Event Registers group (see **STATus:MODule:SLOT[n]:CONDition?** and **STATus:MODule:SLOT[n]:EVENT?** commands). For more information on the SCPI Status System for the Keysight 34980A, see [Status System Introduction](#).
- Selecting the RRESet mode performs a synchronized read and reset operation on the specified totalizer channels. If you were to use discrete commands, such as **READ?** and **[SENSe:]TOTalize:CLEar:IMMediate**, you would likely lose counts occurring between the two commands.

- The ***RST** command will clear the scan list and set all measurement parameters to their factory settings. The Instrument Preset (**SYSTem:PRESet** command) will not clear the scan list; however, this command will clear reading memory and all stored statistical data.

Examples

The following command configures totalizer channels 301 and 302 on the **34950A** in slot 2 to be read without resetting their count.

```
CONF:TOT READ, (@2301,2302)
```

The following command configures totalizer channel 5 on the **34952A** in slot 4 to be reset to "0" after it is read.

```
CONF:TOT RRES, (@4005)
```

See Also

CONFigure?

FETCh?

INITiate

READ?

[SENSe:]TOTalize:DATA?

STATus:MODule:SLOT[n]:CONDition?

STATus:MODule:SLOT[n]:EVENT?

CONFigure[:VOLTage]:AC

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

```
CONFigure[:VOLTage]:AC [{<range>|AUTO|MIN|MAX|DEF} [, {<resolution>|MIN|MAX|DEF}] , ] [(@<ch_list>)]
```

Description

First, this command resets all measurement parameters on the specified channels to their **default values**. Then, configures the channels for ac voltage measurements but *does not* initiate the scan. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

The CONFigure command does *not* place the instrument in the "wait-for-trigger" state. Use the **INITiate** or **READ?** command in conjunction with CONFigure to place the instrument in the "wait-for-trigger" state.

Used With:

- 34921A through 34925A Multiplexer Modules

Parameters

Name	Type	Range of Values	Default Value
<range>	Numeric	Expected value in volts (ranges shown below). 100 mV (MIN) 1 V 10 V 100 V 300 V (MAX)	AUTO (autorange)
<resolution>	Numeric	Desired resolution in volts.	Fixed at 6½ digits
<ch_list>	Numeric	One or more channels in the form (@sccc) .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.

- When you specify a range of channels with this command, any channels that are invalid will be ignored (no error will be generated) but the first and last channel in the range must be valid for the selected function. The Analog Bus relays (numbered **s911**, **s912**, **s913**, etc.) on the multiplexer and matrix modules are ignored if they are included in a range of channels. An error will be generated if an Analog Bus relay is specified as the first or last channel in a range of channels.
- You can allow the instrument to automatically select the measurement range using *autoranging* or you can select a fixed range using manual ranging. Autoranging is convenient because the instrument decides which range to use for each measurement based on the input signal. For fastest scanning operation, use manual ranging on each measurement (some additional time is required for autoranging since the instrument has to make a range selection).
- If you select autoranging (by specifying "AUTO" or "DEF"), an error will be generated if you specify a discrete value for the <resolution> parameter. When autoranging is combined with a discrete resolution, the instrument cannot accurately resolve the integration time (especially if the input signal is continuously changing). If your application requires autoranging, be sure to specify "DEF" for the <resolution> parameter or omit the parameter from the command.
- Autorange thresholds:

Down range <10% of range
at:
Up range at: >120% of range

- Since this command resets all measurement parameters on the specified channels to their **default values**, be sure to send the **CONF**igure command *before* setting any other measurement parameters. For example, to change the sample count, first send the **CONF**igure command (sets the sample count to "1") and then change the sample count to the desired value (see **SAMPLE:COUNT** command).
- If the input signal is greater than can be measured on the selected range (manual ranging), the instrument gives an *overload indication*: "±OVL" from the front panel or "±9.9E+37" from the remote interface.
- For ac measurements, the resolution is fixed at 6½ digits. The only way to control the reading rate for ac measurements is by changing the **channel delay** or by setting the **ac filter** to the highest frequency limit. The <resolution> parameter only affects the number of digits shown on the front panel.
- The ***RST** command will clear the scan list and set all measurement parameters to their factory settings. The Instrument Preset (**SYSTem:PRESet** command) will not clear the scan list; however, this command will clear reading memory and all stored statistical data.

Examples

The following program segment configures the instrument for ac voltage measurements on channel 4 in slot 3. The READ? command places the instrument in the "wait-for-trigger" state, scans the channel once, and then sends the reading to reading memory and the instrument's output buffer. The default range (autorange) and resolution (fixed at 6½ digits) are used for the measurement.

```
CONF:VOLT:AC (@3004)
ROUT:SCAN (@3004)
READ? (@3004)
```

Typical Response: **+1.86850000E-03**

The following program segment configures the instrument for ac voltage measurements on channels 3 and 8 in slot 1. The INITiate command places the instrument in the "wait-for-trigger" state, scans the channels once, and stores the readings in memory. The FETCh? command transfers the readings from reading memory to the instrument's output buffer. The 1 V range is selected.

```
CONF:VOLT:AC 1, (@1003,1008)  
ROUT:SCAN (@1003,1008)  
INIT  
FETC?
```

Typical Response: **+4.27150000E-03,+1.32130000E-03**

The following program segment configures the internal DMM for an ac voltage measurement (no <ch_list> is specified). The READ? command places the internal DMM in the "wait-for-trigger" state, initiates a trigger, and then sends the reading to reading memory and the instrument's output buffer. The default range (autorange) and resolution (fixed at 6½ digits) are used for the measurement.

```
CONF:VOLT:AC !Applies to the internal DMM  
READ?
```

Typical Response: **+1.26360000E-02**

See Also

CONFigure?

FETCh?

INITiate

MEASure[:VOLTage]:AC?

READ?

ROUTe:CHANnel:DELay

ROUTe:SCAN

[SENSe:]VOLTage:AC:BANDwidth

SWEep:COUNt

CONFigure[:VOLTage][:DC]

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

```
CONFigure[:VOLTage][:DC] [{<range>|AUTO|MIN|MAX|DEF} [, {<resolution>|MIN|MAX|DEF}] , ] [(@<ch_list>)]
```

Description

First, this command resets all measurement parameters on the specified channels to their **default values**. Then, configures the channels for dc voltage measurements but *does not* initiate the scan. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

The CONFigure command does *not* place the instrument in the "wait-for-trigger" state. Use the **INITiate** or **READ?** command in conjunction with CONFigure to place the instrument in the "wait-for-trigger" state.

Used With:

- 34921A through 34925A Multiplexer Modules

Parameters

Name	Type	Range of Values	Default Value
<range>	Numeric	Expected value in volts (ranges shown below). 100 mV (MIN) 1 V 10 V 100 V 300 V (MAX)	AUTO (autorange)
<resolution>	Numeric	Desired resolution in volts.	0.000003 x Range (1 PLC)
<ch_list>	Numeric	One or more channels in the form (@sccc) .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.

- When you specify a range of channels with this command, any channels that are invalid will be ignored (no error will be generated) but the first and last channel in the range must be valid for the selected function. The Analog Bus relays (numbered **s911**, **s912**, **s913**, etc.) on the multiplexer and matrix modules are ignored if they are included in a range of channels. An error will be generated if an Analog Bus relay is specified as the first or last channel in a range of channels.
- You can allow the instrument to automatically select the measurement range using *autoranging* or you can select a fixed range using manual ranging. Autoranging is convenient because the instrument decides which range to use for each measurement based on the input signal. For fastest scanning operation, use manual ranging on each measurement (some additional time is required for autoranging since the instrument has to make a range selection).
- If you select autoranging (by specifying "AUTO" or "DEF"), an error will be generated if you specify a discrete value for the <resolution> parameter. When autoranging is combined with a discrete resolution, the instrument cannot accurately resolve the integration time (especially if the input signal is continuously changing). If your application requires autoranging, be sure to specify "DEF" for the <resolution> parameter, or omit the parameter from the command and use the **[SENSe:]VOLTage[:DC]NPLC** command to specify the desired integration time.
- Autorange thresholds:

Down range < 10% of range
 at:
 Up range at: > 120% of range

- Since this command resets all measurement parameters on the specified channels to their default values, be sure to send the CONFigure command *before* setting any other measurement parameters. For example, to change the sample count, first send the CONFigure command (sets the sample count to "1") and then change the sample count to the desired value (see **SAMPLE:COUNT** command).
- If the input signal is greater than can be measured on the selected range (manual ranging), the instrument gives an *overload indication*: "±OVL" from the front panel or "±9.9E+37" from the remote interface.
- The ***RST** command will clear the scan list and set all measurement parameters to their factory settings. The Instrument Preset (**SYSTem:PRESet** command) will not clear the scan list; however, this command will clear reading memory and all stored statistical data.

Examples

The following program segment configures the instrument for dc voltage measurements on channel 4 in slot 3. The READ? command places the instrument in the "wait-for-trigger" state, scans the channel once, and then sends the reading to reading memory and the instrument's output buffer. The default range (autorange) and resolution (1 PLC) are used for the measurement.

```
CONF:VOLT:DC (@3004)
ROUT:SCAN (@3004)
READ? (@3004)
```

Typical Response: **+1.86850000E-03**

The following program segment configures the instrument for dc voltage measurements on channels 3 and 8 in slot 1. The INITiate command places the instrument in the "wait-for-trigger" state, scans the channels once, and stores the readings in memory. The FETCh? command transfers the readings from reading memory to the instrument's output buffer. The 1 V range is selected with 1 mV resolution.

```
CONF:VOLT:DC 1,0.001,(@1003,1008)
ROUT:SCAN (@1003,1008)
INIT
FETC?
```

Typical Response: +4.27150000E-03,+1.32130000E-03

The following program segment configures the internal DMM for a dc voltage measurement (no <ch_list> is specified). The READ? command places the internal DMM in the "wait-for-trigger" state, initiates a trigger, and then sends the reading to reading memory and the instrument's output buffer. The default range (autorange) and resolution (1 PLC) are used for the measurement.

```
CONF:VOLT:DC !Applies to the internal DMM
READ?
```

Typical Response: +1.26360000E-02

See Also

[CONFigure?](#)

[FETCh?](#)

[INITiate](#)

[MEASure\[:VOLTage\]\[:DC\]?](#)

[READ?](#)

[ROUTe:SCAN](#)

[\[SENSe:\]VOLTage\[:DC\]:IMPedance:AUTO](#)

[\[SENSe:\]VOLTage\[:DC\]:ZERO:AUTO](#)

[SWEp:COUNT](#)

CONFigure?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

CONFigure? [(@<ch_list>)]

Description

This command returns the present configuration on the specified channels and returns a series of quoted strings. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

Used With:

- 34921A through 34925A Multiplexer Modules
- 34950A Digital I/O Module (digital I/O and counter channels only)
- 34952A Multifunction Module (digital I/O and totalizer channels only)
- 34959A Breadboard Module (digital I/O channels only)

Parameters

Name	Type	Range of Values	Default Value
<ch_list>	Numeric	One or more channels in the form (@sccc) .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined).
- If the internal DMM is not installed or is disabled, then no DMM-related configurations are allowed. However, scanning is allowed on the digital input and totalizer channels even without the internal DMM.
- The ***RST** command will clear the scan list and set all measurement parameters to their factory settings. The Instrument Preset (**SYSTem:PRESet** command) will not clear the scan list; however, this command will clear reading memory and all stored statistical data.

Return Format

The command returns a series of comma-separated fields indicating the present function, range, and resolution for the specified channels. Multiple responses are separated by commas. The short form of the function name is always returned (e.g., "CURR:AC", "FREQ", etc.).

Example: Multiplexer Channel

"VOLT +1.000000E+01,+3.000000E-03"
Function: DC Volts Range: 10V Resolution: 3 mV

Example: Digital I/O Channel

"DIG OUTP WORD"
Function: DIO State: Output Width: Word

Example: Totalizer Channel

"TOT RRES"
Function: Totalize Mode: Read/Reset

Examples

The following program segment configures multiplexer channels 3 and 8 in slot 1 and then reads back the configuration (the quotes are also returned).

```
CONF:RES 1000,1,(@1003)
CONF:TEMP THER,5000,1,0.1,(@1008)
CONF? (@1003,1008)
```

Typical Response: "RES +1.00000000E+03,+1.00000000E-01","TEMP
THER,5000,+1.00000000E+00,+1.00000000E-04"

The following program segment configures Bank 1 on the 34952A in slot 3 for two 16-bit words, configures the channels for output operations, and then reads back the configuration.

```
CONF:DIG:WIDTH WORD,(@3001,3003)
CONF:DIG:DIR OUTP,(@3001,3003)
CONF? (@3001,3003)
```

Typical Response: "DIG OUTP WORD","DIG OUTP WORD"

The following query returns the present configuration on the internal DMM (no <ch_list> is specified).

```
CONF?
```

Typical Response: "VOLT +1.000000E+01,+3.000000E-05"

See Also

CONFigure

DATA Subsystem Introduction

Command Summary

NOTE

Hold the mouse cursor over a command to view the full syntax statement.

DATA:LAST?

DATA:POINts:EVENT:THReshold

DATA:POINts:EVENT:THReshold?

DATA:POINts?

DATA:REMove?

DATA:LAST?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

DATA:LAST? [,(@<channel>)]

Description

This command returns the last measurement taken on the specified channel (single channel only). You can execute this command at any time, even during a scan. If you omit the optional <channel> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

Used With:

- 34921A through 34925A Multiplexer Modules
- 34950A Digital I/O Module (digital input and counter channels only)
- 34952A Multifunction Module (digital input and totalizer channels only)

Parameters

Name	Type	Range of Values	Default Value
<channel>	Numeric	One channel in the form (@sccc).	If <channel> is omitted, this command applies to the internal DMM.

Remarks

- Readings can be acquired during a scan using the multiplexer or digital modules or by the internal DMM independently (if no channel is specified).
- Each reading is returned with measurement units, time stamp, channel number, and alarm status information (independent of the present settings by the **FORMat:READing** commands). The time stamp is stored in absolute time format (time of day with date), which is based on the instrument's real-time clock as set by the **SYSTem:DATE** and **SYSTem:TIME** commands.
- The instrument clears all readings from memory when mainframe power is cycled.

Return Format

The command returns one reading for the specified channel (or the internal DMM). If readings are acquired using the internal DMM independently (without a multiplexer scan), the channel number will be logged as channel "0". If no data is available for the specified channel, "0" is returned for each field.

For example:

2.61950000E+01 C,2004,11,21,15,30,23.000,1003,2,4

1 Reading with Units (26.195 °C)	4 Channel Number
2 Date (November 21, 2004)	5 Alarm Limit Threshold Crossed (0 = No Alarm, 1 = LO, 2 = HI)
3 Time of Day (3:30:23.000 PM)	

Examples

The following query returns the last reading on channel 8 in slot 1.

```
DATA:LAST? (@1008)
```

Typical Response: +1.84280000E-05 VDC,2004,11,21,14,54,33.104,1008,0

The following query returns the last reading taken by the internal DMM.

```
DATA:LAST?
```

Typical Response: +1.00000000E+38 OHM,2004,11,21,15,04,24.386,0,0

See Also

FORMat:READing

SYSTem:DATE

SYSTem:TIME

DATA:POINts:EVENT:THReshold

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

DATA:POINts:EVENT:THReshold <num_readings>

DATA:POINts:EVENT:THReshold?

Description

This command sets a bit in the *Standard Operation Register* group **event register** when the specified number of readings have been stored in reading memory from a scan or internal DMM measurements. The "Memory Threshold" bit (bit 9) is set to a "1" in the event register when the number of stored readings is greater than or equal to the specified memory threshold.

NOTE

For more information on the SCPI Status System for the Keysight 34980A, see [Status System Introduction](#).

Used With:

- 34921A through 34925A Multiplexer Modules
- 34950A Digital I/O Module (digital input and counter channels only)
- 34952A Multifunction Module (digital input and totalizer channels only)

Parameters

Name	Type	Range of Values	Default Value
<num_readings>	Numeric	Any value between 1 and 500,000 readings.	This is a required parameter

Remarks

- To report any subsequent events, the reading count must first drop below the programmed memory threshold before reaching the threshold again. Use the **R?** or **DATA:REMove** command to remove readings from memory.
- To enable the "Memory Threshold" bit (bit 9) to be reported to the Status Byte, use the **STATus:OPERation:ENABLE** command.
- Once the "Memory Threshold" bit is set, it will remain set until cleared by the **STATus:OPERation[:EVENT]?** command or ***CLS** (clear status) command.

- The instrument resets the memory threshold to "1" after a Factory Reset (***RST** command) or when main-frame power is cycled. The memory threshold value is *not* reset by the **SYSTem:PRESet**, ***CLS**, or **STATus:PRESet** commands, or after a stored state is recalled (***RCL** command).

Return Format

The query command returns the number of readings currently specified as the memory threshold.

Examples

The following command sets the memory threshold to 125 readings.

```
DATA:POIN:EVEN:THR 125
```

The following query reads the memory threshold setting.

```
DATA:POIN:EVEN:THR?
```

Typical Response: **+125**

See Also

STATus:OPERation:ENABLE

DATA:POINts?

Syntax | **Description** | **Parameters** | **Remarks** | **Return Format** | **Example**

Syntax

DATA:POINts?

Description

This command returns the total number of readings currently stored in reading memory from a scan or internal DMM measurements.

Used With:

- 34921A through 34925A Multiplexer Modules
- 34950A Digital I/O Module (digital input and counter channels only)
- 34952A Multifunction Module (digital input and totalizer channels only)

Remarks

- You can read the count at any time, even during a scan or a series of internal DMM measurements.
- You can store at least 500,000 readings in memory and all readings are automatically time stamped. If memory overflows, a status register bit is set and new readings will overwrite the first (oldest) readings stored. The most recent readings are always preserved. Reading memory is not cleared when you read it.
- The instrument clears all readings from memory when a new scan is initiated, when any measurement parameters are changed (CONFigure and SENSE commands), and when the triggering configuration is changed (TRIGger commands).
- The instrument clears all readings from memory after a Factory Reset (***RST** command), after an Instrument Preset (**SYSTem:PRESet** command), or when mainframe power is cycled.

Return Format

The command returns a value between 0 and approximately 500,000 readings indicating the number of readings currently stored in reading memory.

Example

The following query returns the number of readings in memory.

```
DATA:POIN?
```

Typical Response: **+320**

See Also

[DATA:REMove?](#)

DATA:REMove?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

DATA:REMove? <num_readings>

Description

This command reads and erases the specified number of readings from memory. The readings are erased from memory starting with the oldest reading first. The purpose of this command is to allow you to periodically remove readings from memory during a scan than would normally cause reading memory to overflow (for example, during a scan with an infinite trigger count).

Used With:

- 34921A through 34925A Multiplexer Modules
- 34950A Digital I/O Module (digital input and counter channels only)
- 34952A Multifunction Module (digital input and totalizer channels only)

Parameters

Name	Type	Range of Values	Default Value
<num_readings>	Numeric	Specific number of readings to be read and erased from memory.	This is a required parameter

Remarks

- You can remove readings from memory at any time, even during a scan or a series of internal DMM measurements
- You can store at least 500,000 readings in memory during a scan. Readings are stored only during a scan. If memory overflows, the new readings will overwrite the first (oldest) readings stored; the most recent readings are always preserved. In addition, bit 12 is set in the Questionable Data Register's condition register (see [Status System Introduction](#)).
- If fewer than the specified number of readings are currently in memory, an error will be generated. You can use the [DATA:POINts?](#) command to determine the total number of readings currently in memory.
- The output from this command is affected by the settings of the [FORMat:READing](#) commands. Depending on the formats selected, each reading may or may not be stored with measurement units, time stamp, channel number, and alarm status information.
- The instrument clears all readings from memory when a new scan is initiated, when any measurement parameters are changed (CONFigure and SENSE commands), and when the triggering configuration is changed (TRIGger commands).

- The instrument clears all readings from memory after a Factory Reset (***RST** command), after an Instrument Preset (**SYSTem:PRESet** command), or when mainframe power is cycled.

Return Format

The command returns the specified number of readings (with formatting as set by the **FORMat:READing** commands) and then erases them from memory. Multiple responses are separated by commas.

Example

The following query returns 3 readings (starting with the oldest reading first) and erases them from memory.

```
DATA:REM? 3
```

Typical Response: +4.27150000E+02,+1.32130000E+03,+3.65300000E+03

See Also

DATA:POINTs?

FORMat:READing

DIAGnostic Subsystem Introduction

Command Summary

NOTE

Hold the mouse cursor over a command to view the full syntax statement.

DIAGnostic:DMM:CYCLes?

DIAGnostic:RELAy:CYCLes?

DIAGnostic:DMM:CYCLes?

Syntax | Description | Parameters | Remarks | Return Format | Example

Syntax

DIAGnostic:DMM:CYCLes? {1|2|3|4|5|6}

Description

This command reads the cycle count on one of six relays associated with function selection and isolation on the internal DMM. The relays are numbered "1" through "6", which correspond to relays K102 through K107, respectively.

Relay Number	Component Locator	Description
1	K102	For resistance measurements, this relay enables the ohms current source. For current measurements, this relay selects whether the 0.1 Ω (1A range) or the 5 Ω (10 mA, 100 mA range) current shunt is used.
2	K103	For dc voltage measurements, this relay connects Input High to the low-voltage dc input for the 10 Vdc range and below. For ac voltage measurements, this relay connects Input High to the ac input.
3	K104	For dc voltage measurements, this relay connects Input High to the high-voltage attenuator for the ranges greater than 10 Vdc. For all ac measurements, this relay selects between measuring ac voltage or measuring ac current.
4	K105	Input High and Input Low isolation to the backplane.
5	K106	Ohms Sense High and Ohms Sense Low isolation to the backplane.
6	K107	Current High and Current Low isolation to the backplane.

Remarks

- The internal DMM is an optional assembly for the Keysight 34980A. An error is generated if the internal DMM is disabled (see **INSTrument:DMM[:STATe]** command) or not installed in the mainframe.
- To read the cycle count on the multiplexer and switch modules, use the **DIAGnostic:RELAy:CYCLes?** command.
- See the Keysight 34980A *Service Guide* for information on replacing relays.

Return Format

The query command returns the cycle count on the specified internal DMM relay.

Example

The following command returns the cycle count on backplane relay 2 (relay K103).

```
DIAG:DMM:CYCL? 2
```

Typical Response: **+76289**

See Also

DIAGnostic:RELAY:CYCLes?

DIAGnostic:RElay:CYCLes?

Syntax | Description | Parameters | Remarks | Return Format | Example

Syntax

DIAGnostic:RElay:CYCLes? (@<ch_list>)

Description

This command reads the cycle count on the specified channels. In addition to the channel relays, you can also query the count on the Analog Bus relays and bank relays.

Used With:

- 34921A through 34925A Multiplexer Modules
- 34931A through 34934A Matrix Modules
- 34937A through 34939A GP Switch Modules
- 34941A and 34942A RF Multiplexer Modules
- 34945A Microwave Switch/Attenuator Driver
- 34946A and 34947A Microwave Switch Modules

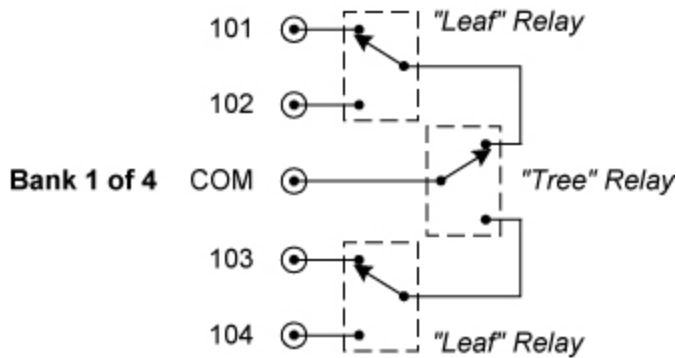
Parameters

Name	Type	Range of Values	Default Value
<ch_list>	Numeric	One or more channels in the form (@sccc) .	This is a required parameter

Remarks

- The 34923A, 34924A, and 34933A modules can be configured for 2-wire (differential) or 1-wire (single ended) measurements (see **SYSTem:MODule:WIRE:MODE** command). Since two coils are required to drive each channel relay in the 2-wire mode, the module stores the cycle count for each coil and returns the *greater* of the two. To determine the cycle count for each coil, reconfigure the module for the 1-wire mode (a power cycle is required) and query the count.
- In theory, the FET switches on the 34925A FET Multiplexer module have an infinite life when used under normal operating conditions. Therefore, the cycle count is *not* recorded and this command always returns "0" (will not generate an error). Although the count on the FET switches is not recorded, you can read the actual cycle count on the mechanical Analog Bus relays.

- On the RF Multiplexer modules (34941A, 34942A), each bank consists of two *leaf* relays and one *tree* relay (see diagram below). The module stores the cycle count for each of the three relays on all four banks. The DIAGnostic:RElay:CYCLes? command returns the greater of the three values on the specified bank (i.e., reflecting the cycle count for the entire bank). Therefore, the count for Channels 101, 102, 103, and 104 will *always* be equal.



- The *reset* state of the three relays is shown above for Bank 1 (a reset operation selects the lowest channel within the bank). The cycle count for any of the three relays is incremented whenever the relay transitions from the reset state. Therefore, the cycle count reflects a complete transition of the relay from, and back to, the reset state. For example, closing Channel 101 will not increment the *leaf* relay cycle count, but closing Channel 102 will increment the cycle count.
- To maintain repeatable crosstalk behavior, whenever the *tree* relay changes position, the unconnected *leaf* relay will automatically return to its reset position. Note that this may result in unexpected cycle counts. For example, switching back and forth between Channels 102 and 104 will result in both leaf relay cycle counts being incremented upon each channel transition.

- Obtaining relay cycle counts for the 34934A high-density matrix module is best accomplished using the 34980A web interface. To access to the web interface and view 34934A relay cycle counts:
 - connect the 34980A to the PC using the LAN interface (note - the web interface is only available from the LAN)
 - open a web browser and enter the 34980A IP address. To view the IP address from the front panel select:
 - 'Utility' | 'Remote IO' | 'LAN' | 'Enable LAN' | 'View' | 'DHCP BOOT' - rotate knob
 - with the 34980A web interface open, select:
 - > Browser Web Control (either 'Observe Only' or 'Allow Full Control' mode is ok)
 - > System Overview
 - > Module Information - select the slot containing the 34934A
 - > Relay Cycle Counts - all channels
 - > Generate Report
 - the cycle count returned includes all channels of the matrix configuration and the row protection connect/disconnect and bypass relays. The row protection relays are not independently controlled but are a function of the **SYSTem:MODule:ROW:PROTection** command.
- On the 34945A Microwave Switch/Attenuator Driver, this command returns the number of times the specified coil drive has been *activated*.
 - a. The module will never assume that a channel is already closed/open and will always drive the channel (as long as the channel drive is not OFF; see **ROUTe:RMODule:DRIVE:SOURce[:IMMediate]** command).
 - b. For paired operations (see **ROUTe:CHANnel:DRIVE:PAIRed[:MODE]** command), the count on both the lower and upper channel in the pair will be incremented on *each* open/close operation.
- To read the cycle count on the relays associated with function selection and isolation on the internal DMM, use the **DIAGnostic:DMM:CYCLes?** command.
- See the Keysight 34980A *Service Guide* for information on replacing relays.

Return Format

The command returns the cycle count for each channel specified. The value returned is between 0 and 4,294,967,294 (32-bit value). Multiple responses are separated by commas.

Example

The following command returns the cycle count on channels 3 and 13 in slot 1.

```
DIAG:REL:CYCL? (@1003,1013)
```

Typical Response: **+76289,+11055**

See Also

[DIAGnostic:DMM:CYCLes?](#)

[SYSTem:MODule:WIRE:MODE](#)

DISPlay Subsystem Introduction

Command Summary

NOTE

Hold the mouse cursor over a command to view the full syntax statement.

DISPlay:TEXT

DISPlay:TEXT?

DISPlay:TEXT:CLEAr

DISPlay[:STATe]

DISPlay[:STATe]?

DISPlay[:STATe]

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

DISPlay[:STATe] <mode>

DISPlay[:STATe]?

Description

This command disables or enables the instrument's front-panel display. For security reasons or for a slight increase in measurement rates, you may want to turn off the front-panel display. When disabled, the entire front-panel display goes dark and all display annunciators except *ERROR*, *HOT*, and *Safety Interlock* are disabled.

Parameters

Name	Type	Range of Values	Default Value
<mode>	Boolean	{OFF 0 ON 1}	Display ON

Remarks

- You can disable the front-panel display from the remote interface only.
- Sending a text message to the display (see **DISPlay:TEXT** command) overrides the display state; this means that you can display a message even if the display is turned off.
- The display setting is *not* stored as part of the instrument state by the ***SAV** command.
- The front-panel display is automatically enabled when power is cycled, after a Factory Reset (***RST** command), or after an Instrument Preset (**SYSTem:PRESet** command).

Return Format

The query command returns "0" (OFF) or "1" (ON).

Examples

The following command disables the front-panel display.

```
DISP OFF
```

The following query returns the front-panel display setting.

```
DISP?
```

Typical Response: 0

See Also

DISPlay:TEXT

DISPlay:TEXT

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

DISPlay:TEXT "<string>"

DISPlay:TEXT?

Description

This command displays a text message on the upper line of the instrument's front-panel display. The instrument can display up to 18 characters on the front panel; any additional characters are truncated (no error is generated).

Parameters

Name	Type	Range of Values	Default Value
<string>	Quoted ASCII String	A string of up to 18 characters enclosed in quotes. You can use letters (A-Z), numbers (0-9), and special characters like "@", "%", "*", etc. Use "#" character to display a degree symbol (°).	This is a required parameter

Remarks

- Commas, periods, and semicolons share a display space with the preceding character, and are not considered individual characters.
- While a message is displayed on the front panel, readings from a scan or monitor are not sent to the front-panel display.
- Sending a text message to the display overrides the display state (see **DISPlay:STATe** command); this means that you can display a message even if the display is turned off.
- Pressing any front-panel key will clear the text message. To prevent this, use the **SYSTem:LOCK:REQuest?** command.
- The display text is *not* stored as part of the instrument state by the ***SAV** command.
- The front-panel display is automatically cleared when power is cycled, after a Factory Reset (***RST** command), or after an Instrument Preset (**SYSTem:PRESet** command).

Return Format

The query command reads the message currently displayed on the front panel and returns an ASCII string enclosed in double quotes. If no message is displayed, a null string (" ") is returned.

Examples

The following commands display a message on the upper line of the front panel (the quotes are not displayed).

```
DISP:TEXT "SCANNING ..." or DISP:TEXT 'SCANNING ...'
```

The following query returns the message currently displayed on the front panel (the quotes are also returned).

```
DISP:TEXT?
```

Typical Response: **"SCANNING ..."**

See Also

DISPlay:TEXT:CLEAr

SYSTem:LOCK:REQuest?

DISPlay:TEXT:CLEAr

Syntax | Description | Parameters | Remarks | Return Format | Example

Syntax

DISPlay:TEXT:CLEAr

Description

This command clears the text message displayed on the upper line of the instrument's front-panel display (see **DISPlay:TEXT** command).

Remarks

- Clearing the text message does not override the display state (see **DISPlay:STATe** command); if the display was disabled prior to clearing the text message, the display will remain disabled.
- Pressing any front-panel button will also clear the text message. To prevent this, use the **SYSTem:LOCK:REQuest?** command.
- The front-panel display is automatically cleared when power is cycled, after a Factory Reset (***RST** command), or after an Instrument Preset (**SYSTem:PRESet** command).

Example

The following command clears the text message on the front panel.

```
DISP:TEXT:CLEAR
```

See Also

DISPlay:TEXT

DISPlay[:STATe]

SYSTem:LOCK:REQuest?

FORMat Subsystem Introduction

During a scan, the instrument automatically adds a time stamp to all readings and stores them in memory. Each reading is also stored with measurement units, time stamp, channel number, and alarm status information. You can specify which information you want returned with the readings (from the front panel, all of the information is available for viewing). The reading format applies to all readings being removed from the instrument from a scan; you cannot set the format on a per-channel basis. The examples below show a reading in **relative** and **absolute** format with all fields enabled.

Relative Format (Default):

2.61950000E+01 C,000000000.017,1003,2

① ② ③ ④

1 Reading with Units (26.195 °C)	3 Channel Number
2 Time Since Start of Scan (17 ms)	4 Alarm Limit Threshold Crossed (0 = No Alarm, 1 = LO, 2 = HI)

Absolute Format:

2.61950000E+01 C,2004,11,21,15,30,23.000,1003,2,4

① ② ③ ④ ⑤ ⑥

1 Reading with Units (26.195 °C)	4 Channel Number
2 Date (November 21, 2004)	5 Alarm Limit Threshold Crossed (0 = No Alarm, 1 = LO, 2 = HI)
3 Time of Day (3:30:23.000 PM)	

The FORMat commands are valid only with the following Keysight 34980A plug-in modules which can be configured to be part of a scan. The internal DMM must also be installed and enabled.

34921A	40-Channel Armature Multiplexer (including temperature and current)
34922A	70-Channel Armature Multiplexer
34923A	40/80-Channel Reed Multiplexer
34924A	70-Channel Reed Multiplexer
34925A	40/80-Channel FET Multiplexer
34950A	64-Bit Digital I/O Module (digital input and counter channels only)
34952A	Multifunction Module (digital input and totalizer channels only)

Command Summary

NOTE

Hold the mouse cursor over a command to view the full syntax statement.

FORMat:BORDER

FORMat:BORDER?

FORMat:READIng:ALARm

FORMat:READIng:ALARm?

FORMat:READIng:CHANnel

FORMat:READIng:CHANnel?

FORMat:READIng:TIME

FORMat:READIng:TIME?

FORMat:READIng:TIME:TYPE

FORMat:READIng:TIME:TYPE?

FORMat:READIng:UNIT

FORMat:READIng:UNIT?

FORMat:BORDER

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

FORMat:BORDER {NORMal|SWAPped}

FORMat:BORDER?

Description

Used for binary block transfers only. This command selects the byte order for binary block transfers using the **TRACe[:DATA]** and **TRACe[:DATA]:DAC** commands on the 34951A Isolated DAC Module and the **TRACe[:DATA]:DIGital[:<width>]** command on the 34950A Digital I/O Module. Note that this command applies globally and cannot be applied on a channel-by-channel basis.

Remarks

- In the *NORMal* byte order (default), the most-significant byte (MSB) of each data point is assumed first.
- In the *SWAPped* byte order, the least-significant byte (LSB) of each data point is assumed first. Most computers use the "swapped" byte order.
- The byte order setting is stored **volatile** memory and will be reset to *NORMal* when power is turned off or after a Factory Reset (***RST** command).

Return Format

The query command returns "NORM" or "SWAP".

Examples

The following command enables the "swapped" byte order mode.

```
FORM:BORD SWAP
```

The following query returns the current byte order setting.

```
FORM:BORD?
```

Typical Response: **SWAP**

See Also

[\[SENSe:\]DIGital:MEMory\[:DATA\]?](#)

[\[SENSe:\]DIGital:MEMory\[:DATA\]:ALL?](#)

TRACe[:DATA]

TRACe[:DATA]:DAC

TRACe[:DATA]:DIGita[:<width>]

FORMat:READIng:ALARm

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

FORMat:READIng:ALARm <mode>

FORMat:READIng:ALARm?

Description

This command disables or enables the inclusion of alarm information with data retrieved by the **READ?** command, the **FETCh?** command, or other queries of scan results. This command operates in conjunction with the other FORMat:READIng commands (they are not mutually exclusive). See [Format Subsystem Introduction](#) for examples of fully-formatted results from a scan.

Used With:

- 34921A through 34925A Multiplexer Modules
- 34950A Digital I/O Module (digital input and counter channels only)
- 34952A Multifunction Module (digital input and totalizer channels only)

Parameters

Name	Type	Range of Values	Default Value
<mode>	Boolean	{OFF 0 ON 1}	OFF (alarm data not included)

Remarks

- The reading format applies to all readings being retrieved from the instrument; you cannot set the format on a per-channel basis.
- The CONFigure and MEASure? commands automatically disable the alarm setting.
- The alarm setting is stored in **volatile** memory and will be disabled (OFF) when power is turned off or after a Factory Reset (***RST** command).

Return Format

The query command returns "0" (OFF) or "1" (ON).

Examples

The following command enables the inclusion of alarm information.

```
FORM:READ:ALAR ON
```

The following query returns the alarm setting.

```
FORM:READ:ALAR?
```

Typical Response: 1

See Also

[FORMat:READIng:CHANnel](#)

[FORMat:READIng:TIME](#)

[FORMat:READIng:UNIT](#)

FORMat:READIng:CHANnel

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

FORMat:READIng:CHANnel <mode>

FORMat:READIng:CHANnel?

Description

This command disables or enables the inclusion of channel number information with data retrieved by the **READ?** command, the **FETCh?** command, or other queries of scan results. This command operates in conjunction with the other FORMat:READIng commands (they are not mutually exclusive). See **Format Subsystem Introduction** for examples of fully-formatted results from a scan.

Used With:

- 34921A through 34925A Multiplexer Modules
- 34950A Digital I/O Module (digital input and counter channels only)
- 34952A Multifunction Module (digital input and totalizer channels only)

Parameters

Name	Type	Range of Values	Default Value
<mode>	Boolean	{OFF 0 ON 1}	OFF (channel data not included)

Remarks

- The reading format applies to all readings being retrieved from the instrument; you cannot set the format on a per-channel basis.
- If readings are acquired using the internal DMM independently (without a multiplexer scan), the channel number will be logged as channel "0000".
- The CONFigure and MEASure? commands automatically disable the channel setting.
- The channel setting is stored in **volatile** memory and will be disabled (OFF) when power is turned off or after a Factory Reset (***RST** command).

Return Format

The query command returns "0" (OFF) or "1" (ON).

Examples

The following command enables the inclusion of channel number information.

```
FORM:READ:CHAN ON
```

The following query returns the channel number setting.

```
FORM:READ:CHAN?
```

Typical Response: **1**

See Also

[FORMat:READIng:ALARm](#)

[FORMat:READIng:TIME](#)

[FORMat:READIng:UNIT](#)

FORMat:READIng:TIME

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

FORMat:READIng:TIME <mode>

FORMat:READIng:TIME?

Description

This command disables or enables the inclusion of a time stamp with data retrieved by the **READ?** command, the **FETCh?** command, or other queries of scan results. This command operates in conjunction with the other FORMat:READIng commands (they are not mutually exclusive). See [Format Subsystem Introduction](#) for examples of fully-formatted results from a scan.

Used With:

- 34921A through 34925A Multiplexer Modules
- 34950A Digital I/O Module (digital input and counter channels only)
- 34952A Multifunction Module (digital input and totalizer channels only)

Parameters

Name	Type	Range of Values	Default Value
<mode>	Boolean	{OFF 0 ON 1}	OFF (time stamp not included)

Remarks

- The reading format applies to all readings being retrieved from the instrument; you cannot set the format on a per-channel basis.
- If enabled, the time stamp information is shown either in absolute time (time of day with date) or relative time (time in seconds since start of scan) as set by the **FORMat:READIng:TIME:TYPE** command.
- The CONFigure and MEASure? commands automatically disable the time stamp setting.
- The time stamp setting is stored in **volatile** memory and will be disabled (OFF) when power is turned off or after a Factory Reset (***RST** command).

Return Format

The query command returns "0" (OFF) or "1" (ON).

Examples

The following command enables the inclusion of a time stamp.

```
FORM:READ:TIME ON
```

The following query returns the time stamp setting.

```
FORM:READ:TIME?
```

Typical Response: **1**

See Also

[FORMat:READIng:ALARm](#)

[FORMat:READIng:CHANnel](#)

[FORMat:READIng:TIME:TYPE](#)

[FORMat:READIng:UNIT](#)

FORMat:READIng:TIME:TYPE

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

FORMat:READIng:TIME:TYPE <format>

FORMat:READIng:TIME:TYPE?

Description

This command selects the time format for storing scanned data in memory. You can select absolute time (time of day with date) or relative time (time in seconds since start of scan). This command operates in conjunction with the **FORMat:READIng:TIME** command (they are not mutually exclusive). See [Format Subsystem Introduction](#) for examples of fully-formatted results from a scan.

Used With:

- 34921A through 34925A Multiplexer Modules
- 34950A Digital I/O Module (digital input and counter channels only)
- 34952A Multifunction Module (digital input and totalizer channels only)

Parameters

Name	Type	Range of Values	Default Value
<format>	Discrete	{ABSolute RELative}	RELative

Remarks

- The reading format applies to all readings being retrieved from the instrument; you cannot set the format on a per-channel basis.
- In terms of reading stored data from memory, the relative format is considerably faster than the absolute format (more information is stored).
- The absolute format is based on the instrument's real-time clock as set by the **SYSTem:DATE** and **SYSTem:TIME** commands.
- The time format setting is stored in **volatile** memory and will be disabled (OFF) when power is turned off or after a Factory Reset (***RST** command).

Return Format

The query command returns "ABS" or "REL".

Examples

The following command enables the absolute time format (readings are stored with time of day and date information).

```
FORM:READ:TIME:TYPE ABS  
FORM:READ:TIME ON
```

The following query returns the time format setting.

```
FORM:READ:TIME:TYPE?
```

Typical Response: **ABS**

See Also

FORMat:READIng:TIME

SYSTem:DATE

SYSTem:TIME

FORMat:READIng:UNIT

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

FORMat:READIng:UNIT <mode>

FORMat:READIng:UNIT?

Description

This command disables or enables the inclusion of measurement units (VAC, VDC, OHM, etc.) with data retrieved by the **READ?** command, the **FETCH?** command, or other queries of scan results. This command operates in conjunction with the other FORMat:READIng commands (they are not mutually exclusive). See [Format Subsystem Introduction](#) for examples of fully-formatted results from a scan.

Used With:

- 34921A through 34925A Multiplexer Modules
- 34950A Digital I/O Module (frequency measurements only)

Parameters

Name	Type	Range of Values	Default Value
<mode>	Boolean	{OFF 0 ON 1}	OFF (measurement units are not included)

Remarks

- The reading format applies to all readings being retrieved from the instrument; you cannot set the format on a per-channel basis.
- The CONFigure and MEASure? commands automatically disable the unit setting.
- The unit setting is stored in **volatile** memory and will be disabled (OFF) when power is turned off or after a Factory Reset (***RST** command).

Return Format

The query command returns "0" (OFF) or "1" (ON).

Examples

The following command enables the inclusion of measurement units.

```
FORM:READ:UNIT ON
```

The following query returns the measurement units setting.

```
FORM:READ:UNIT?
```

Typical Response: 1

See Also

[FORMat:READIng:ALARm](#)

[FORMat:READIng:CHANnel](#)

[FORMat:READIng:TIME](#)

[FORMat:READIng:UNIT](#)

IEEE-488 Common Commands Introduction

Command Summary

NOTE

Hold the mouse cursor over a command to view the full syntax statement.

*CLS

*ESE

*ESE?

*ESR?

*IDN?

*OPC

*OPC?

*RCL

*RST

*SAV

*SRE

*SRE?

*STB?

*TRG

*TST?

*WAI

*CLS

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

***CLS**

Description

This command clears the event registers in all register groups. This command also clears the Error queue and the Alarm queue.

Example

The following command clears the event register bits.

```
*CLS
```

*ESE

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

*ESE <enable_value>

*ESE?

Description

This command enables bits in the **enable register** for the *Standard Event Register* group. The selected bits are then reported to bit 5 of the Status Byte Register.

NOTE

For more information on the SCPI Status System for the Keysight 34980A, see [Status System Introduction](#).

Parameters

Name	Type	Range of Values	Default Value
<enable_value>	Numeric	A decimal value which corresponds to the binary-weighted sum of the bits in the register (see table below).	This is a required parameter

Remarks

- The following table lists the bit definitions for the Standard Event Register.

Bit Number	Decimal Value	Definition
0 Operation Complete	1	All commands prior to and including *OPC have been executed.
1 Not Used	Not Used	"0" is returned.
2 Query Error	4	The instrument tried to read the output buffer but it was empty. Or, a new command line was received before a previous query has been read. Or, both the input and output buffers are full.
3 Device Error	8	A self-test or calibration error occurred (an error in the -300 range or any positive error has been generated). For a complete listing of the error messages, see SCPI Error Messages .
4 Execution Error	16	An execution error occurred (an error in the -200 range has been generated).

5 Command Error	32	A command syntax error occurred (an error in the -100 range has been generated).
6 Not Used	Not Used	"0" is returned.
7 Power On	128	Power has been turned off and on since the last time the event register was read or cleared.

- Use the <enable_value> parameter to specify which bits will be enabled. The decimal value specified corresponds to the binary-weighted sum of the bits you wish to enable in the register. For example, to enable bit 2 (decimal value = 4), bit 3 (decimal value = 8), and bit 7 (decimal value = 128), the corresponding decimal value would be 140 (4 + 8 + 128).
- The ***CLS** (clear status) command will not clear the enable register but it does clear all bits in the **event register**.
- An Instrument Preset (**SYSTem:PRESet** command) does *not* clear the bits in the Status Byte enable register.

Return Format

The query command reads the enable register and returns a decimal value which corresponds to the binary-weighted sum of all bits set in the register. For example, if bit 3 (decimal value = 8) and bit 7 (decimal value = 128) are enabled, the query command will return **" +136"**.

Examples

The following command enables bit 4 (decimal value = 16) in the enable register. If an Execution Error occurs, this condition will be reported to the Status Byte Register (bit 5 will be set high).

```
*ESE 16
```

The following query returns which bits are enabled in the register.

```
*ESE?
```

Typical Response: **+16**

See Also

***ESR?**

*ESR?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

*ESR?

Description

This command queries the **event register** for the *Standard Event Register* group.

NOTE

For more information on the SCPI Status System for the Keysight 34980A, see [Status System Introduction](#).

Remarks

- The following table lists the bit definitions for the Standard Event Register.

Bit Number	Decimal Value	Definition
0 Operation Complete	1	All commands prior to and including *OPC have been executed.
1 Not Used	Not Used	"0" is returned.
2 Query Error	4	The instrument tried to read the output buffer but it was empty. Or, a new command line was received before a previous query has been read. Or, both the input and output buffers are full.
3 Device Error	8	A self-test or calibration error occurred (an error in the -300 range or any positive error has been generated). For a complete listing of the error messages, see SCPI Error Messages .
4 Execution Error	16	An execution error occurred (an error in the -200 range has been generated).
5 Command Error	32	A command syntax error occurred (an error in the -100 range has been generated).
6 Not Used	Not Used	"0" is returned.
7 Power On	128	Power has been turned off and on since the last time the event register was read or cleared.

- In order to be reported to the Standard Event Register, the corresponding bits in the event register must be enabled using the ***ESE** command.
- Once a bit is set, it remains set until cleared by reading the event register or the ***CLS** (clear status) command.

Return Format

The command reads the event register and returns a decimal value which corresponds to the binary-weighted sum of all bits set in the register (see table above). For example, if bit 1 (decimal value = 2) and bit 4 (decimal value = 16) are set (and the corresponding bits are enabled), this command will return "+18".

Example

The following command reads the event register (bits 3 and 4 are set).

```
*ESR?
```

Typical Response: **+24**

See Also

***ESE**

*IDN?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

*IDN?

Description

This command reads the instrument's (mainframe) identification string which contains four comma-separated fields. The first field is the manufacturer's name, the second field is the instrument model number, the third field is the serial number, and the fourth field is a firmware revision code which contains four codes separated by dashes.

Return Format

The command returns a string with the following format (the response will be less than or equal to 72 characters).

Keysight Technologies,34980A,<Serial Number>,m.mm–b.bb–f.ff–d.dd

m.mm	= Mainframe revision number
b.bb	= Boot code revision number
f.ff	= Front-panel revision number
d.dd	= Internal DMM revision number

Example

The following query returns the instrument's identification string.

```
*IDN?
```

Typical Response: **Keysight Technologies,34980A,MY12345678,1.00-1.00-2.00-1.00**

See Also

[SYSTem:CTYPe?](#)

[SYSTem:CDEscription?](#)

*OPC

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

***OPC**

Description

This command sets the "Operation Complete" bit (bit 0) in the Standard Event register at the completion of the current operation. This command is most useful with the **INITiate**, **ROUTe:CLOSe**, and **ROUTe:OPeN** commands.

NOTE

For more information on the SCPI Status System for the Keysight 34980A, see [Status System Introduction](#).

Remarks

- The purpose of this command is to synchronize your application with the instrument.
- Note the difference between the *OPC command and the ***OPC?** query command which returns "1" to the output buffer at the completion of the current operation.

Example

The following command waits until channel 1 on the module in slot 2 is fully closed and then sets the "Operation Complete" bit.

```
ROUT:CLOS (@2001); *OPC
```

See Also

[INITiate](#)

[ROUTe:CLOSe](#)

[ROUTe:OPeN](#)

[*OPC?](#)

[*WAI](#)

*OPC?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

***OPC?**

Description

This command returns "1" to the output buffer at the completion of the current operation.

NOTE

For more information on the SCPI Status System for the Keysight 34980A, see [Status System Introduction](#).

Remarks

- The purpose of this command is to synchronize your application with the instrument.
- Note the difference between the *OPC? command and the ***OPC** command which sets the "Operation Complete" bit (bit 0) in the Standard Event register at the completion of the current operation.
- For overlapped switching operations, the **ROUTe:MODUle:WAIT?** command is similar to *OPC?. See the **ROUTe:OPERation:OVERlap[:ENABLE]** command for more information on enabling the overlapped mode.

Return Format

The command returns "1" to the output buffer.

Example

The following command waits until channel 1 on the module in slot 2 is fully closed and then sends "1" to the output buffer.

```
ROUT:CLOS (@2001); *OPC?
```

See Also

***OPC**

ROUTe:MODUle:WAIT?

*RCL

Syntax | Description | Parameters | Remarks | Return Format | Example

Syntax

*RCL {1|2|3|4|5}

Description

This command recalls the instrument state stored in the specified storage location. You cannot recall the instrument state from a storage location that is empty or was deleted. When shipped from the factory, storage locations 1 through 5 are empty.

Use the ***SAV** command to store the current instrument state.

Remarks

- The instrument has five storage locations in non-volatile memory to store instrument states. You can only recall a state from a location that contains a previously stored state.
- Before recalling a stored state, the instrument verifies that the same plug-in module types are installed in each slot. If different module types are installed, the instrument will perform the equivalent of a Factory Reset (***RST** command) and an error will be generated.
- On the 34951A DAC Module, nearly all of the channel parameters are *lost* when the instrument state is stored. The exceptions are the clock output frequency (**SOURce:MODUle:CLOCK:FREQuency** command), the clock output state (**SOURce:MODUle:CLOCK:STATe** command), and the trigger output state (**SOURce:MODUle:TRIGger:OUTPut** command), which are stored as part of the instrument state. All other channel parameters are set to their default values. In addition, trace data is *not* stored as part of the instrument state and you must download the trace points to memory again after recalling a stored state.
- Non-sequential scan lists are *not* restored by the *RCL command (see **ROUTe:SCAN:ORDered** command).
- A Factory Reset (***RST** command) has no effect on the configurations stored in memory. Once a state is stored, it remains until it is overwritten or specifically deleted.

Example

The following command recalls the instrument state previously stored in location 1.

```
*RCL 1
```

See Also

***SAV**

MEMory:STATe:DELeTe:ALL

MEMory:STATe:NAME

MEMory:STATe:RECall:AUTO

*RST

Syntax | Description | Parameters | Remarks | Return Format | Example

Syntax

*RST

Description

This command resets the mainframe, internal DMM, and all installed modules to the Factory configuration. See **Factory Reset State** for a complete listing of the instrument's Factory configuration.

Remarks

- This command does not affect any previously-stored instrument states (see ***SAV** command).
- This command does not affect any previously-defined channel labels (see **ROUTe:CHANnel:LABel[:DEFine]** command).
- On the 34945A Microwave Switch/Attenuator Driver, this command drives all channels on a remote module to their default switch states as specified by the **ROUTe:CHANnel:DRIVE:OPEN:DEFault** command and sets all channel drives to the specified boot state (see **ROUTe:RMOdule:DRIVE:SOURce:BOOT** command). In addition, when the *RST command is executed, the 34945A automatically re-evaluates all external remote module connections to determine what is connected, what is powered, etc. No other settings are changed.
- On the 34945A Microwave Switch/Attenuator Driver, the time required to complete a reset may be significant depending on the specified pulse width (see **ROUTe:CHANnel:DRIVE:PULSe:WIDTh** command) and power supply recovery time (see **ROUTe:CHANnel:DRIVE:TIME:RECoverY** command). If both values are set to their upper limits (255 ms each) for all channels, the time required to reset (or boot) the module may exceed 30 seconds:

$$64 \text{ Channels} \times (255 \text{ ms Pulse Width} + 255 \text{ ms Recovery Time}) = \sim 33 \text{ seconds}$$

Example

The following command resets the instrument.

```
*RST
```

See Also

ROUTe:CHANnel:DRIVE:PULSe:WIDTh (34945A only)

ROUTe:CHANnel:DRIVE:TIME:RECoverY (34945A only)

SYSTem:CPON

SYSTem:PRESet

*SAV

Syntax | Description | Parameters | Remarks | Return Format | Example

Syntax

*SAV {1|2|3|4|5}

Description

This command stores (saves) the current instrument state in the specified storage location. Any state previously stored in the same location is overwritten (no error is generated).

Use the ***RCL** command to recall a stored instrument state.

Remarks

- The instrument has five storage locations in non-volatile memory to store instrument states. You can store the instrument state in any of the five locations, but you can only recall a state from a location that contains a previously stored state.
- The instrument stores the state of all plug-in modules including all channel configurations, scanning setups, and Mx+B scaling values. However, note that only the measurement attributes of the currently-selected function (range, resolution, etc.) will be preserved in the stored states.
- Before recalling a stored state, the instrument verifies that the same plug-in module types are installed in each slot. If a different module type is installed, the instrument will perform the equivalent of a Factory Reset (***RST** command) and an error will be generated.
- When shipped from the factory, storage locations 1 through 5 are empty. In addition, the automatic recall mode is disabled (see **MEMory:STAtE:RECall:AUTO OFF** command) and a Factory Reset is issued when power is turned on.
- You can assign a user-defined name to each of locations 1 through 5. See the **MEMory:STAtE:NAME** command for details.
- On the 34951A DAC Module, nearly all of the channel parameters are *lost* when the instrument state is stored. The exceptions are the clock output frequency (**SOURce:MODUle:CLOCK:FREQuency** command), the clock output state (**SOURce:MODUle:CLOCK:STATe** command), and the trigger output state (**SOURce:MODUle:TRIGger:OUTPut** command), which are stored as part of the instrument state. All other channel parameters are set to their default values. In addition, trace data is *not* stored as part of the instrument state and you must download the trace points to memory again after recalling a stored state.
- Non-sequential scan lists are *not* stored by the *SAV command (see **ROUTe:SCAN:ORDer** command).
- A Factory Reset (***RST** command) does not affect the configurations stored in memory. Once a state is stored, it remains until it is overwritten or specifically deleted.

Example

The following command stores the current instrument state in location 1.

```
*SAV 1
```

See Also

[*RCL](#)

[MEMory:STATe:DELeTe:ALL](#)

[MEMory:STATe:NAME](#)

[MEMory:STATe:RECall:AUTO](#)

*SRE

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

*SRE <enable_value>

*SRE?

Description

This command enables bits in the **enable register** for the *Status Byte Register* group. Once enabled, the corresponding bits may generate a Request for Service (RQS) in the Status Byte. This RQS event may generate a "call back" to your application as a type of asynchronous interrupt.

NOTE

For more information on the SCPI Status System for the Keysight 34980A, see [Status System Introduction](#).

Parameters

Name	Type	Range of Values	Default Value
<enable_value>	Numeric	A decimal value which corresponds to the binary-weighted sum of the bits in the register (see table below).	This is a required parameter

Remarks

- The following table lists the bit definitions for the Status Byte Register.

Bit Number	Decimal Value	Definition
0 Module Event Summary	1	One or more bits are set in the Module Event Register (bits must be enabled, see STATus:MODUle:ENABLe command).
1 Alarm Condition	2	One or more bits are set in the Alarm Register (bits must be enabled, see STATus:ALARm:ENABLe command).
2 Error Queue	4	One or more errors have been stored in the Error Queue. Use the SYSTem:ERRor? command to read and delete errors.
3 Questionable Data Summary	8	One or more bits are set in the Questionable Data Register (bits must be enabled, see STATus:QUEStionable:ENABLe command).

4 Message Available	16	Data is available in the instrument's output buffer.
5 Standard Event Summary	32	One or more bits are set in the Standard Event Register (bits must be enabled, see *ESE command).
6 Master Summary	64	One or more bits are set in the Status Byte Register and may generate a Request for Service (RQS). Bits must be enabled using the *SRE command.
7 Standard Operation Summary	128	One or more bits are set in the Standard Operation Register (bits must be enabled, see STATus:OPERation:ENABLE command).

- Use the <enable_value> parameter to specify which bits will be enabled. The decimal value specified corresponds to the binary-weighted sum of the bits you wish to enable in the register. For example, to enable bit 1 (decimal value = 2), bit 3 (decimal value = 8), and bit 6 (decimal value = 64), the corresponding decimal value would be 74 (2 + 8 + 64).
- A **STATus:PRESet** command does not clear the bits in the Status Byte enable register.
- The Status Byte enable register is cleared when you execute the ***SRE 0** command.

Return Format

The query command reads the enable register and returns a decimal value which corresponds to the binary-weighted sum of all bits set in the register. For example, if bit 3 (decimal value = 8) and bit 7 (decimal value = 128) are enabled, the query command will return **" +136"**.

Examples

The following command enables bit 4 (decimal value = 16) in the enable register.

```
*SRE 16
```

The following query returns which bits are enabled in the register.

```
*SRE?
```

Typical Response: **+16**

See Also

***STB?**

*STB?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

*STB?

Description

This command queries the **condition register** for the *Status Byte Register* group. This command is similar to a Serial Poll but it is processed like any other instrument command. This is a read-only register and the bits are not cleared when you read the register.

NOTE

For more information on the SCPI Status System for the Keysight 34980A, see [Status System Introduction](#).

Remarks

- The following table lists the bit definitions for the Status Byte Register.

Bit Number	Decimal Value	Definition
0 Module Event Summary	1	One or more bits are set in the Module Event Register (bits must be enabled, see STATus:MODUle:ENABle command).
1 Alarm Condition	2	One or more bits are set in the Alarm Register (bits must be enabled, see STATus:ALARm:ENABle command).
2 Error Queue	4	One or more errors have been stored in the Error Queue. Use the SYSTem:ERRor? command to read and delete errors.
3 Questionable Data Summary	8	One or more bits are set in the Questionable Data Register (bits must be enabled, see STATus:QUESTionable:ENABle command).
4 Message Available	16	Data is available in the instrument's output buffer.
5 Standard Event Summary	32	One or more bits are set in the Standard Event Register (bits must be enabled, see *ESE command).
6 Master Summary	64	One or more bits are set in the Status Byte Register and may generate a Request for Service (RQS). Bits must be enabled using the *SRE command.

7 Standard Operation Summary	128	One or more bits are set in the Standard Operation Register (bits must be enabled, see STATus:OPERation:ENABLE command).

- This command returns the same results as a Serial Poll but the "Master Summary" bit (bit 6) is *not* cleared if a Serial Poll has occurred.
- The Status Byte condition register is cleared when you execute the ***CLS** (clear status) command.
- The Status Byte condition register is cleared when you read the event register from one of the other register groups (only the corresponding bits are cleared in the condition register).

Return Format

The command reads the condition register and returns a decimal value which corresponds to the binary-weighted sum of all bits set in the register (see table above). For example, if bit 1 (decimal value = 2) and bit 4 (decimal value = 16) are set (and the corresponding bits are enabled), this command will return "**+18**".

Example

The following command reads the condition register (bits 3 and 4 are set).

```
*STB?
```

Typical Response: **+24**

See Also

***CLS**

***SRE**

*TRG

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

***TRG**

Description

This command is used in conjunction with the **TRIGger:SOURce BUS** command to trigger the instrument from the remote interface.

Remarks

- Use the TRIGger:SOURce command to select the BUS (software) trigger source.
- After setting the trigger source, you must place the internal DMM in the "wait-for-trigger" state using the **INITiate** command. The *TRG command will not be accepted unless the internal DMM is in the "wait-for-trigger" state.
- The *TRG command is not valid with the **READ?** command.

Example

The following command triggers the instrument.

```
TRIG:SOUR BUS  
INIT  
*TRG
```

See Also

[INITiate](#)

[TRIGger:SOURce](#)

*TST?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

*TST?

Description

This command performs a complete self-test of the instrument and all installed plug-in modules and returns a pass/fail indication. The self-test runs a series of tests and will take approximately 20 seconds to complete. If all tests pass, you can have a high confidence that the instrument and all installed plug-in modules are operational.

NOTE

The self-test will abort if any signals are connected to ABus1 via the rear-panel **Analog Bus** connector (pins 4, 5, and 9). Be sure to disconnect any signals from ABus1 prior to running the self-test.

Remarks

- On the 34945A Microwave Switch/Attenuator Driver, this command performs a self-test of the 34945A and all connected 34945EXT remote modules.
- If you have a 34951A Isolated DAC Module installed, the self-test will require an additional 15 seconds to complete per DAC module (a memory test is performed).
- If one or more tests fail, "+1" is returned and an error is stored in the error queue. For a complete listing of the error messages related to self-test failures, see [SCPI Error Messages](#).
- If one or more tests fail, see the Keysight 34980A *Service Guide* for instructions on returning the instrument to Keysight for service.
- Following the *TST? command, the instrument issues a Factory Reset (***RST** command).

Return Format

The command returns "+0" (all tests passed) or "+1" (one or more tests failed).

Example

The following command performs a self-test and returns a pass/fail indication.

```
*TST?
```

Typical Response: +0

*WAI

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

*WAI

Description

This command configures the instrument to wait for all pending operations to complete before executing any additional commands over the interface.

Remarks

- For overlapped switching operations, the [ROUTe:MODUle:WAIT](#) command may be preferable to *WAI. See the [ROUTe:OPERation:OVERlap\[:ENABle\]](#) command for more information on enabling the overlapped mode.

Example

The following command waits for channels 1 through 5 (slot 2) to fully close before opening channel 9.

```
ROUT:CLOS (@2001:2005); *WAI; ROUT:OPEN (@2009)
```

See Also

[*OPC](#)

[ROUTe:MODUle:WAIT](#)

[ROUTe:OPERation:OVERlap\[:ENABle\]](#)

INSTRument Subsystem Introduction

Command Summary

NOTE

Hold the mouse cursor over a command to view the full syntax statement.

INSTRument:DMM:CONNect

INSTRument:DMM:CONNect?

INSTRument:DMM:DISConnect

INSTRument:DMM:DISConnect?

INSTRument:DMM:INSTalled?

INSTRument:DMM[:STATe]

INSTRument:DMM[:STATe]?

INSTRument:DMM:CONNeCT

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

INSTRument:DMM:CONNeCT

INSTRument:DMM:CONNeCT?

Description

This command connects the internal DMM to the Analog Buses. When connected, the internal DMM is *always* connected to Analog Bus 1 (MEAS). For 4-wire measurements, the internal DMM is also connected to Analog Bus 2 (SENS).

Remarks

- The internal DMM setting is stored as part of the instrument state by the ***SAV** command.
- The internal DMM is an optional assembly for the Keysight 34980A. This command will generate an error if the internal DMM is disabled (see **INSTRument:DMM[:STATe]** command) or not installed in the mainframe.
- The connection setting is stored in **volatile** memory and will be disconnected (OFF) when power is turned off or after a Factory Reset (***RST** command).

Return Format

The query command returns "0" (disconnected) or "1" (connected).

Examples

The following command connects the internal DMM to ABus 1 and ABus2.

```
INST:DMM:CONN
```

The following query returns the status of the internal DMM connection.

```
INST:DMM:CONN?
```

Typical Response: 1

See Also

INSTRument:DMM:DISConnect

INSTRument:DMM:DISConnect

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

INSTRument:DMM:DISConnect

INSTRument:DMM:DISConnect?

Description

This command disconnects the internal DMM from the Analog Buses (ABus1 and ABus2).

Remarks

- With the internal DMM disconnected, you can still configure DMM measurements and channel-based measurements; however, the internal DMM will not be reconnected until you send the **INSTRument:DMM:CONNect** command or a Factory Reset (***RST** command).
- The internal DMM setting is stored as part of the instrument state by the ***SAV** command.
- The internal DMM is an optional assembly for the Keysight 34980A. This command will generate an error if the internal DMM is disabled (see **INSTRument:DMM[:STATe]** command) or not installed in the mainframe.
- The connection setting is stored in **volatile** memory and will be connected (OFF) when power is turned off or after a Factory Reset (***RST** command).

Return Format

The query command returns "0" (connected) or "1" (disconnected).

Examples

The following command disconnects the internal DMM from ABus1 and ABus2.

```
INST:DMM:DISC
```

The following query returns the status of the internal DMM connection.

```
INST:DMM:DISC?
```

Typical Response: 1

See Also

INSTRument:DMM:CONNect

INSTrument:DMM:INSTalled?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

INSTrument:DMM:INSTalled?

Description

This command queries the instrument to determine if the internal DMM is installed in the mainframe.

Remarks

- The internal DMM is an optional assembly for the Keysight 34980A.

Return Format

The query command returns "0" (not installed) or "1" (installed).

Example

The following command determines if the internal DMM is present.

```
INST:DMM:INST?
```

Typical Response: 1

See Also

[INSTrument:DMM\[:STATe\]](#)

INSTrument:DMM[:STATe]

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

INSTrument:DMM[:STATe] <mode>

INSTrument:DMM[:STATe]?

Description

This command disables or enables the internal DMM. Disabling the internal DMM has the same effect as physically removing the DMM assembly, including removing the connections to the Analog Buses.

Parameters

Name	Type	Range of Values	Default Value
<mode>	Discrete	{OFF 0 ON 1}	This is a required parameter

Remarks

- With the internal DMM disabled, any command received that is directed to the DMM or requires its use (e.g., configuring a multiplexer channel for a DMM measurement), will generate an error.
- When you change the state of the internal DMM, the instrument issues a Factory Reset (***RST** command).
- If you ordered the internal DMM, it is enabled when shipped from the factory.
- The internal DMM setting is stored in **volatile** memory and will be enabled (ON) when power is turned off or after a Factory Reset (***RST** command).

Return Format

The query command returns "0" (OFF) or "1" (ON).

Examples

The following command disables the internal DMM.

```
INST:DMM OFF
```

The following query returns the internal DMM setting.

```
INST:DMM?
```

Typical Response: 0

See Also

[INSTRument:DMM:CONNect](#)

[INSTRument:DMM:DISConnect](#)

[INSTRument:DMM:INSTalled?](#)

[ROUTe:CHANnel:ADVance:SOURce](#)

[ROUTe:CHANnel:FWIRe](#)

MEASure Subsystem Introduction

The MEASure? command provides the easiest way to program the instrument for measurements. However, this command does not offer much flexibility. When you execute this command, the instrument uses default values for the requested measurement configuration and immediately performs the measurement. You cannot change any measurement attributes (other than function, range, and resolution) before the measurement is taken. The results are sent directly to reading memory and the instrument's output buffer.

NOTE

Sending MEASure? is functionally the same as sending CONFigure followed immediately by a READ? command.

NOTE

For a comparison of the MEASure? and CONFigure commands, see [MEASure? Versus CONFigure](#).

The MEASure? commands are valid only with the following Keysight 34980A plug-in modules which can be configured to be part of a scan. If the internal DMM is not installed or is disabled, then no DMM-related configurations are allowed. However, scanning is allowed on the digital input and totalizer channels even without the internal DMM.

34921A	40-Channel Armature Multiplexer (including temperature and current)
34922A	70-Channel Armature Multiplexer
34923A	40/80-Channel Reed Multiplexer
34924A	70-Channel Reed Multiplexer
34925A	40/80-Channel FET Multiplexer
34950A	64-Bit Digital I/O Module (digital input and counter only)
34952A	Multifunction Module (digital input and totalizer only)

Command Summary

NOTE

Hold the mouse cursor over a command to view the full syntax statement.

[MEASure:COUNter:DCYCLE?](#)

[MEASure:COUNter:FREQuency?](#)

[MEASure:COUNter:PERiod?](#)

[MEASure:COUNter:PWIDth?](#)

[MEASure:COUNter:TOTalize?](#)

[MEASure:CURREnt:AC?](#)

[MEASure:CURREnt\[:DC\]?](#)

[MEASure:DIGital?](#)

[MEASure:FREQuency?](#)

[MEASure:FRESistance?](#)

[MEASure:PERiod?](#)

[MEASure:RESistance?](#)

[MEASure:TEMPerature?](#)

MEASure:TOTalize?
MEASure[:VOLTage]:AC?
MEASure[:VOLTage][:DC]?

Default Settings for the MEASure? Command

With the MEASure? command, you can select the function, range, and resolution all in one command. All other measurement parameters are set to their default values as shown below. The MEASure? command does *not* redefine the scan list as set by the ROUTe:SCAN command.

Measurement Parameter	MEASure? Setting
Integration Time	1 PLC
Input Resistance	10 M Ω (fixed for all DCV ranges)
AC Filter / Frequency Timeout	20 Hz (medium filter)
Range	Autorange Enabled
Autozero	Enabled
Offset Compensation	Disabled
Channel Delay	Automatic Delay
Sample Count	1 Sample per Trigger
Sweep Count	1 Scan Sweep
Trigger Count	1 Trigger
Trigger Delay	Automatic Delay
Trigger Source	Immediate

Using the MEASure? Command

The following command shows how to use the MEASure? command to make a measurement on one channel. This example configures the instrument for dc voltage measurements, internally triggers the instrument to scan channel 10 on the module in slot 3, and then transfers the reading to reading memory and the instrument's output buffer. Any existing scan list is *not* redefined. The default range (autorange) and resolution (1 PLC) are used for the measurement.

```
MEAS:VOLT:DC? (@3010)
```

Typical Response: **+4.23450000E-03**

The following command configures the instrument for 2-wire resistance measurements, triggers the internal DMM to scan two channels (channels 3 and 8 in slot 1), and then transfers the two readings to reading memory and the instrument's output buffer. The 1 k Ω range is selected with 1 Ω resolution.

```
MEAS:RES? 1000,1, (@1003,1008)
```

Typical Response: **+3.27150000E+02,+1.32130000E+02**

If you omit the <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (the scan list is not redefined). The following command configures the instrument for a 2-wire resistance measurement, triggers the internal DMM to make one measurement, and then transfers the reading to reading memory and the instrument's output buffer. The 10 k Ω range is selected with 100 Ω resolution.

```
MEAS:RES? 10000,100
```

Typical Response: **+5.95850000E+03**

MEASure:CURRent:AC?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

MEASure:CURRent:AC? [{<range>|AUTO|MIN|MAX|DEF} [, {<resolution>|MIN|MAX|DEF}] ,] [(@<ch_list>)]

Description

First, this command resets all measurement parameters on the specified channels to their [default values](#). Then, configures the channels for ac current measurements and immediately sweeps through the specified channels one time (independent of the present scan list). The results are sent directly to reading memory and the instrument's output buffer. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels.

Used With:

- 34921A Armature Multiplexer (channels 41 through 44 only)

Parameters

Name	Type	Range of Values	Default Value
<range>	Numeric	Expected value in amps (ranges shown below). 10 mA (MIN) 100 mA 1 A (MAX)	AUTO (autorange)
<resolution>	Numeric	Desired resolution in amps.	Fixed at 6½ digits
<ch_list>	Numeric	One or more channels in the form (@sccc). Current measurements are allowed only on channels 41 through 44 on the 34921A.	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- By default, the instrument scans the list of channels in ascending order from slot 1 through slot 8 (channels are reordered as needed). If your application requires non-ordered scanning of the channels in the present scan list, you can use the [ROUTe:SCAN:ORDERed](#) command to enable the non-sequential scanning mode. In either mode, channels which are not in the scan list are skipped during the scan.
 - For *sequential* scanning (default, ROUT:SCAN:ORDERED ON), the specified channels are reordered as needed and duplicate channels are eliminated. For example, (@2001,1003,1001,1003) will be interpreted as (@1001,1003,2001).

- b. For *non-sequential* scanning (ROUT:SCAN:ORDERED **OFF**), the channels remain in the order presented in the scan list (see exception below). Multiple occurrences of the same channel are allowed. For example, (@2001,2001,2001) and (@3010,1003,1001,1005) are valid and the channels will be scanned in the order presented.
 - c. When you specify a *range* of channels in the scan list, the channels are always sorted in ascending order, regardless of the ROUTe:SCAN:ORDERed setting. Therefore, (@1009:1001) will always be interpreted as 1001, 1002, 1003, etc.
- The Analog Bus relays are automatically opened and closed as required during the scan to connect to the internal DMM for the measurement. For example, all 2-wire measurements use the ABus1 (MEAS) relays; for 4-wire measurements, the ABus2 (SENS) relays are used in addition to the ABus1 relays.
 - If you specify a <ch_list> with the MEASure? command, the instrument performs a "temporary" scan of the specified channels (independent of the present scan list as set by the **ROUTe:SCAN** command). The following rules apply while the temporary scan is running (these rules supersede the rules for the pre-existing scan list, but that scan list is not modified).
 - a. When the temporary scan is initiated, the instrument will open all channels in banks that contain one or more channels in the <ch_list>.
 - b. In order to guarantee that no signals are connected to the Analog Buses prior to the temporary scan, the instrument will open all ABus1 relays (applies to all banks in all slots). In banks that contain channels in the <ch_list>, the instrument will also open all ABus2 relays (regardless of whether 4-wire measurements are involved). If no channels configured for 4-wire measurements are included in the <ch_list>, the state of the ABus2 relays in the non-scanned banks is not altered.
 - c. The state of the ABus3 and ABus4 relays is not altered and these relays remain available for use during the scan. However, be sure to use *CAUTION* when closing these relays on banks involved in the temporary scan. While the scan is running, any signals present on ABus3 and/or ABus4 will be joined with the scanned measurement on ABus1 and ABus2. If you have any doubt regarding the state of the ABus3 and ABus4 relays, it is recommended that you send a **ROUTe:OPEN:ABUS ALL** command prior to scanning operations.
 - d. While the temporary scan is running, the instrument prevents use of all channels in banks that contain one or more channels in the specified <ch_list> (these channels are dedicated to the temporary scan). In addition, the instrument prevents use of all ABus1 and ABus2 relays on banks containing channels in the <ch_list>. If one or more channels configured for 4-wire measurements are included in the <ch_list>, then the rules for ABus2 relay operations are extended to the non-scanned banks as well.
 - e. If the ABus1 relay used for current measurements (channel 931) is *not* closed prior to the initiation of the temporary scan, the four current channels are not affected by the scan. However, if the ABus1 relay is closed, the instrument will open the ABus1 relay as well as the four associated current channels in a *make-before-break* fashion.
 - f. At the end of the temporary scan, the last channel that was scanned will be opened (as well as any Analog Bus relays used during the scan). Any channels that were opened during the scan will remain open at the completion of the scan.
 - If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.

- When you specify a range of channels with this command, any channels that are invalid will be ignored (no error will be generated) but the first and last channel in the range must be valid for the selected function. The Analog Bus relays (numbered **s911**, **s912**, **s913**, etc.) on the multiplexer and matrix modules are ignored if they are included in a range of channels. An error will be generated if an Analog Bus relay is specified as the first or last channel in a range of channels.
- You can allow the instrument to automatically select the measurement range using *autoranging* or you can select a fixed range using manual ranging. Autoranging is convenient because the instrument decides which range to use for each measurement based on the input signal. For fastest scanning operation, use manual ranging on each measurement (some additional time is required for autoranging since the instrument has to make a range selection).
- If you select autoranging (by specifying "AUTO" or "DEF"), an error will be generated if you specify a discrete value for the `<resolution>` parameter. When autoranging is combined with a discrete resolution, the instrument cannot accurately resolve the integration time (especially if the input signal is continuously changing). If your application requires autoranging, be sure to specify "DEF" for the `<resolution>` parameter or omit the parameter from the command.
- Autorange thresholds:

Down range at: <10% of range
Up range at: >120% of range

- If the input signal is greater than can be measured on the selected range (manual ranging), the instrument gives an *overload indication*: "**±OVLD**" from the front panel or "**±9.9E+37**" from the remote interface.
- For ac measurements, the resolution is fixed at 6½ digits. The only way to control the reading rate for ac measurements is by changing the **channel delay** or by setting the **ac filter** to the highest frequency limit. The `<resolution>` parameter only affects the number of digits shown on the front panel.
- The default trigger delays for ac measurements (see **TRIGger:DElay:AUTO** and **ROUTe:CHANnel:DElay:AUTO** commands) do not account for worst case settling delays that can occur when measuring ac signals with large dc offsets. Significant measurement errors may result. Use the **TRIGger:DElay** command (for stand-alone DMM measurements) or **ROUTe:CHANnel:DElay** command (for scanned measurements) to allow adequate settling time before the measurement.
- The ***RST** command will clear the scan list and set all measurement parameters to their factory settings. The Instrument Preset (**SYSTem:PRESet** command) will not clear the scan list; however, this command will clear reading memory and all stored statistical data.

Return Format

The command returns one reading for each channel specified (multiple responses are separated by commas). If you omit the `<ch_list>` parameter, the command applies to the internal DMM and a single reading is returned. The output from this command is *not* affected by the settings of the **FORMat:READing** commands.

Examples

The following command configures the instrument for ac current measurements, triggers the internal DMM to scan one channel (channel 41 in slot 1), and then transfers the reading to reading memory and the instrument's output buffer. The default range (autorange) and resolution (fixed at 6½ digits) are used for the measurement.

```
MEAS:CURREN:AC? (@1041)
```

Typical Response: **+8.54530000E-02**

The following command configures the instrument for ac current measurements, triggers the internal DMM to scan two channels (channels 41 and 42 in slot 1), and then transfers the reading to reading memory and the instrument's output buffer. The 1 A range is selected with 200 mA resolution.

```
MEAS:CURREN:AC? 1,0.2, (@1041,1042)
```

Typical Response: **+4.27150000E-02,+1.32130000E-03**

The following command configures the internal DMM for an ac current measurement (no <ch_list> is specified), triggers the internal DMM, and then transfers the reading to reading memory and the instrument's output buffer. The default range and resolution are used for the measurement.

```
MEAS:CURREN:AC? !Applies to the internal DMM
```

Typical Response: **+3.73620000E-02**

See Also

[CONFigure:CURRENt:AC](#)

[ROUTe:CHANnel:DELay](#)

[ROUTe:CHANnel:DELay:AUTO](#)

[ROUTe:SCAN:ORDered](#)

[\[SENSe:\]CURRENt:AC:BANDwidth](#)

[TRIGger:DELay](#)

[TRIGger:DELay:AUTO](#)

MEASure:COUNter:DCYcle?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

MEASure:COUNter:DCYcle? [{<gate_time>|MIN|MAX|DEF},] (@<ch_list>)

Description

This command configures the specified counter channels on the 34950A Digital I/O Module to measure the duty cycle of the incoming signal and immediately initiates the measurement. The results are sent directly to the instrument's output buffer. The specified gate time is the measurement aperture during which the signal data is gathered. For repetitive signals, longer gate times will lead to increased resolution for frequency, period, pulse width, and duty cycle measurements.

The MEASure? command sets the counter parameters to their default values as shown below.

Parameter	MEASure? Settings
Slope	POSitive (rising edge)
Input Threshold Voltage	2.5V
Gate Source	INTernal
Gate Polarity	NORMal (active high)

Used With:

- 34950A Digital I/O Module

Parameters

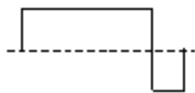
Name	Type	Range of Values	Default Value
<gate_time>	Numeric	Desired gate time between 100 ns and 10 seconds, with 50 ns resolution. MIN = 100 ns, MAX = 10 seconds	1 ms
<ch_list>	Numeric	One or more counter channels in the form (@sccc) . Select from s301 or s302.	This is a required parameter

Remarks

- The duty cycle represents the amount of time per cycle that the input signal is at a high level (assuming that the polarity is not reversed) and is expressed as a percentage. The specified counter channels must detect at least two edges for a valid duty cycle measurement.



20% Duty Cycle



80% Duty Cycle

- Sending the MEASure? command clears reading memory and resets the triggering system.

Return Format

The command returns the duty cycle as a percentage for each counter channel specified. The output from this command is affected by the settings of the **FORMat:READing** commands.

Example

The following command configures counter channel 301 on the module in slot 3 to measure duty cycle. The value is transferred to the instrument's output buffer. The gate time is set to 1 ms.

```
MEAS:COUN:DCYC? 1E-3, (@3301)
```

Typical Response: **+5.00000000E+01**

See Also

CONFigure:COUNter:DCYCLE

FORMat:READing

MEASure:COUNter:FREQuency?

Syntax | Description | Parameters | Remarks | Return Format | Example

Syntax

MEASure:COUNter:FREQuency? [{<gate_time>|MIN|MAX|DEF},] (@<ch_list>)

Description

This command configures the specified counter channels on the 34950A Digital I/O Module to measure the frequency of the incoming signal and immediately initiates the measurement. The results are sent directly to the instrument's output buffer. The specified gate time is the measurement aperture during which the signal data is gathered. For repetitive signals, longer gate times will lead to increased resolution for frequency, period, pulse width, and duty cycle measurements.

The MEASure? command sets the counter parameters to their default values as shown below.

Parameter	MEASure? Settings
Slope	POSitive (rising edge)
Input Threshold Voltage	2.5V
Gate Source	INTernal
Gate Polarity	NORMal (active high)

Used With:

- 34950A Digital I/O Module

Parameters

Name	Type	Range of Values	Default Value
<gate_time>	Numeric	Desired gate time between 100 ns and 10 seconds, with 50 ns resolution. MIN = 100 ns, MAX = 10 seconds	1 ms
<ch_list>	Numeric	One or more counter channels in the form (@sccc) . Select from s301 or s302.	This is a required parameter

Remarks

- The frequency is measured as: $(NumberRisingEdges - 1) / GateTime$. The specified counter channels must detect at least two edges for a valid frequency measurement. The maximum input frequency allowed is 10 MHz.
- Sending the MEASure? command clears reading memory and resets the triggering system.

Return Format

The command returns the frequency in hertz for each counter channel specified. The output from this command is affected by the settings of the **FORMat:READing** commands.

Example

The following command configures counter channel 301 on the module in slot 3 to measure frequency. The value is transferred to the instrument's output buffer. The gate time is set to 1 ms.

```
MEAS:COUN:FREQ? 1E-3, (@3301)
```

Typical Response: **+3.45600000E+05**

See Also

CONFigure:COUNter:FREQuency

FORMat:READing

MEASure:COUNter:PERiod?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

MEASure:COUNter:PERiod? [{<gate_time>|MIN|MAX|DEF},] (@<ch_list>)

Description

This command configures the specified counter channels on the 34950A Digital I/O Module to measure the period of the incoming signal and immediately initiates the measurement (this is the reciprocal of the frequency). The results are sent directly to the instrument's output buffer. The specified gate time is the measurement aperture during which the signal data is gathered. For repetitive signals, longer gate times will lead to increased resolution for frequency, period, pulse width, and duty cycle measurements.

The MEASure? command sets the counter parameters to their default values as shown below.

Parameter	MEASure? Settings
Slope	POSitive (rising edge)
Input Threshold Voltage	2.5V
Gate Source	INTernal
Gate Polarity	NORMal (active high)

Used With:

- 34950A Digital I/O Module

Parameters

Name	Type	Range of Values	Default Value
<gate_time>	Numeric	Desired gate time between 100 ns and 10 seconds, with 50 ns resolution. MIN = 100 ns, MAX = 10 seconds	1 ms
<ch_list>	Numeric	One or more counter channels in the form (@sccc) . Select from s301 or s302.	This is a required parameter

Remarks

- The specified counter channels must detect at least two edges for a valid period measurement.
- Sending the MEASure? command clears reading memory and resets the triggering system.

Return Format

The command returns the period in seconds for each counter channel specified. The output from this command is affected by the settings of the **FORMat:READing** commands.

Example

The following command configures counter channel 301 on the module in slot 3 to measure period. The value is transferred to the instrument's output buffer. The gate time is set to 1 ms.

```
MEAS:COUN:PER? 1E-3, (@3301)
```

Typical Response: **+2.89400000E-06**

See Also

CONFigure:COUNter:PERiod

FORMat:READing

MEASure:COUNter:PWIDth?

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Syntax

MEASure:COUNter:PWIDth? [{<gate_time>|MIN|MAX|DEF},] (@<ch_list>)

Description

This command configures the specified counter channels on the 34950A Digital I/O Module to measure the pulse width of the incoming signal and immediately initiates the measurement. The results are sent directly to the instrument's output buffer. The specified gate time is the measurement aperture during which the signal data is gathered. For repetitive signals, longer gate times will lead to increased resolution for frequency, period, pulse width, and duty cycle measurements.

The MEASure? command sets the counter parameters to their default values as shown below.

Parameter	MEASure? Settings
Slope	POSitive (rising edge)
Input Threshold Voltage	2.5V
Gate Source	INTernal
Gate Polarity	NORMal (active high)

Used With:

- 34950A Digital I/O Module

Parameters

Name	Type	Range of Values	Default Value
<gate_time>	Numeric	Desired gate time between 100 ns and 10 seconds, with 50 ns resolution. MIN = 100 ns, MAX = 10 seconds	1 ms
<ch_list>	Numeric	One or more counter channels in the form (@sccc) . Select from s301 or s302.	This is a required parameter

Remarks

- The pulse width represents the amount of time per cycle that the input signal is at a high level (assuming that the polarity is not reversed) and is expressed in seconds. If multiple pulses occur during the specified gate time, the result will be the average width of all pulses.
- Sending the MEASure? command clears reading memory and resets the triggering system.

Return Format

The command returns the pulse width in seconds for each counter channel specified. The output from this command is affected by the settings of the **FORMat:READing** commands.

Example

The following command configures counter channel 301 on the module in slot 3 to measure pulse width. The value is transferred to the instrument's output buffer. The gate time is set to 1 ms.

```
MEAS:COUN:PWID? 1E-3, (@3301)
```

Typical Response: **+1.44700000E-06**

See Also

CONFigure:COUNter:PWIDth

FORMat:READing

MEASure:COUNter:TOTalize?

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Syntax

MEASure:COUNter:TOTalize? [<mode>,<ch_list>]

Description

This command configures the specified counter channels on the 34950A Digital I/O Module for totalizer count measurements and immediately initiates the measurement. You can read the totalizer either with or without resetting the count. The results are sent directly to the instrument's output buffer.

The MEASure? command sets the counter parameters to their default values as shown below.

Parameter	MEASure? Settings
Slope	POSitive (rising edge)
Input Threshold Voltage	2.5 V

Used With:

- 34950A Digital I/O Module

Parameters

Name	Type	Range of Values	Default Value
<mode>	Discrete	{READ RRESet}	READ (read without resetting the count)
<ch_list>	Numeric	One or more counter channels in the form (<ch_list>). Select from s301 or s302.	This is a required parameter

Remarks

- To read the totalizer without resetting the count, select the READ parameter. To read the totalizer and reset the count to "0" after it is read, select the RRESet parameter (this means "read and reset").
- The maximum count is 4,294,967,295 ($2^{32} - 1$). The count rolls over to "0" after reaching the maximum allowed value.
- If the count rolls over to "0", the "Totalizer Overflow" bit is set in the Slot Event Registers group (see [STATus:MODule:SLOT\[n\]:CONDition?](#) and [STATus:MODule:SLOT\[n\]:EVENT?](#) commands). For more information on the SCPI Status System for the Keysight 34980A, see [Status System Introduction](#).
- Sending the MEASure? command clears reading memory and resets the triggering system.

Return Format

The command returns an unsigned decimal value representing the count on each totalizer channel specified (a full 32-bit count is returned). If you have specified RRESet, the count is reset to "0" after it is read. Multiple responses are separated by commas. The output from this command is affected by the settings of the **FORMat:READing** commands.

Example

The following command configures counter channel 301 on the module in slot 3 to be read without resetting its count. The value is transferred to the instrument's output buffer.

```
MEAS:COUN:TOT? READ, (@3301)
```

Typical Response: **1.321300000E+03**

See Also

CONFigure:COUNter:TOTalize

FORMat:READing

STATus:MODule:SLOT[n]:CONDition?

STATus:MODule:SLOT[n]:EVENT?

MEASure:CURRent[:DC]?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

MEASure:CURRent[:DC]? [{<range>|AUTO|MIN|MAX|DEF} [{<resolution>|MIN|MAX|DEF}] ,] [(@<ch_list>)]

Description

First, this command resets all measurement parameters on the specified channels to their **default values**. Then, configures the channels for dc current measurements and immediately sweeps through the specified channels one time (independent of the present scan list). The results are sent directly to reading memory and the instrument's output buffer. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels.

Used With:

- 34921A Armature Multiplexer (channels 41 through 44 only)

Parameters

Name	Type	Range of Values	Default Value
<range>	Numeric	Expected value in amps (ranges shown below). 10 mA (MIN) 100 mA 1 A (MAX)	AUTO (autorange)
<resolution>	Numeric	Desired resolution in amps.	0.000003 x Range (1 PLC)
<ch_list>	Numeric	One or more channels in the form (@sccc). Current measurements are allowed only on channels 41 through 44 of the 34921A.	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- By default, the instrument scans the list of channels in ascending order from slot 1 through slot 8 (channels are reordered as needed). If your application requires non-ordered scanning of the channels in the present scan list, you can use the **ROUTe:SCAN:ORDeRed** command to enable the non-sequential scanning mode. In either mode, channels which are not in the scan list are skipped during the scan.
 - a. For *sequential* scanning (default, ROUT:SCAN:ORDERED **ON**), the specified channels are reordered as needed and duplicate channels are eliminated. For example, (@2001,1003,1001,1003) will be interpreted as (@1001,1003,2001).

- b. For *non-sequential* scanning (ROUT:SCAN:ORDERED **OFF**), the channels remain in the order presented in the scan list (see exception below). Multiple occurrences of the same channel are allowed. For example, (@2001,2001,2001) and (@3010,1003,1001,1005) are valid and the channels will be scanned in the order presented.
- c. When you specify a *range* of channels in the scan list, the channels are always sorted in ascending order, regardless of the ROUTe:SCAN:ORDERed setting. Therefore, (@1009:1001) will always be interpreted as 1001, 1002, 1003, etc.
- The Analog Bus relays are automatically opened and closed as required during the scan to connect to the internal DMM for the measurement. For example, all 2-wire measurements use the ABus1 (MEAS) relays; for 4-wire measurements, the ABus2 (SENS) relays are used in addition to the ABus1 relays.
- If you specify a <ch_list> with the MEASure? command, the instrument performs a "temporary" scan of the specified channels (independent of the present scan list as set by the **ROUTe:SCAN** command). The following rules apply while the temporary scan is running (these rules supersede the rules for the pre-existing scan list, but that scan list is not modified).
 - a. When the temporary scan is initiated, the instrument will open all channels in banks that contain one or more channels in the <ch_list>.
 - b. In order to guarantee that no signals are connected to the Analog Buses prior to the temporary scan, the instrument will open all ABus1 relays (applies to all banks in all slots). In banks that contain channels in the <ch_list>, the instrument will also open all ABus2 relays (regardless of whether 4-wire measurements are involved). If no channels configured for 4-wire measurements are included in the <ch_list>, the state of the ABus2 relays in the non-scanned banks is not altered.
 - c. The state of the ABus3 and ABus4 relays is not altered and these relays remain available for use during the scan. However, be sure to use *CAUTION* when closing these relays on banks involved in the temporary scan. While the scan is running, any signals present on ABus3 and/or ABus4 will be joined with the scanned measurement on ABus1 and ABus2. If you have any doubt regarding the state of the ABus3 and ABus4 relays, it is recommended that you send a **ROUTe:OPEN:ABUS ALL** command prior to scanning operations.
 - d. While the temporary scan is running, the instrument prevents use of all channels in banks that contain one or more channels in the specified <ch_list> (these channels are dedicated to the temporary scan). In addition, the instrument prevents use of all ABus1 and ABus2 relays on banks containing channels in the <ch_list>. If one or more channels configured for 4-wire measurements are included in the <ch_list>, then the rules for ABus2 relay operations are extended to the non-scanned banks as well.
 - e. If the ABus1 relay used for current measurements (channel 931) is *not* closed prior to the initiation of the temporary scan, the four current channels are not affected by the scan. However, if the ABus1 relay is closed, the instrument will open the ABus1 relay as well as the four associated current channels in a *make-before-break* fashion.
 - f. At the end of the temporary scan, the last channel that was scanned will be opened (as well as any Analog Bus relays used during the scan). Any channels that were opened during the scan will remain open at the completion of the scan.
- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.

- When you specify a range of channels with this command, any channels that are invalid will be ignored (no error will be generated) but the first and last channel in the range must be valid for the selected function. The Analog Bus relays (numbered **s911**, **s912**, **s913**, etc.) on the multiplexer and matrix modules are ignored if they are included in a range of channels. An error will be generated if an Analog Bus relay is specified as the first or last channel in a range of channels.
- You can allow the instrument to automatically select the measurement range using *autoranging* or you can select a fixed range using *manual ranging*. Autoranging is convenient because the instrument decides which range to use for each measurement based on the input signal. For fastest scanning operation, use manual ranging on each measurement (some additional time is required for autoranging since the instrument has to make a range selection).
- If you select autoranging (by specifying "AUTO" or "DEF"), an error will be generated if you specify a discrete value for the <resolution> parameter. When autoranging is combined with a discrete resolution, the instrument cannot accurately resolve the integration time (especially if the input signal is continuously changing). If your application requires autoranging, be sure to specify "DEF" for the <resolution> parameter or omit the parameter from the command.
- Autorange thresholds:

Down range <10% of range
at:
Up range at: >120% of range

- If the input signal is greater than can be measured on the selected range (manual ranging), the instrument gives an *overload indication*: "**±OVL**D" from the front panel or "**±9.9E+37**" from the remote interface.
- The ***RST** command will clear the scan list and set all measurement parameters to their factory settings. The Instrument Preset (**SYSTem:PRESet** command) will not clear the scan list; however, this command will clear reading memory and all stored statistical data.

Return Format

The command returns one reading for each channel specified (multiple responses are separated by commas). If you omit the <ch_list> parameter, the command applies to the internal DMM and a single reading is returned. The output from this command is *not* affected by the settings of the **FORMat:READing** commands.

Examples

The following command configures the instrument for dc current measurements, triggers the internal DMM to scan one channel (channel 41 in slot 1), and then transfers the reading to reading memory and the instrument's output buffer. The default range (autorange) and resolution (1 PLC) are used for the measurement.

```
MEAS:CURREN:DC? (@1041)
```

Typical Response: **+8.54530000E-03**

The following command configures the instrument for dc current measurements, triggers the internal DMM to scan two channels (channels 41 and 42 in slot 1), and then transfers the reading to reading memory and the instrument's output buffer. The 1 A range is selected with 200 mA resolution.

```
MEAS:CURRE:DC? 1,0.2,(@1041,1042)
```

Typical Response: **+4.27150000E-02,+1.32130000E-03**

The following command configures the internal DMM for a dc current measurement (no <ch_list> is specified), triggers the internal DMM, and then transfers the reading to reading memory and the instrument's output buffer. The default range and resolution are used for the measurement.

```
MEAS:CURRE:DC? !Applies to the internal DMM
```

Typical Response: **+3.73620000E-02**

See Also

CONFigure:CURRent[:DC]

ROUTe:SCAN:ORDered

[SENSe:]CURRent[:DC]:ZERO:AUTO

MEASure:DIGital?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

MEASure:DIGital? <width>, [<voltage>,<polarity>] (@<ch_list>)

Description

This command configures the specified channels for unbuffered (no memory) input operations and immediately sweeps through the specified channels one time (independent of the present scan list). The results are sent directly to reading memory and the instrument's output buffer.

Used With:

- 34950A Digital I/O Module (digital input channels only)
- 34952A Multifunction Module (digital input channels only)
- 34959A Breadboard Module (digital input channels only)

Parameters

Name	Type	Range of Values	Default Value
<width>	Discrete	{BYTE 1 WORD 2 LWORD 4} BYTE (or "1" byte): 8 bits WORD (or "2" bytes): 16 bits LWORD (or "4" bytes): 32 bits 34959A: <i>Only valid configurations are BYTE/WORD.</i>	This is a required parameter
<voltage> ¹	Numeric	Desired threshold voltage between 0V and 5V, with 20 mV resolution. MIN = 0V, MAX = 5V	0.8V (TTL)
<polarity> ²	Discrete	{NORMal INVerted}	NORMal (active high)
<ch_list>	Numeric	One or more digital input or output channels in the form (@sccc). 34950A: s101 through s104, s201 through s204 34952A: s001 through s004 34959A: s001 or s002	This is a required parameter
¹ Variable threshold voltage is available only on the 34950A. ² Variable polarity is available only on the 34950A and 34952A.			

Remarks

- By default, the instrument scans the list of channels in ascending order from slot 1 through slot 8 (channels are reordered as needed). If your application requires non-ordered scanning of the channels in the present scan list, you can use the **ROUTe:SCAN:ORDer** command to enable the non-sequential scanning mode. In either mode, channels which are not in the scan list are skipped during the scan.
- When you specify a range of channels with this command, any channels that are invalid will be ignored (no error will be generated) but the first and last channel in the range must be valid for the selected function.
- If this command is directed to the first channel on a bank on the 34950A (i.e., channel 101 or 201) this command will reset all handshaking parameters (see **CONFigure:DIGital:HANDshake** command) and the buffered memory mode will be aborted and disabled.
- Changing the channel width will disable buffered (memory) operations and clear memory on the specified digital channels (see **[SENSe:]DIGital:MEMory:ENABle** command).
- The ***RST** command will clear the scan list and set all measurement parameters to their factory settings. The Instrument Preset (**SYSTem:PRESet** command) will not clear the scan list; however, this command will clear reading memory.

Return Format

This command returns a decimal value representing the bit pattern on each digital input channel specified. Multiple responses are separated by commas. The output from this command is affected by the settings of the **FORMat:READIng** commands.

Examples

The following command configures the **34950A** in slot 3 for two 16-bit words, selects an "active low" polarity (the optional threshold voltage parameter is omitted in this example), triggers the module to read the channels one time, and then transfers the readings to reading memory and the instrument's output buffer.

```
MEAS:DIG? WORD,INV,(@3101,3103)
```

Typical Response: **65487,64972**

The following command configures the **34952A** in slot 5 for one 32-bit word, selects an "active high" polarity, triggers the module to read the channel one time, and then transfers the reading to reading memory and the instrument's output buffer.

```
MEAS:DIG? LWORD,NORM,(@5001)
```

Typical Response: **529755**

See Also

CONFigure:DIGital

ROUTe:SCAN:ORDer

MEASure:FREQuency?

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

MEASure:FREQuency? [{<range>|MIN|MAX|DEF} [{<resolution>|MIN|MAX|DEF}] ,] [(@<ch_list>)]

Description

First, this command resets all measurement parameters on the specified channels to their **default values**. Then, configures the channels for frequency measurements and immediately sweeps through the specified channels one time (independent of the present scan list). The results are sent directly to reading memory and the instrument's output buffer. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels.

Used With:

- 34921A through 34925A Multiplexer Modules

Parameters

Name	Type	Range of Values	Default Value
<range>	Numeric	Expected frequency of the input signal in hertz, between 3 Hz and 300 kHz.	20 Hz
<resolution>	Numeric	Desired resolution in hertz.	Fixed at 6½ digits
<ch_list>	Numeric	One or more channels in the form (@sccc) .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- By default, the instrument scans the list of channels in ascending order from slot 1 through slot 8 (channels are reordered as needed). If your application requires non-ordered scanning of the channels in the present scan list, you can use the **ROUTe:SCAN:ORDERed** command to enable the non-sequential scanning mode. In either mode, channels which are not in the scan list are skipped during the scan.
 - a. For *sequential* scanning (default, ROUT:SCAN:ORDERED **ON**), the specified channels are reordered as needed and duplicate channels are eliminated. For example, (@2001,1003,1001,1003) will be interpreted as (@1001,1003,2001).

- b. For *non-sequential* scanning (ROUT:SCAN:ORDERED **OFF**), the channels remain in the order presented in the scan list (see exception below). Multiple occurrences of the same channel are allowed. For example, (@2001,2001,2001) and (@3010,1003,1001,1005) are valid and the channels will be scanned in the order presented.
 - c. When you specify a *range* of channels in the scan list, the channels are always sorted in ascending order, regardless of the ROUTe:SCAN:ORDERed setting. Therefore, (@1009:1001) will always be interpreted as 1001, 1002, 1003, etc.
- The Analog Bus relays are automatically opened and closed as required during the scan to connect to the internal DMM for the measurement. For example, all 2-wire measurements use the ABus1 (MEAS) relays; for 4-wire measurements, the ABus2 (SENS) relays are used in addition to the ABus1 relays.
 - If you specify a <ch_list> with the MEASure? command, the instrument performs a "temporary" scan of the specified channels (independent of the present scan list as set by the ROUTe:SCAN command). The following rules apply while the temporary scan is running (these rules supersede the rules for the pre-existing scan list, but that scan list is not modified).
 - a. When the temporary scan is initiated, the instrument will open all channels in banks that contain one or more channels in the <ch_list>.
 - b. In order to guarantee that no signals are connected to the Analog Buses prior to the temporary scan, the instrument will open all ABus1 relays (applies to all banks in all slots). In banks that contain channels in the <ch_list>, the instrument will also open all ABus2 relays (regardless of whether 4-wire measurements are involved). If no channels configured for 4-wire measurements are included in the <ch_list>, the state of the ABus2 relays in the non-scanned banks is not altered.
 - c. The state of the ABus3 and ABus4 relays is not altered and these relays remain available for use during the scan. However, be sure to use *CAUTION* when closing these relays on banks involved in the temporary scan. While the scan is running, any signals present on ABus3 and/or ABus4 will be joined with the scanned measurement on ABus1 and ABus2. If you have any doubt regarding the state of the ABus3 and ABus4 relays, it is recommended that you send a ROUTe:OPEN:ABUS **ALL** command prior to scanning operations.
 - d. While the temporary scan is running, the instrument prevents use of all channels in banks that contain one or more channels in the specified <ch_list> (these channels are dedicated to the temporary scan). In addition, the instrument prevents use of all ABus1 and ABus2 relays on banks containing channels in the <ch_list>. If one or more channels configured for 4-wire measurements are included in the <ch_list>, then the rules for ABus2 relay operations are extended to the non-scanned banks as well.
 - e. At the end of the temporary scan, the last channel that was scanned will be opened (as well as any Analog Bus relays used during the scan). Any channels that were opened during the scan will remain open at the completion of the scan.
 - If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.

- When you specify a range of channels with this command, any channels that are invalid will be ignored (no error will be generated) but the first and last channel in the range must be valid for the selected function. The Analog Bus relays (numbered **s911**, **s912**, **s913**, etc.) on the multiplexer and matrix modules are ignored if they are included in a range of channels. An error will be generated if an Analog Bus relay is specified as the first or last channel in a range of channels.
- The *<range>* parameter is required only to specify the measurement resolution parameter. Therefore, it is not necessary to send a new command for each new frequency to be measured.
- If the input signal is greater than can be measured on the selected range (manual ranging), the instrument gives an *overload indication*: "**±OVLD**" from the front panel or "**±9.9E+37**" from the remote interface.
- The 34923A, 34924A, and 34933A modules use *non-latching* reed relays. Due to power dissipation issues, there is a limit to the number of relays that can be closed at a time on these modules (you cannot close all channels simultaneously). See the **ROUTe:CLOSE** command for details.
- The *Safety Interlock* feature prevents connections to the Analog Buses if no terminal block or properly-wired cable is connected to the module. An error will be generated if scanning is performed on banks without a terminal block or properly-wired cable. See the **SYSTem:ABUS:INTERlock:SIMulate** command to *temporarily* disable errors generated by the Safety Interlock feature.
- With no signal applied to the specified channels, "0" is returned.
- The ***RST** command will clear the scan list and set all measurement parameters to their factory settings. The Instrument Preset (**SYSTem:PRESet** command) will not clear the scan list; however, this command will clear reading memory and all stored statistical data.

Return Format

The command returns one reading for each channel specified (multiple responses are separated by commas). If you omit the *<ch_list>* parameter, the command applies to the internal DMM and a single reading is returned. The output from this command is *not* affected by the settings of the **FORMat:READing** commands.

Examples

The following command configures the instrument for frequency measurements, triggers the internal DMM to scan one channel (channel 4 in slot 3), and then transfers the reading to reading memory and the instrument's output buffer. The default range (autorange) and resolution (fixed at 6½ digits) are used for the measurement.

```
MEAS:FREQ? (@3004)
```

Typical Response: **+1.32130000E+03**

The following command configures the instrument for frequency measurements, triggers the internal DMM to scan two channels (channels 3 and 8 in slot 1), and then transfers the reading to reading memory and the instrument's output buffer. The default range and resolution are used for the measurement.

```
MEAS:FREQ? 100, (@1003,1008)
```

Typical Response: **+4.27150000E+03,+1.32130000E+03**

The following command configures the internal DMM for a frequency measurement (no <ch_list> is specified), triggers the internal DMM, and then transfers the reading to reading memory and the instrument's output buffer. The default range and resolution are used for the measurement.

```
MEAS:FREQ? !Applies to the internal DMM
```

Typical Response: **+10.13240000E+03**

See Also

[CONFigure:FREQuency](#)

[ROUTe:SCAN:ORDer](#)

[\[SENSe:\]FREQuency:RANGe:LOWer](#)

[\[SENSe:\]FREQuency:VOLTage:RANGe](#)

MEASure:FRESistance?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

MEASure:FRESistance? [{<range>|AUTO|MIN|MAX|DEF} [, {<resolution>|MIN|MAX|DEF}] ,] [(@<ch_list>)]

Description

First, this command resets all measurement parameters on the specified channels to their **default values**. Then, configures the channels for 4-wire resistance measurements and immediately sweeps through the specified channels one time, independent of the present scan list (channels in Bank 1 are automatically paired with corresponding channels in Bank 2). The results are sent directly to reading memory and the instrument's output buffer. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels.

Used With:

- 34921A Armature Multiplexer
- 34922A Armature Multiplexer
- 34923A Reed Multiplexer (differential mode only) *
- 34924A Reed Multiplexer *
- 34925A FET Multiplexer (differential mode only) *

* Series channel resistance must be taken into account for resistance measurements on this module.

Parameters

Name	Type	Range of Values	Default Value
<range>	Numeric	Expected value in ohms (ranges shown below). 100Ω (MIN) 1 kΩ 10 kΩ 100 kΩ 1 MΩ 10 MΩ 100 MΩ (MAX)	AUTO (autorange)
<resolution>	Numeric	Desired resolution in ohms.	0.000003 x Range (1 PLC)

<ch_list>	Numeric	One or more channels in the form <u>(@sccc)</u> .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- By default, the instrument scans the list of channels in ascending order from slot 1 through slot 8 (channels are reordered as needed). If your application requires non-ordered scanning of the channels in the present scan list, you can use the **ROUTe:SCAN:ORDeRed** command to enable the non-sequential scanning mode. In either mode, channels which are not in the scan list are skipped during the scan.
 - For *sequential* scanning (default, ROUT:SCAN:ORDERED **ON**), the specified channels are reordered as needed and duplicate channels are eliminated. For example, (@2001,1003,1001,1003) will be interpreted as (@1001,1003,2001).
 - For *non-sequential* scanning (ROUT:SCAN:ORDERED **OFF**), the channels remain in the order presented in the scan list (see exception below). Multiple occurrences of the same channel are allowed. For example, (@2001,2001,2001) and (@3010,1003,1001,1005) are valid and the channels will be scanned in the order presented.
 - When you specify a *range* of channels in the scan list, the channels are always sorted in ascending order, regardless of the ROUTe:SCAN:ORDeRed setting. Therefore, (@1009:1001) will always be interpreted as 1001, 1002, 1003, etc.
- The Analog Bus relays are automatically opened and closed as required during the scan to connect to the internal DMM for the measurement. For example, all 2-wire measurements use the ABus1 (MEAS) relays; for 4-wire measurements, the ABus2 (SENS) relays are used in addition to the ABus1 relays.
- If you specify a <ch_list> with the MEASure? command, the instrument performs a temporary scan of the specified channels (independent of the present scan list as set by the **ROUTe:SCAN** command). The following rules apply while the temporary scan is running (these rules supersede the rules for the pre-existing scan list, but that scan list is not modified).
 - When the temporary scan is initiated, the instrument will open all channels in banks that contain one or more channels in the <ch_list>.
 - In order to guarantee that no signals are connected to the Analog Buses prior to the "temporary" scan, the instrument will open all ABus1 relays (applies to all banks in all slots). In banks that contain channels in the <ch_list>, the instrument will also open all ABus2 relays (regardless of whether 4-wire measurements are involved). If no channels configured for 4-wire measurements are included in the <ch_list>, the state of the ABus2 relays in the non-scanned banks is not altered.
 - The state of the ABus3 and ABus4 relays is not altered and these relays remain available for use during the scan. However, be sure to use **CAUTION** when closing these relays on banks involved in the temporary scan. While the scan is running, any signals present on ABus3 and/or ABus4 will be joined with the scanned measurement on ABus1 and ABus2. If you have any doubt regarding the state of the ABus3 and ABus4 relays, it is recommended that you send a **ROUTe:OPEN:ABUS ALL** command prior to scanning operations.

- d. While the temporary scan is running, the instrument prevents use of all channels in banks that contain one or more channels in the specified <ch_list> (these channels are dedicated to the temporary scan). In addition, the instrument prevents use of all ABus1 and ABus2 relays on banks containing channels in the <ch_list>. If one or more channels configured for 4-wire measurements are included in the <ch_list>, then the rules for ABus2 relay operations are extended to the non-scanned banks as well.
- e. At the end of the temporary scan, the last channel that was scanned will be opened (as well as any Analog Bus relays used during the scan). Any channels that were opened during the scan will remain open at the completion of the scan.
- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.
- When you specify a range of channels with this command, any channels that are invalid will be ignored (no error will be generated) but the first and last channel in the range must be valid for the selected function. The Analog Bus relays (numbered s911, s912, s913, etc.) on the multiplexer and matrix modules are ignored if they are included in a range of channels. An error will be generated if an Analog Bus relay is specified as the first or last channel in a range of channels.
- You can allow the instrument to automatically select the measurement range using *autoranging* or you can select a fixed range using *manual ranging*. Autoranging is convenient because the instrument decides which range to use for each measurement based on the input signal. For fastest scanning operation, use manual ranging on each measurement (some additional time is required for autoranging since the instrument has to make a range selection).
- If you select autoranging (by specifying "AUTO" or "DEF"), an error will be generated if you specify a discrete value for the <resolution> parameter. When autoranging is combined with a discrete resolution, the instrument cannot accurately resolve the integration time (especially if the input signal is continuously changing). If your application requires autoranging, be sure to specify "DEF" for the <resolution> parameter or omit the parameter from the command.
- Autorange thresholds:

Down range	<10% of range
at:	
Up range at:	>120% of range

- If the input signal is greater than can be measured on the selected range (manual ranging), the instrument gives an *overload indication*: "±OVLD" from the front panel or "±9.9E+37" from the remote interface.
- For 4-wire resistance measurements, the instrument automatically pairs channel *n* in Bank 1 with channel *n+20* in Bank 2 (34921A, 34923A, 34925A) or *n+35* (34922A, 34924A) to provide the source and sense connections. For example, make the source connections to the HI and LO terminals on channel 2 in Bank 1 and the sense connections to the HI and LO terminals on channel 22 (or 37) in Bank 2. Specify the paired channel in Bank 1 (source) as the <ch_list> channel (channels in Bank 2 are not allowed in the <ch_list>).

- Since channels are automatically paired for 4-wire resistance measurements (see previous Remark), attempts to re-configure the paired channel in Bank 2 will result in an error. In addition, if the Bank 2 channel was previously configured to be part of the active scan list (see **ROUTe:SCAN** command) and is then re-configured to be paired with a Bank 1 channel, an error will be generated and the previous scan list will be cleared. For example:

```
CONF:VOLT:DC (@1021) !Configure Bank 2 channel for dc voltage
measurements
ROUT:SCAN (@1001:1040) !Add channels to scan list
CONF:FRES (@1001) !Generates error and clears scan list
```

- Four-wire measurements are not allowed on the multiplexer modules configured for the single-ended mode (see **SYSTem:MODUle:WIRE:MODE** command).
- For 4-wire measurements, the instrument automatically enables the **autozero** function.
- The ***RST** command will clear the scan list and set all measurement parameters to their factory settings. The Instrument Preset (**SYSTem:PRESet** command) will not clear the scan list; however, this command will clear reading memory and all stored statistical data.

Return Format

The command returns one reading for each channel specified (multiple responses are separated by commas). If you omit the `<ch_list>` parameter, the command applies to the internal DMM and a single reading is returned. The output from this command is *not* affected by the settings of the **FORMat:READIng** commands.

Examples

The following command configures the instrument for 4-wire measurements, triggers the internal DMM to scan one channel (channel 4 in slot 3), and then transfers the reading to reading memory and the instrument's output buffer. The default range (autorange) and resolution (1 PLC) are used for the measurement.

Note that for this 4-wire measurement, channel 4 is automatically paired with channel 24 (assumes 34921A).

```
MEAS:FRES? (@3004)
```

Typical Response: **+1.32130000E+03**

The following command generates an error since you must always specify the paired channel in Bank 1 as the `<ch_list>` channel for 4-wire measurements (channel 36 is in Bank 2).

```
MEAS:FRES? (@4036) !Generates an error, channel in Bank 2 is specified
```

The following command configures the instrument for 4-wire resistance measurements, triggers the internal DMM to scan two channels (channels 3 and 8 in slot 1), and then transfers the reading to reading memory and the instrument's output buffer. The 1 k Ω range is selected with 1 Ω resolution.

Note that for this 4-wire measurement, channels 3 and 8 in Bank 1 are automatically paired with channels 23 and 28 in Bank 2, respectively (assumes 34921A).

```
MEAS:FRES? 1000,1, (@1003,1008)
```

Typical Response: **+4.27150000E+02,+1.32130000E+02**

The following command configures the internal DMM for a 4-wire resistance measurement (no <ch_list> is specified), triggers the internal DMM, and then transfers the reading to reading memory and the instrument's output buffer. The default range and resolution are used for the measurement.

```
MEAS:FRES? !Applies to the internal DMM
```

Typical Response: **+2.93830000E+03**

See Also

[CONFigure:FRESistance](#)

[ROUTE:SCAN:ORDERed](#)

[\[SENSe:\]FRESistance:OCOMpensated](#)

MEASure:PERiod?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

MEASure:PERiod? [{<range>|MIN|MAX|DEF} [, {<resolution>|MIN|MAX|DEF}] ,] [(@<ch_list>)]

Description

First, this command resets all measurement parameters on the specified channels to their **default values**. Then, configures the channels for period measurements and immediately sweeps through the specified channels one time (independent of the present scan list). The results are sent directly to reading memory and the instrument's output buffer. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels.

Used With:

- 34921A through 34925A Multiplexer Modules

Parameters

Name	Type	Range of Values	Default Value
<range>	Numeric	Expected period of the input signal in seconds, between 3.33 μ s and 333.33 ms.	20 Hz
<resolution>	Numeric	Desired resolution in seconds.	Fixed at 6½ digits
<ch_list>	Numeric	One or more channels in the form (@sccc) .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- By default, the instrument scans the list of channels in ascending order from slot 1 through slot 8 (channels are reordered as needed). If your application requires non-ordered scanning of the channels in the present scan list, you can use the **ROUTe:SCAN:ORDERed** command to enable the non-sequential scanning mode. In either mode, channels which are not in the scan list are skipped during the scan.
 - a. For *sequential* scanning (default, ROUT:SCAN:ORDERED ON), the specified channels are reordered as needed and duplicate channels are eliminated. For example, (@2001,1003,1001,1003) will be interpreted as (@1001,1003,2001).

- b. For *non-sequential* scanning (ROUT:SCAN:ORDERED **OFF**), the channels remain in the order presented in the scan list (see exception below). Multiple occurrences of the same channel are allowed. For example, (@2001,2001,2001) and (@3010,1003,1001,1005) are valid and the channels will be scanned in the order presented.
 - c. When you specify a *range* of channels in the scan list, the channels are always sorted in ascending order, regardless of the ROUTe:SCAN:ORDERed setting. Therefore, (@1009:1001) will always be interpreted as 1001, 1002, 1003, etc.
- The Analog Bus relays are automatically opened and closed as required during the scan to connect to the internal DMM for the measurement. For example, all 2-wire measurements use the ABus1 (MEAS) relays; for 4-wire measurements, the ABus2 (SENS) relays are used in addition to the ABus1 relays.
 - If you specify a <ch_list> with the MEASure? command, the instrument performs a "temporary" scan of the specified channels (independent of the present scan list as set by the **ROUTe:SCAN** command). The following rules apply while the temporary scan is running (these rules supersede the rules for the pre-existing scan list, but that scan list is not modified).
 - a. When the temporary scan is initiated, the instrument will open all channels in banks that contain one or more channels in the <ch_list>.
 - b. In order to guarantee that no signals are connected to the Analog Buses prior to the temporary scan, the instrument will open all ABus1 relays (applies to all banks in all slots). In banks that contain channels in the <ch_list>, the instrument will also open all ABus2 relays (regardless of whether 4-wire measurements are involved). If no channels configured for 4-wire measurements are included in the <ch_list>, the state of the ABus2 relays in the non-scanned banks is not altered.
 - c. The state of the ABus3 and ABus4 relays is not altered and these relays remain available for use during the scan. However, be sure to use *CAUTION* when closing these relays on banks involved in the temporary scan. While the scan is running, any signals present on ABus3 and/or ABus4 will be joined with the scanned measurement on ABus1 and ABus2. If you have any doubt regarding the state of the ABus3 and ABus4 relays, it is recommended that you send a **ROUTe:OPEN:ABUS ALL** command prior to scanning operations.
 - d. While the temporary scan is running, the instrument prevents use of all channels in banks that contain one or more channels in the specified <ch_list> (these channels are dedicated to the temporary scan). In addition, the instrument prevents use of all ABus1 and ABus2 relays on banks containing channels in the <ch_list>. If one or more channels configured for 4-wire measurements are included in the <ch_list>, then the rules for ABus2 relay operations are extended to the non-scanned banks as well.
 - e. At the end of the temporary scan, the last channel that was scanned will be opened (as well as any Analog Bus relays used during the scan). Any channels that were opened during the scan will remain open at the completion of the scan.
 - If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.

- When you specify a range of channels with this command, any channels that are invalid will be ignored (no error will be generated) but the first and last channel in the range must be valid for the selected function. The Analog Bus relays (numbered **s911**, **s912**, **s913**, etc.) on the multiplexer and matrix modules are ignored if they are included in a range of channels. An error will be generated if an Analog Bus relay is specified as the first or last channel in a range of channels.
- The *<range>* parameter is required only to specify the measurement resolution parameter. Therefore, it is not necessary to send a new command for each new period to be measured.
- If the input signal is greater than can be measured on the selected range (manual ranging), the instrument gives an *overload indication*: "**±OVLD**" from the front panel or "**±9.9E+37**" from the remote interface.
- With no signal applied to the specified channels, "**0**" is returned.
- The 34923A, 34924A, and 34933A modules use *non-latching* reed relays. Due to power dissipation issues, there is a limit to the number of relays that can be closed at a time on these modules (you cannot close all channels simultaneously). See the **ROUTe:CLOSe** command for details.
- The *Safety Interlock* feature prevents connections to the Analog Buses if no terminal block or properly-wired cable is connected to the module. An error will be generated if scanning is performed on banks without a terminal block or properly-wired cable. See the **SYSTem:ABUS:INTerlock:SIMulate** command to *temporarily* disable errors generated by the Safety Interlock feature.
- The ***RST** command will clear the scan list and set all measurement parameters to their factory settings. The Instrument Preset (**SYSTem:PRESet** command) will not clear the scan list; however, this command will clear reading memory and all stored statistical data.

Return Format

The command returns one reading for each channel specified (multiple responses are separated by commas). If you omit the *<ch_list>* parameter, the command applies to the internal DMM and a single reading is returned. The output from this command is *not* affected by the settings of the **FORMat:READing** commands.

Examples

The following command configures the instrument for period measurements, triggers the internal DMM to scan one channel (channel 4 in slot 3), and then transfers the reading to reading memory and the instrument's output buffer. The default range (autorange) and resolution (fixed at 6½ digits) are used for the measurement.

```
MEAS:PER? (@3004)
```

Typical Response: **+1.32130000E-03**

The following command configures the instrument for period measurements, triggers the internal DMM to scan two channels (channels 3 and 8 in slot 1), and then transfers the reading to reading memory and the instrument's output buffer.

```
MEAS:PER? 1,0.001, (@1003,1008)
```

Typical Response: **+4.27150000E-04,+1.32130000E-04**

The following command configures the internal DMM for a period measurement (no <ch_list> is specified), triggers the internal DMM, and then transfers the reading to reading memory and the instrument's output buffer. The default range and resolution are used for the measurement.

```
MEAS:PER? !Applies to the internal DMM
```

Typical Response: **+2.93830000E-03**

See Also

CONFigure:PERiod

ROUTe:SCAN:ORDered

[SENSe:]PERiod:VOLTage:RANGe

MEASure:RESistance?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

MEASure:RESistance? [{<range>|AUTO|MIN|MAX|DEF} [, {<resolution>|MIN|MAX|DEF}] ,] [(@<ch_list>)]

Description

First, this command resets all measurement parameters on the specified channels to their **default values**. Then, configures the channels for 2-wire resistance measurements and immediately sweeps through the specified channels one time (independent of the present scan list). The results are sent directly to reading memory and the instrument's output buffer. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels.

Used With:

- 34921A Armature Multiplexer
- 34922A Armature Multiplexer
- 34923A Reed Multiplexer *
- 34924A Reed Multiplexer *
- 34925A FET Multiplexer *

* Series channel resistance must be taken into account for resistance measurements on this module.

Parameters

Name	Type	Range of Values	Default Value
<range>	Numeric	Expected value in ohms (ranges shown below). 100Ω (MIN) 1 kΩ 10 kΩ 100 kΩ 1 MΩ 10 MΩ 100 MΩ (MAX)	AUTO (autorange)
<resolution>	Numeric	Desired resolution in ohms.	0.000003 x Range (1 PLC)

<ch_list>	Numeric	One or more channels in the form (@sccc).	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- By default, the instrument scans the list of channels in ascending order from slot 1 through slot 8 (channels are reordered as needed). If your application requires non-ordered scanning of the channels in the present scan list, you can use the **ROUTe:SCAN:ORDeRed** command to enable the non-sequential scanning mode. In either mode, channels which are not in the scan list are skipped during the scan.
 - a. For *sequential* scanning (default, ROUT:SCAN:ORDERED **ON**), the specified channels are reordered as needed and duplicate channels are eliminated. For example, (@2001,1003,1001,1003) will be interpreted as (@1001,1003,2001).
 - b. For *non-sequential* scanning (ROUT:SCAN:ORDERED **OFF**), the channels remain in the order presented in the scan list (see exception below). Multiple occurrences of the same channel are allowed. For example, (@2001,2001,2001) and (@3010,1003,1001,1005) are valid and the channels will be scanned in the order presented.
 - c. When you specify a *range* of channels in the scan list, the channels are always sorted in ascending order, regardless of the ROUTe:SCAN:ORDeRed setting. Therefore, (@1009:1001) will always be interpreted as 1001, 1002, 1003, etc.
- The Analog Bus relays are automatically opened and closed as required during the scan to connect to the internal DMM for the measurement. For example, all 2-wire measurements use the ABus1 (MEAS) relays; for 4-wire measurements, the ABus2 (SENS) relays are used in addition to the ABus1 relays.
- If you specify a <ch_list> with the MEASure? command, the instrument performs a "temporary" scan of the specified channels (independent of the present scan list as set by the **ROUTe:SCAN** command). The following rules apply while the temporary scan is running (these rules supersede the rules for the pre-existing scan list, but that scan list is not modified).
 - a. When the temporary scan is initiated, the instrument will open all channels in banks that contain one or more channels in the <ch_list>.
 - b. In order to guarantee that no signals are connected to the Analog Buses prior to the temporary scan, the instrument will open all ABus1 relays (applies to all banks in all slots). In banks that contain channels in the <ch_list>, the instrument will also open all ABus2 relays (regardless of whether 4-wire measurements are involved). If no channels configured for 4-wire measurements are included in the <ch_list>, the state of the ABus2 relays in the non-scanned banks is not altered.
 - c. The state of the ABus3 and ABus4 relays is not altered and these relays remain available for use during the scan. However, be sure to use **CAUTION** when closing these relays on banks involved in the temporary scan. While the scan is running, any signals present on ABus3 and/or ABus4 will be joined with the scanned measurement on ABus1 and ABus2. If you have any doubt regarding the state of the ABus3 and ABus4 relays, it is recommended that you send a **ROUTe:OPEN:ABUS ALL** command prior to scanning operations.

- d. While the temporary scan is running, the instrument prevents use of all channels in banks that contain one or more channels in the specified <ch_list> (these channels are dedicated to the temporary scan). In addition, the instrument prevents use of all ABus1 and ABus2 relays on banks containing channels in the <ch_list>. If one or more channels configured for 4-wire measurements are included in the <ch_list>, then the rules for ABus2 relay operations are extended to the non-scanned banks as well.
- e. At the end of the temporary scan, the last channel that was scanned will be opened (as well as any Analog Bus relays used during the scan). Any channels that were opened during the scan will remain open at the completion of the scan.
- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.
- When you specify a range of channels with this command, any channels that are invalid will be ignored (no error will be generated) but the first and last channel in the range must be valid for the selected function. The Analog Bus relays (numbered s911, s912, s913, etc.) on the multiplexer and matrix modules are ignored if they are included in a range of channels. An error will be generated if an Analog Bus relay is specified as the first or last channel in a range of channels.
- You can allow the instrument to automatically select the measurement range using autoranging or you can select a fixed range using manual ranging. Autoranging is convenient because the instrument decides which range to use for each measurement based on the input signal. For fastest scanning operation, use manual ranging on each measurement (some additional time is required for autoranging since the instrument has to make a range selection).
- If you select autoranging (by specifying "AUTO" or "DEF"), an error will be generated if you specify a discrete value for the <resolution> parameter. When autoranging is combined with a discrete resolution, the instrument cannot accurately resolve the integration time (especially if the input signal is continuously changing). If your application requires autoranging, be sure to specify "DEF" for the <resolution> parameter or omit the parameter from the command.
- Autorange thresholds:

Down range < 10% of range
 at:
 Up range at: > 120% of range

- If the input signal is greater than can be measured on the selected range (manual ranging), the instrument gives an *overload indication*: "±OVLD" from the front panel or "±9.9E+37" from the remote interface.
- The 34923A, 34924A, and 34933A modules use *non-latching* reed relays. Due to power dissipation issues, there is a limit to the number of relays that can be closed at a time on these modules (you cannot close all channels simultaneously). See the **ROUTe:CLOSE** command for details.
- The *Safety Interlock* feature prevents connections to the Analog Buses if no terminal block or properly-wired cable is connected to the module. An error will be generated if scanning is performed on banks without a terminal block or properly-wired cable. See the **SYSTem:ABUS:INTerlock:SIMulate** command to *temporarily* disable errors generated by the Safety Interlock feature.

- The ***RST** command will clear the scan list and set all measurement parameters to their factory settings. The Instrument Preset (**SYSTem:PRESet** command) will not clear the scan list; however, this command will clear reading memory and all stored statistical data.

Return Format

The command returns one reading for each channel specified (multiple responses are separated by commas). If you omit the <ch_list> parameter, the command applies to the internal DMM and a single reading is returned. The output from this command is *not* affected by the settings of the **FORMat:READing** commands.

Examples

The following command configures the instrument for 2-wire resistance measurements, triggers the internal DMM to scan one channel (channel 4 in slot 3), and then transfers the reading to reading memory and the instrument's output buffer. The default range (autorange) and resolution (1 PLC) are used for the measurement.

```
MEAS:RES? (@3004)
```

Typical Response: **+1.32130000E+04**

The following command configures the instrument for 2-wire resistance measurements, triggers the internal DMM to scan two channels (channels 3 and 8 in slot 1), and then transfers the reading to reading memory and the instrument's output buffer. The 1 k Ω range is selected with 1 Ω resolution.

```
MEAS:RES? 1000,1, (@1003,1008)
```

Typical Response: **+4.27150000E+02,+1.32130000E+02**

The following command configures the internal DMM for a 2-wire resistance measurement (no <ch_list> is specified), triggers the internal DMM, and then transfers the reading to reading memory and the instrument's output buffer. The default range and resolution are used for the measurement.

```
MEAS:RES? !Applies to the internal DMM
```

Typical Response: **+2.93830000E+03**

See Also

CONFigure:RESistance

ROUTe:SCAN:ORDered

[SENSe:]RESistance:OCOMpensated

[SENSe:]RESistance:ZERO:AUTO

MEASure:TEMPerature?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

MEASure:TEMPerature? {<probe_type>|DEF}, {<type>|DEF} [,1 [, {<resolution>|MIN|MAX|DEF}]] [, (@<ch_list>)]

Description

First, this command resets all measurement parameters on the specified channels to their **default values**. Then, configures the channels for temperature measurements and immediately sweeps through the specified channels one time (independent of the present scan list). The results are sent directly to reading memory and the instrument's output buffer. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels.

The following table shows which temperature transducers are supported by each of the multiplexer modules.

	Thermocouple	RTD 2-Wire	RTD 4-Wire	Thermistor
34921A Armature Multiplexer	Yes ¹	Yes	Yes	Yes
34922A Armature Multiplexer	Yes ²	Yes	Yes	Yes
34923A Reed Multiplexer (2-Wire)	Yes ^{2,3}	Yes ⁴	Yes ⁴	Yes ⁵
34923A Reed Multiplexer (1-Wire)	Yes ^{2,3}	Yes ⁴	No	Yes ⁵
34924A Reed Multiplexer	Yes ^{2,3}	Yes ⁴	Yes ⁴	Yes ⁵
34925A FET Multiplexer (2-Wire)	Yes ²	No	Yes ⁵	No
34925A FET Multiplexer (1-Wire)	Yes ²	No	No	No

¹Optional 34921T Terminal Block is required for thermocouple measurements with built-in internal reference junction.

²A fixed or external reference junction temperature is required for thermocouple measurements with this module.

³Impact of higher offset voltage specification (< 50 μ V) must be taken into consideration.

⁴1 k Ω or higher range used unless 100 Ω series resistors are bypassed on module.

⁵10 k Ω or higher range used for loads over approximately 300 Ω due to series resistance of FET channels.

Parameters

Name	Type	Range of Values	Default Value
<probe_type>	Discrete	{TCouple RTD FRTD THERmistor}	TCouple
<type>	Discrete	For TC: {B E J K N R S T} ¹	J Type
		For RTD: {85 91} ²	85
		For FRTD: {85 91} ²	85
		For THER: { 2252 5000 10000}	5000
<resolution>	Numeric	Desired <u>resolution</u> in °C, °F, or K.	1 PLC
<ch_list>	Numeric	One or more channels in the form (@sccc).	If <ch_list> is omitted, this command applies to the internal DMM.

¹ Using ITS-90 software conversions.

² Using IPTS-68 software conversions.

Remarks

- By default, the instrument scans the list of channels in ascending order from slot 1 through slot 8 (channels are reordered as needed). If your application requires non-ordered scanning of the channels in the present scan list, you can use the ROUTe:SCAN:ORDERed command to enable the non-sequential scanning mode. In either mode, channels which are not in the scan list are skipped during the scan.
 - For *sequential* scanning (default, ROUT:SCAN:ORDERed **ON**), the specified channels are reordered as needed and duplicate channels are eliminated. For example, (@2001,1003,1001,1003) will be interpreted as (@1001,1003,2001).
 - For *non-sequential* scanning (ROUT:SCAN:ORDERed **OFF**), the channels remain in the order presented in the scan list (see exception below). Multiple occurrences of the same channel are allowed. For example, (@2001,2001,2001) and (@3010,1003,1001,1005) are valid and the channels will be scanned in the order presented.
 - When you specify a *range* of channels in the scan list, the channels are always sorted in ascending order, regardless of the ROUTe:SCAN:ORDERed setting. Therefore, (@1009:1001) will always be interpreted as 1001, 1002, 1003, etc.
- The Analog Bus relays are automatically opened and closed as required during the scan to connect to the internal DMM for the measurement. For example, all 2-wire measurements use the ABus1 (MEAS) relays; for 4-wire measurements, the ABus2 (SENS) relays are used in addition to the ABus1 relays.
- For temperature measurements, the instrument internally selects the range; you cannot select which range is used. In the command syntax, be sure to include "1" as shown for the <range> parameter (preceding the <resolution> parameter).

- If you specify a `<ch_list>` with the `MEASure?` command, the instrument performs a "temporary" scan of the specified channels (independent of the present scan list as set by the `ROUTe:SCAN` command). The following rules apply while the temporary scan is running (these rules supersede the rules for the pre-existing scan list, but that scan list is not modified).
 - a. When the temporary scan is initiated, the instrument will open all channels in banks that contain one or more channels in the `<ch_list>`.
 - b. In order to guarantee that no signals are connected to the Analog Buses prior to the temporary scan, the instrument will open all ABus1 relays (applies to all banks in all slots). In banks that contain channels in the `<ch_list>`, the instrument will also open all ABus2 relays (regardless of whether 4-wire measurements are involved). If no channels configured for 4-wire measurements are included in the `<ch_list>`, the state of the ABus2 relays in the non-scanned banks is not altered.
 - c. The state of the ABus3 and ABus4 relays is not altered and these relays remain available for use during the scan. However, be sure to use *CAUTION* when closing these relays on banks involved in the temporary scan. While the scan is running, any signals present on ABus3 and/or ABus4 will be joined with the scanned measurement on ABus1 and ABus2. If you have any doubt regarding the state of the ABus3 and ABus4 relays, it is recommended that you send a `ROUTe:OPEN:ABUS ALL` command prior to scanning operations.
 - d. While the temporary scan is running, the instrument prevents use of all channels in banks that contain one or more channels in the specified `<ch_list>` (these channels are dedicated to the temporary scan). In addition, the instrument prevents use of all ABus1 and ABus2 relays on banks containing channels in the `<ch_list>`. If one or more channels configured for 4-wire measurements are included in the `<ch_list>`, then the rules for ABus2 relay operations are extended to the non-scanned banks as well.
 - e. At the end of the temporary scan, the last channel that was scanned will be opened (as well as any Analog Bus relays used during the scan). Any channels that were opened during the scan will remain open at the completion of the scan.
- If you omit the optional `<ch_list>` parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.
- When you specify a range of channels with this command, any channels that are invalid will be ignored (no error will be generated) but the first and last channel in the range must be valid for the selected function. The Analog Bus relays (numbered `s911`, `s912`, `s913`, etc.) on the multiplexer and matrix modules are ignored if they are included in a range of channels. An error will be generated if an Analog Bus relay is specified as the first or last channel in a range of channels.
- For thermocouple measurements, the instrument internally selects the 100 mV range. For thermistor and RTD measurements, the instrument autoranges to the correct range for the transducer resistance measurement. Specify the paired channel in the lower bank (source) as the `<ch_list>` channel.
- Thermocouple measurements require a reference junction temperature (see `[SENSe:]TEMPerature:TRANsducer:TCouple:RJUNction:TYPE` command). For the reference junction temperature, you can use an *internal* measurement on the module's terminal block (34921A only), an *external* thermistor or RTD measurement, or a known *fixed* junction temperature. By default, a fixed reference junction temperature of 0.0 °C is used (see `[SENSe:]TEMPerature:TRANsducer:TCouple:RJUNction` command).

- If you select autoranging (by specifying "AUTO" or "DEF"), an error will be generated if you specify a discrete value for the <resolution> parameter. When autoranging is combined with a discrete resolution, the instrument cannot accurately resolve the integration time (especially if the input signal is continuously changing). If your application requires autoranging, be sure to specify "DEF" for the <resolution> parameter or omit the parameter from the command.
- For 4-wire RTD measurements (FRTD), the instrument automatically pairs channel *n* in Bank 1 with channel *n+20* in Bank 2 (34921A, 34923A) or *n+35* (34922A, 34924A) to provide the source and sense connections. For example, make the source connections to the HI and LO terminals on channel 2 in Bank 1 and the sense connections to the HI and LO terminals on channel 22 (or 37) in Bank 2. Specify the paired channel in Bank 1 (source) as the <ch_list> channel (channels in Bank 2 are not allowed in the <ch_list>).
- Since channels are automatically paired for 4-wire resistance measurements (see previous Remark), attempts to re-configure the paired channel in Bank 2 will result in an error. In addition, if the Bank 2 channel was previously configured to be part of the active scan list (see **ROUTe:SCAN** command) and is then re-configured to be paired with a Bank 1 channel, an error will be generated and the previous scan list will be cleared. For example:

```
CONF:VOLT:DC (@1021) !Configure Bank 2 channel for dc voltage
measurements
ROUT:SCAN (@1001:1040) !Add channels to scan list
CONF:FRES (@1001) !Generates error and clears scan list
```

- Four-wire RTD measurements are not allowed on the multiplexer modules configured for the single-ended mode (see **SYSTem:MODUle:WIRE:MODE** command).
- For 4-wire RTD measurements, the instrument automatically enables the **autozero** function.
- The 34923A, 34924A, and 34933A modules use *non-latching* reed relays. Due to power dissipation issues, there is a limit to the number of relays that can be closed at a time on these modules (you cannot close all channels simultaneously). See the **ROUTe:CLOSe** command for details.
- The *Safety Interlock* feature prevents connections to the Analog Buses if no terminal block or properly-wired cable is connected to the module. An error will be generated if scanning is performed on banks without a terminal block or properly-wired cable. See the **SYSTem:ABUS:INTerlock:SIMulate** command to *temporarily* disable errors generated by the Safety Interlock feature.
- The ***RST** command will clear the scan list and set all measurement parameters to their factory settings. The Instrument Preset (**SYSTem:PRESet** command) will not clear the scan list; however, this command will clear reading memory and all stored statistical data.

Return Format

The command returns one reading for each channel specified (multiple responses are separated by commas). If you omit the <ch_list> parameter, the command applies to the internal DMM and a single reading is returned. The output from this command is *not* affected by the settings of the **FORMat:READIng** commands.

Examples

The following command configures the instrument for B-type thermocouple measurements, triggers the internal DMM to scan one channel (channel 4 in slot 3), and then transfers the reading to reading memory and the instrument's output buffer. The default resolution (fixed at 6½ digits) is used for the measurement (assumes default temperature units).

```
MEAS:TEMP? TC,B, (@3004)
```

Typical Response: **+3.65640000E+01**

The following command configures the instrument for 5 k Ω thermistor measurements, triggers the internal DMM to scan two channels (channels 3 and 8 in slot 1), and then transfers the reading to reading memory and the instrument's output buffer. This 2-wire measurement is made with 0.1 °C resolution (assumes default temperature units).

```
MEAS:TEMP? THER,5000,1,0.1, (@1003,1008)
```

Typical Response: **+2.47150000E+01,+3.12130000E+01**

The following command configures the internal DMM for a 2-wire RTD measurement (no <ch_list> is specified), triggers the internal DMM, and then transfers the reading to reading memory and the instrument's output buffer. The default range and resolution are used for the measurement.

```
MEAS:TEMP? RTD,85 !Applies to the internal DMM
```

Typical Response: **+2.12320000E+01**

See Also

CONFigure:TEMPerature

ROUTe:SCAN:ORDered

[SENSe:]TEMPerature:TRANsducer:TCouple:IMPedance:AUTO

[SENSe:]TEMPerature:ZERO:AUTO

UNIT:TEMPerature

MEASure:TOTalize?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

MEASure:TOTalize? [<mode>,@<ch_list>]

Description

This command configures the specified totalizer channels and immediately sweeps through the list one time. You can read the totalizer either with or without resetting the count. The results are sent directly to the instrument's output buffer.

Used With:

- 34950A Digital I/O Module (counter channels only)
- 34952A Multifunction Module (totalizer channels only)

Parameters

Name	Type	Range of Values	Default Value
<mode>	Discrete	{READ RRESet}	READ (read without resetting the count)
<ch_list>	Numeric	One or more totalizer channels in the form (@sccc). 34950A: s301, s302 34952A: s005	This is a required parameter

Remarks

- By default, the instrument scans the list of channels in ascending order from slot 1 through slot 8 (channels are reordered as needed). If your application requires non-ordered scanning of the channels in the present scan list, you can use the ROUTe:SCAN:ORDERed command to enable the non-sequential scanning mode. In either mode, channels which are not in the scan list are skipped during the scan.
- When you specify a range of channels with this command, any channels that are invalid will be ignored (no error will be generated) but the first and last channel in the range must be valid for the selected function.
- The instrument performs a temporary scan of the specified channels, independent of the present scan list.
- To read the totalizer without resetting the count, select the READ parameter. To read the totalizer and reset the count to "0" after it is read, select the RRESet parameter (this means "read and reset").
- The maximum count is 4,294,967,295 ($2^{32} - 1$). The count rolls over to "0" after reaching the maximum allowed value.

- If the count rolls over to "0", the "Totalizer Overflow" bit is set in the Slot Event Registers group (see **STATus:MODule:SLOT[n]:CONDition?** and **STATus:MODule:SLOT[n]:EVENT?** commands). For more information on the SCPI Status System for the Keysight 34980A, see **Status System Introduction**.
- The ***RST** command will clear the scan list and set all measurement parameters to their factory settings. The Instrument Preset (**SYSTem:PRESet** command) will not clear the scan list; however, this command will clear reading memory and all stored statistical data.

Return Format

The command returns an unsigned decimal value representing the count on each totalizer channel specified (a full 32-bit count is returned). If you have specified RRESet, the count is reset to "0" after it is read. Multiple responses are separated by commas. The output from this command is affected by the settings of the **FORMat:READIng** commands.

Examples

The following command reads the count on totalizer channel 301 on the **34950A** in slot 2 (the count is not reset after it is read). The value is transferred to the instrument's output buffer.

```
MEAS:TOT? READ, (@2301)
```

Typical Response: **1.321300000E+03**

The following command reads the count on totalizer channel 5 on the **34952A** in slot 4 (the count is reset to "0" on both channels after it is read). The values are transferred to the instrument's output buffer.

```
MEAS:TOT? RRESET, (@4005)
```

Typical Response: **2.737300000E+02**

See Also

ROUTE:SCAN:ORDered

STATus:MODule:SLOT[n]:CONDition?

STATus:MODule:SLOT[n]:EVENT?

MEASure[:VOLTage]:AC?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

MEASure[:VOLTage]:AC? [{<range>|AUTO|MIN|MAX|DEF} [, {<resolution>|MIN|MAX|DEF}] ,] [(@<ch_list>)]

Description

First, this command resets all measurement parameters on the specified channels to their **default values**. Then, configures the channels for ac voltage measurements and immediately sweeps through the specified channels one time (independent of the present scan list). The results are sent directly to reading memory and the instrument's output buffer. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels.

Used With:

- 34921A through 34925A Multiplexer Modules

Parameters

Name	Type	Range of Values	Default Value
<range>	Numeric	Expected value in volts (ranges shown below). 100 mV (MIN) 1 V 10 V 100 V 300 V (MAX)	AUTO (autorange)
<resolution>	Numeric	Desired resolution in volts.	Fixed at 6½ digits
<ch_list>	Numeric	One or more channels in the form (@sccc) .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- By default, the instrument scans the list of channels in ascending order from slot 1 through slot 8 (channels are reordered as needed). If your application requires non-ordered scanning of the channels in the present scan list, you can use the **ROUTe:SCAN:ORDer** command to enable the non-sequential scanning mode. In either mode, channels which are not in the scan list are skipped during the scan.

- a. For *sequential* scanning (default, ROUT:SCAN:ORDERED **ON**), the specified channels are reordered as needed and duplicate channels are eliminated. For example, (@2001,1003,1001,1003) will be interpreted as (@1001,1003,2001).
 - b. For *non-sequential* scanning (ROUT:SCAN:ORDERED **OFF**), the channels remain in the order presented in the scan list (see exception below). Multiple occurrences of the same channel are allowed. For example, (@2001,2001,2001) and (@3010,1003,1001,1005) are valid and the channels will be scanned in the order presented.
 - c. When you specify a *range* of channels in the scan list, the channels are always sorted in ascending order, regardless of the ROUTe:SCAN:ORDERed setting. Therefore, (@1009:1001) will always be interpreted as 1001, 1002, 1003, etc.
- The Analog Bus relays are automatically opened and closed as required during the scan to connect to the internal DMM for the measurement. For example, all 2-wire measurements use the ABus1 (MEAS) relays; for 4-wire measurements, the ABus2 (SENS) relays are used in addition to the ABus1 relays.
 - If you specify a <ch_list> with the MEASure? command, the instrument performs a "temporary" scan of the specified channels (independent of the present scan list as set by the ROUTe:SCAN command). The following rules apply while the temporary scan is running (these rules supersede the rules for the pre-existing scan list, but that scan list is not modified).
 - a. When the temporary scan is initiated, the instrument will open all channels in banks that contain one or more channels in the <ch_list>.
 - b. In order to guarantee that no signals are connected to the Analog Buses prior to the temporary scan, the instrument will open all ABus1 relays (applies to all banks in all slots). In banks that contain channels in the <ch_list>, the instrument will also open all ABus2 relays (regardless of whether 4-wire measurements are involved). If no channels configured for 4-wire measurements are included in the <ch_list>, the state of the ABus2 relays in the non-scanned banks is not altered.
 - c. The state of the ABus3 and ABus4 relays is not altered and these relays remain available for use during the scan. However, be sure to use *CAUTION* when closing these relays on banks involved in the temporary scan. While the scan is running, any signals present on ABus3 and/or ABus4 will be joined with the scanned measurement on ABus1 and ABus2. If you have any doubt regarding the state of the ABus3 and ABus4 relays, it is recommended that you send a ROUTe:OPEN:ABUS ALL command prior to scanning operations.
 - d. While the temporary scan is running, the instrument prevents use of all channels in banks that contain one or more channels in the specified <ch_list> (these channels are dedicated to the temporary scan). In addition, the instrument prevents use of all ABus1 and ABus2 relays on banks containing channels in the <ch_list>. If one or more channels configured for 4-wire measurements are included in the <ch_list>, then the rules for ABus2 relay operations are extended to the non-scanned banks as well.
 - e. At the end of the temporary scan, the last channel that was scanned will be opened (as well as any Analog Bus relays used during the scan). Any channels that were opened during the scan will remain open at the completion of the scan.
 - If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.

- When you specify a range of channels with this command, any channels that are invalid will be ignored (no error will be generated) but the first and last channel in the range must be valid for the selected function. The Analog Bus relays (numbered **s911**, **s912**, **s913**, etc.) on the multiplexer and matrix modules are ignored if they are included in a range of channels. An error will be generated if an Analog Bus relay is specified as the first or last channel in a range of channels.
- You can allow the instrument to automatically select the measurement range using *autoranging* or you can select a fixed range using *manual ranging*. Autoranging is convenient because the instrument decides which range to use for each measurement based on the input signal. For fastest scanning operation, use manual ranging on each measurement (some additional time is required for autoranging since the instrument has to make a range selection).
- If you select autoranging (by specifying "AUTO" or "DEF"), an error will be generated if you specify a discrete value for the <resolution> parameter. When autoranging is combined with a discrete resolution, the instrument cannot accurately resolve the integration time (especially if the input signal is continuously changing). If your application requires autoranging, be sure to specify "DEF" for the <resolution> parameter or omit the parameter from the command.
- Autorange thresholds:

Down range <10% of range
at:
Up range at: >120% of range

- If the input signal is greater than can be measured on the selected range (manual ranging), the instrument gives an *overload indication*: "**±OVLD**" from the front panel or "**±9.9E+37**" from the remote interface.
- For ac measurements, the resolution is fixed at 6½ digits. The only way to control the reading rate for ac measurements is by changing the **channel delay** or by setting the **ac filter** to the highest frequency limit. The <resolution> parameter only affects the number of digits shown on the front panel.
- The default trigger delays for ac measurements (see **TRIGger:DElay:AUTO** and **ROUTe:CHANnel:DElay:AUTO** commands) do not account for worst case settling delays that can occur when measuring ac signals with large dc offsets. Significant measurement errors may result. Use the **TRIGger:DElay** command (for stand-alone DMM measurements) or **ROUTe:CHANnel:DElay** command (for scanned measurements) to allow adequate settling time before the measurement.
- The 34923A, 34924A, and 34933A modules use *non-latching* reed relays. Due to power dissipation issues, there is a limit to the number of relays that can be closed at a time on these modules (you cannot close all channels simultaneously). See the **ROUTe:CLOSe** command for details.
- The *Safety Interlock* feature prevents connections to the Analog Buses if no terminal block or properly-wired cable is connected to the module. An error will be generated if scanning is performed on banks without a terminal block or properly-wired cable. See the **SYSTem:ABUS:INTERlock:SIMulate** command to *temporarily* disable errors generated by the Safety Interlock feature.
- The ***RST** command will clear the scan list and set all measurement parameters to their factory settings. The Instrument Preset (**SYSTem:PRESet** command) will not clear the scan list; however, this command will clear reading memory and all stored statistical data.

Return Format

The command returns one reading for each channel specified (multiple responses are separated by commas). If you omit the <ch_list> parameter, the command applies to the internal DMM and a single reading is returned. The output from this command is *not* affected by the settings of the **FORMat:READing** commands.

Examples

The following command configures the instrument for ac voltage measurements, triggers the internal DMM to scan one channel (channel 4 in slot 3), and then transfers the reading to reading memory and the instrument's output buffer. The default range (autorange) and resolution (fixed at 6½ digits) are used for the measurement.

```
MEAS:VOLT:AC? (@3004)
```

Typical Response: **+1.86850000E-03**

The following command configures the instrument for ac voltage measurements, triggers the internal DMM to scan two channels (channels 3 and 8 in slot 1), and then transfers the reading to reading memory and the instrument's output buffer. The 1 V range is selected.

```
MEAS:VOLT:AC? 1, (@1003,1008)
```

Typical Response: **+4.27150000E-03,+1.32130000E-03**

The following command configures the internal DMM for an ac voltage measurement (no <ch_list> is specified), triggers the internal DMM, and then transfers the reading to reading memory and the instrument's output buffer. The default range and resolution are used for the measurement.

```
MEAS:VOLT:AC? !Applies to the internal DMM
```

Typical Response: **+1.26360000E-02**

See Also

CONFigure[:VOLTage]:AC

ROUTe:CHANnel:DELay

ROUTe:CHANnel:DELay:AUTO

ROUTe:SCAN:ORDer

[SENSe:]VOLTage:AC:BANDwidth

TRIGger:DELay:AUTO

MEASure[:VOLTage][:DC]?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

MEASure[:VOLTage][:DC]? [{<range>|AUTO|MIN|MAX|DEF} [, {<resolution>|MIN|MAX|DEF}] ,] [(@<ch_list>)]

Description

First, this command resets all measurement parameters on the specified channels to their **default values**. Then, configures the channels for dc voltage measurements and immediately sweeps through the specified channels one time (independent of the present scan list). The results are sent directly to reading memory and the instrument's output buffer. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels.

Used With:

- 34921A through 34925A Multiplexer Modules

Parameters

Name	Type	Range of Values	Default Value
<range>	Numeric	Expected value in volts (ranges shown below). 100 mV (MIN) 1 V 10 V 100 V 300 V (MAX)	AUTO (autorange)
<resolution>	Numeric	Desired resolution in volts.	0.000003 x Range (1 PLC)
<ch_list>	Numeric	One or more channels in the form (@sccc) .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- By default, the instrument scans the list of channels in ascending order from slot 1 through slot 8 (channels are reordered as needed). If your application requires non-ordered scanning of the channels in the present scan list, you can use the **ROUTe:SCAN:ORDer** command to enable the non-sequential scanning mode. In either mode, channels which are not in the scan list are skipped during the scan.

- a. For *sequential* scanning (default, ROUT:SCAN:ORDERED **ON**), the specified channels are reordered as needed and duplicate channels are eliminated. For example, (@2001,1003,1001,1003) will be interpreted as (@1001,1003,2001).
 - b. For *non-sequential* scanning (ROUT:SCAN:ORDERED **OFF**), the channels remain in the order presented in the scan list (see exception below). Multiple occurrences of the same channel are allowed. For example, (@2001,2001,2001) and (@3010,1003,1001,1005) are valid and the channels will be scanned in the order presented.
 - c. When you specify a *range* of channels in the scan list, the channels are always sorted in ascending order, regardless of the ROUTe:SCAN:ORDERed setting. Therefore, (@1009:1001) will always be interpreted as 1001, 1002, 1003, etc.
- The Analog Bus relays are automatically opened and closed as required during the scan to connect to the internal DMM for the measurement. For example, all 2-wire measurements use the ABus1 (MEAS) relays; for 4-wire measurements, the ABus2 (SENS) relays are used in addition to the ABus1 relays.
 - If you specify a <ch_list> with the MEASure? command, the instrument performs a "temporary" scan of the specified channels (independent of the present scan list as set by the ROUTe:SCAN command). The following rules apply while the temporary scan is running (these rules supersede the rules for the pre-existing scan list, but that scan list is not modified).
 - a. When the temporary scan is initiated, the instrument will open all channels in banks that contain one or more channels in the <ch_list>.
 - b. In order to guarantee that no signals are connected to the Analog Buses prior to the temporary scan, the instrument will open all ABus1 relays (applies to all banks in all slots). In banks that contain channels in the <ch_list>, the instrument will also open all ABus2 relays (regardless of whether 4-wire measurements are involved). If no channels configured for 4-wire measurements are included in the <ch_list>, the state of the ABus2 relays in the non-scanned banks is not altered.
 - c. The state of the ABus3 and ABus4 relays is not altered and these relays remain available for use during the scan. However, be sure to use *CAUTION* when closing these relays on banks involved in the temporary scan. While the scan is running, any signals present on ABus3 and/or ABus4 will be joined with the scanned measurement on ABus1 and ABus2. If you have any doubt regarding the state of the ABus3 and ABus4 relays, it is recommended that you send a ROUTe:OPEN:ABUS ALL command prior to scanning operations.
 - d. While the temporary scan is running, the instrument prevents use of all channels in banks that contain one or more channels in the specified <ch_list> (these channels are dedicated to the temporary scan). In addition, the instrument prevents use of all ABus1 and ABus2 relays on banks containing channels in the <ch_list>. If one or more channels configured for 4-wire measurements are included in the <ch_list>, then the rules for ABus2 relay operations are extended to the non-scanned banks as well.
 - e. At the end of the temporary scan, the last channel that was scanned will be opened (as well as any Analog Bus relays used during the scan). Any channels that were opened during the scan will remain open at the completion of the scan.
 - If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.

- When you specify a range of channels with this command, any channels that are invalid will be ignored (no error will be generated) but the first and last channel in the range must be valid for the selected function. The Analog Bus relays (numbered **s911**, **s912**, **s913**, etc.) on the multiplexer and matrix modules are ignored if they are included in a range of channels. An error will be generated if an Analog Bus relay is specified as the first or last channel in a range of channels.
- You can allow the instrument to automatically select the measurement range using *autoranging* or you can select a fixed range using *manual ranging*. Autoranging is convenient because the instrument decides which range to use for each measurement based on the input signal. For fastest scanning operation, use manual ranging on each measurement (some additional time is required for autoranging since the instrument has to make a range selection).
- If you select autoranging (by specifying "AUTO" or "DEF"), an error will be generated if you specify a discrete value for the <resolution> parameter. When autoranging is combined with a discrete resolution, the instrument cannot accurately resolve the integration time (especially if the input signal is continuously changing). If your application requires autoranging, be sure to specify "DEF" for the <resolution> parameter or omit the parameter from the command.
- Autorange thresholds:

Down range <10% of range
 at:
 Up range at: >120% of range

- If the input signal is greater than can be measured on the selected range (manual ranging), the instrument gives an *overload indication*: "**±OVLD**" from the front panel or "**±9.9E+37**" from the remote interface.
- The 34923A, 34924A, and 34933A modules use *non-latching* reed relays. Due to power dissipation issues, there is a limit to the number of relays that can be closed at a time on these modules (you cannot close all channels simultaneously). See the **ROUTe:CLOSE** command for details.
- The *Safety Interlock* feature prevents connections to the Analog Buses if no terminal block or properly-wired cable is connected to the module. An error will be generated if scanning is performed on banks without a terminal block or properly-wired cable. See the **SYSTem:ABUS:INTerlock:SIMulate** command to *temporarily* disable errors generated by the Safety Interlock feature.
- The ***RST** command will clear the scan list and set all measurement parameters to their factory settings. The Instrument Preset (**SYSTem:PRESet** command) will not clear the scan list; however, this command will clear reading memory and all stored statistical data.

Return Format

The command returns one reading for each channel specified (multiple responses are separated by commas). If you omit the <ch_list> parameter, the command applies to the internal DMM and a single reading is returned. The output from this command is *not* affected by the settings of the **FORMat:READing** commands.

Examples

The following command configures the instrument for dc voltage measurements, triggers the internal DMM to scan one channel (channel 4 in slot 3), and then transfers the reading to reading memory and the instrument's output buffer. The default range (autorange) and resolution (1 PLC) are used for the measurement.

```
MEAS:VOLT:DC? (@3004)
```

Typical Response: **+1.86850000E-03**

The following command configures the instrument for dc voltage measurements, triggers the internal DMM to scan two channels (channels 3 and 8 in slot 1), and then transfers the reading to reading memory and the instrument's output buffer. The 1 V range is selected with 1 mV resolution.

```
MEAS:VOLT:DC? 1,0.001, (@1003,1008)
```

Typical Response: **+4.27150000E-03,+1.32130000E-03**

The following command configures the internal DMM for a dc voltage measurement (no <ch_list> is specified), triggers the internal DMM, and then transfers the reading to reading memory and the instrument's output buffer. The default range and resolution are used for the measurement.

```
MEAS:VOLT:DC? !Applies to the internal DMM
```

Typical Response: **+1.26360000E-02**

See Also

CONFigure[:VOLTage][:DC]

ROUTe:SCAN:ORDer

[SENSe:]VOLTage[:DC]:IMPedance:AUTO

[SENSe:]VOLTage[:DC]:ZERO:AUTO

MEMory Subsystem Introduction

Command Summary

NOTE

Hold the mouse cursor over a command to view the full syntax statement.

MEMory:NSTates?

MEMory:STAtE:CATalog?

MEMory:STAtE:DELeTe

MEMory:STAtE:DELeTe:ALL

MEMory:STAtE:NAME

MEMory:STAtE:NAME?

MEMory:STAtE:RECall:AUTO

MEMory:STAtE:RECall:AUTO?

MEMory:STAtE:RECall:SELeCt

MEMory:STAtE:RECall:SELeCt?

MEMory:STAtE:VALId?

MEMory:NSTates?

Syntax | Description | Parameters | Remarks | Return Format | Example

Syntax

MEMory:NSTates?

Description

This command returns the total number of memory locations available for state storage. For the 34980A, this command always returns "+5".

MEMory:STATe:CATalog?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

MEMory:STATe:CATalog?

Description

This command returns the names assigned to storage locations 1 through 5. When shipped from the factory, default names are assigned to storage locations 1 through 5 ("STATE_1", "STATE_2", etc.).

Return Format

This command returns a comma-separated list representing the names assigned to the storage locations.

Example

The following command returns the names assigned to storage locations 1 through 5 (the quotes are also returned for each name).

```
MEM:STAT:CAT?
```

Typical Response: "STATE_1","STATE_2","STATE_3","STATE_4","STATE_5"

See Also

[MEMory:STATe:NAME](#)

MEMory:STATe:DELeTe

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

MEMory:STATe:DELeTe {1|2|3|4|5}

MEMory:STATe:DELeTe:ALL

Description

This command deletes the contents of the specified storage location.

Remarks

- If you have named a storage location (see **MEMory:STATe:NAME** command), deleting the contents of a storage location will reset the associated name to its factory default ("STATE_1", "STATE_2", "STATE_3", etc.).
- Note that you cannot recall the instrument state from a storage location that was deleted. An error is generated if you attempt to recall a deleted state (+291,"Not able to recall state: it is empty").

Examples

The following command deletes the contents of storage location 1.

```
MEM:STAT:DEL 1
```

The following command deletes the contents of storage locations 1 through 5.

```
MEM:STAT:DEL:ALL
```

See Also

***SAV**

***RCL**

MEMory:STATe:DELeTe

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

MEMory:STATe:DELeTe {1|2|3|4|5}

MEMory:STATe:DELeTe:ALL

Description

This command deletes the contents of the specified storage location.

Remarks

- If you have named a storage location (see **MEMory:STATe:NAME** command), deleting the contents of a storage location will reset the associated name to its factory default ("STATE_1", "STATE_2", "STATE_3", etc.).
- Note that you cannot recall the instrument state from a storage location that was deleted. An error is generated if you attempt to recall a deleted state (**+291,"Not able to recall state: it is empty"**).

Examples

The following command deletes the contents of storage location 1.

```
MEM:STAT:DEL 1
```

The following command deletes the contents of storage locations 1 through 5.

```
MEM:STAT:DEL:ALL
```

See Also

***SAV**

***RCL**

MEMory:STAtE:NAME

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

MEMory:STAtE:NAME {1|2|3|4|5} [,<name>]

MEMory:STAtE:NAME? {1|2|3|4|5}

Description

This command assigns a name to the specified storage location. You can name a location from the front panel or over the remote interface but you can recall a named state *only* from the front panel. From the remote interface, you can only recall a stored state using the ***RCL** command with number (1 through 5).

Parameters

Name	Type	Range of Values	Default Value
<name>	ASCII String	A string of up to 12 characters. The first character must be a letter (A-Z), but the remaining 11 characters can be letters, numbers (0-9), or the underscore character ("_"). Blank spaces are not allowed.	If omitted, the default name is used for the specified storage location.

Remarks

- When shipped from the factory, default names are assigned to storage locations 1 through 5. The default names are "STATE_1", "STATE_2", etc.
- If you omit the <name> parameter, the default name is assigned to the specified storage location. This provides an easy way to reset the associated name to its factory default; however, the stored state is *not* deleted.
- An error is generated if you specify a name with more than 12 characters.
- Deleting the contents of a storage location (see **MEMory:STAtE:DELeTe** command) will reset the associated name to its factory default ("STATE_1", "STATE_2", etc.).
- A Factory Reset (***RST** command) does not affect the configurations stored in memory. Once a state is stored, it remains until it is overwritten or specifically deleted.

Return Format

The query command reads the name assigned to the specified storage location and returns an ASCII string. If the specified location has no custom assigned, the default name is returned ("STATE_1", "STATE_2", etc.).

Examples

The following command assigns a name to storage location 1.

```
MEM:STAT:NAME 1,TEST_RACK_1
```

The following query returns the name assigned to storage location 1.

```
MEM:STAT:NAME? 1
```

Typical Response: **TEST_RACK_1**

See Also

MEMory:STATe:CATalog?

***SAV**

***RCL**

MEMory:STATe:RECall:AUTO

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

MEMory:STATe:RECall:AUTO <mode>

MEMory:STATe:RECall:AUTO?

Description

This command enables or disables (default) the automatic recall of a specific stored instrument state when power is turned on. Select "ON" to automatically recall one of the five stored states or the power-down state (see **MEMory:STATe:RECall:SElect** command). Select "OFF" to issue a Factory Reset when power is turned on (in this mode, the power-down state is *not* automatically recalled).

Parameters

Name	Type	Range of Values	Default Value
<mode>	Discrete	{OFF 0 ON 1}	Off

Remarks

- When shipped from the factory, storage locations 1 through 5 are empty and the automatic recall mode is disabled.
- Before enabling the automatic recall mode, you should first store the state that you want to restore (see ***SAV** command) and then select that state with the **MEMory:STATe:RECall:SElect** command. If you enable the automatic recall mode but have not stored the selected state (or if the state has been deleted), an error will be generated.

Return Format

The query command returns "0" (OFF) or "1" (ON).

Examples

The following command stores the instrument state in location 2, selects state 2 to be recalled at power-on, and enables the automatic recall mode.

```
*SAV 2
MEM:STAT:REC:SELECT 2
MEM:STAT:REC:AUTO ON
```

The following query returns the automatic recall setting.

MEM:STAT:REC:AUTO?

Typical Response: 1

See Also

MEMory:STATe:RECall:SElect

*SAV

MEMory:STAtE:RECall:SElect

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

MEMory:STAtE:RECall:SElect {0|1|2|3|4|5}

MEMory:STAtE:RECall:SElect?

Description

This command selects which instrument state will be used at power on if the automatic recall mode is enabled (see **MEMory:STAtE:RECall:AUTO ON** command). If the automatic recall mode is disabled (MEMory:STAtE:RECall:AUTO OFF), then a Factory Reset (***RST** command) is issued when power is turned on.

Remarks

- When shipped from the factory, storage locations 1 through 5 are empty and the automatic recall mode is disabled (see **MEMory:STAtE:RECall:AUTO OFF** command).
- Before enabling the automatic recall mode, you should first store the state that you want to restored (see ***SAV** command) and then select that state using the MEMory:STAtE:RECall:SElect command. If you enable the automatic recall mode but have not stored the selected state (or if the state has been deleted), an error will be generated when power is turned on.
- The power-down state is automatically stored in location 0 (this location is available only to store the power-down state). When power is lost, the instrument stores the following:
 - a. All non-channel specific configurations such as the internal DMM configuration, scanning parameters, reading output format, triggering parameters, etc.
 - b. The open/closed state of the switches on all installed modules. Per-channel measurement/math configurations are *not* stored and will be initialized to their factory defaults on all channels.

Return Format

The query command returns "0", "1", "2", "3", "4", or "5" indicating which instrument state will be used at power on. When shipped from the factory, the query command will return "0" indicating that the power-down state has been selected. Note that by default, MEMory:STAtE:RECall:AUTO will be OFF, which automatically issues a Factory Reset when power is turned on (regardless of the automatic recall setting).

Examples

The following command stores the instrument state in location 2, selects state 2 to be recalled at power-on, and enables the automatic recall mode.

```
*SAV 2  
MEM:STAT:REC:SELECT 2  
MEM:STAT:REC:AUTO ON
```

The following query returns the instrument state selected.

```
MEM:STAT:REC:SEL?
```

Typical Response: **2**

See Also

MEMory:STATe:RECall:AUTO

***SAV**

MEMory:STATe:VALid?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

MEMory:STATe:VALid? {1|2|3|4|5}

Description

This command queries the specified storage location to determine if a valid state is currently stored in this location. During the validation process, the instrument verifies that the location is *not* empty. You can use this command before sending the ***RCL** command to determine if a state has been previously stored in this location.

Remarks

- This command does not guarantee that no errors will be generated when a stored state is recalled using the ***RCL** command. Even if this command determines that the specified storage location is valid, individual modules may still be in states that will generate an error.

Return Format

The command returns "0" if no state has been stored or if it has been deleted. Returns "1" if a valid state is stored in this location.

Example

The following command returns the state of storage location 3.

```
MEM:STAT:VAL? 3
```

Typical Response: 0

See Also

***RCL**

***SAV**

OUTPut Subsystem Introduction

Command Summary

NOTE

Hold the mouse cursor over a command to view the full syntax statement.

OUTPut:ALARm<*n*>:CLEar
OUTPut:ALARm:CLEar:ALL
OUTPut:ALARm:MODE
OUTPut:ALARm:MODE?
OUTPut:ALARm:SLOPe
OUTPut:ALARm:SLOPe?
OUTPut:ALARm<*n*>:SEQuence?
OUTPut:ALARm<*n*>:SOURce
OUTPut:ALARm<*n*>:SOURce?
OUTPut[:STATe]
OUTPut[:STATe]?

OUTPut:ALARm<n>:CLEar

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

OUTPut:ALARm<n>:CLEar

OUTPut:ALARm:CLEar:ALL

Description

This command clears the specified alarm output line. Send the OUTPut:ALARm:CLEar:ALL command to clear all four alarm output lines.

Used With:

- 34921A through 34925A Multiplexer Modules
- 34950A Digital I/O Module (digital input and counter channels only)
- 34952A Multifunction Module (digital input and totalizer channels only)

Parameters

Name	Type	Range of Values	Default Value
<n>	Discrete	{1 2 3 4}	This is a required parameter

Remarks

- You can manually clear the output lines at any time (even during a scan) and the alarm data in memory is not cleared (however, data is cleared when you initiate a new scan). The alarm outputs are also cleared when you initiate a new scan.
- A Factory Reset (***RST** command) clears all four alarm outputs but does not clear the alarm queue in either configuration.

Examples

The following command clears alarm output line 2.

```
OUTP:ALAR2:CLE
```

The following command clears all four alarm output lines.

```
OUTP:ALAR:CLE:ALL
```

See Also

`OUTPut:ALARm:MODE`

`OUTPut:ALARm:SLOPe`

`OUTPut:ALARm<n>:SOURce`

OUTPut:ALARm<n>:CLEar

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

OUTPut:ALARm<n>:CLEar

OUTPut:ALARm:CLEar:ALL

Description

This command clears the specified alarm output line. Send the OUTPut:ALARm:CLEar:ALL command to clear all four alarm output lines.

Used With:

- 34921A through 34925A Multiplexer Modules
- 34950A Digital I/O Module (digital input and counter channels only)
- 34952A Multifunction Module (digital input and totalizer channels only)

Parameters

Name	Type	Range of Values	Default Value
<n>	Discrete	{1 2 3 4}	This is a required parameter

Remarks

- You can manually clear the output lines at any time (even during a scan) and the alarm data in memory is not cleared (however, data is cleared when you initiate a new scan). The alarm outputs are also cleared when you initiate a new scan.
- A Factory Reset (***RST** command) clears all four alarm outputs but does not clear the alarm queue in either configuration.

Examples

The following command clears alarm output line 2.

```
OUTP:ALAR2:CLE
```

The following command clears all four alarm output lines.

```
OUTP:ALAR:CLE:ALL
```

See Also

`OUTPut:ALARm:MODE`

`OUTPut:ALARm:SLOPe`

`OUTPut:ALARm<n>:SOURce`

OUTPut:ALARm:MODE

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

OUTPut:ALARm:MODE <mode>

OUTPut:ALARm:MODE?

Description

This command selects the configuration of the four TTL alarm output lines (the selected configuration applies to all four alarm output lines). The four alarm outputs are available from the rear-panel **Alarm Output** connector.

Latch Mode: In this mode (default), the corresponding output line is latched true when the first alarm occurs and remains asserted until you clear it by initiating a new scan or cycling power. You can manually clear the output lines at any time (even during a scan) and the alarm data in memory is not cleared (however, data is cleared when you initiate a new scan).

Track Mode: In this mode, the corresponding output line is asserted only while a channel's reading crosses a limit and subsequent readings remain outside the limit. When a reading returns to within limits, the output line is automatically cleared. You can manually clear the output lines at any time (even during a scan) and the alarm data in memory is not cleared (however, data is cleared when you initiate a new scan). The alarm outputs are also cleared when you initiate a new scan.

Used With:

- 34921A through 34925A Multiplexer Modules
- 34950A Digital I/O Module (digital input and counter channels only)
- 34952A Multifunction Module (digital input and totalizer channels only)

Parameters

Name	Type	Range of Values	Default Value
<mode>	Discrete	{LATCh TRACk}	LATCh

Remarks

- A Factory Reset (***RST** command) clears all four alarm outputs but does not clear the alarm queue in either configuration.

Return Format

The query command returns "LATC" or "TRAC". The selected configuration applies to all four alarm output lines.

Examples

The following command enables the track mode on all four alarm output lines.

```
OUTP:ALAR:MODE TRAC
```

The following query returns the configuration of the four alarm output lines.

```
OUTP:ALAR:MODE?
```

Typical Response: **TRAC**

See Also

OUTPut:ALARm:SLOPe

OUTPut:ALARm<n>:SOURce

OUTPut:ALARm<n>:CLEar

OUTPut:ALARm<n>:SEQuence

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

OUTPut:ALARm<n>:SEQuence?

Description

This command returns the name of the sequence currently associated with the specified alarm.

Used With:

- 34921A through 34925A Multiplexer Modules
- 34950A Digital I/O Module (digital input and counter channels only)
- 34952A Multifunction Module (digital input and totalizer channels only)

Parameters

Name	Type	Range of Values	Default Value
<n>	Discrete	{1 2 3 4}	This is a required parameter

Remarks

- You can assign multiple channels to any of the four available alarms (numbered 1 through 4, see **OUTPut:ALARm<n>:SOURce** command). For example, you can configure the instrument to generate an alarm on the Alarm 1 output when a limit is exceeded on any of channels 1003, 2005, or 3010. You cannot, however, assign alarms on a specific channel to more than one alarm number.
- A Factory Reset (***RST** command) will remove all alarm associations. Redefining or deleting a sequence will also remove all alarm associations.

Return Format

This command returns the sequence name currently associated with the specified alarm. If no sequence has been associated, "NONE" is returned.

Example

The following query returns the sequence name currently associated with Alarm 1.

```
OUTPut:ALAR1:SEQ?
```

Typical Response: MYSEQ_1

See Also

OUTPut:ALARm<*n*>:SOURce

ROUTe:SEQuence:TRIGger:SOURce

OUTPut:ALARm:SLOPe

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

OUTPut:ALARm:SLOPe <edge>

OUTPut:ALARm:SLOPe?

Description

This command selects the slope of the pulse from the four TTL alarm outputs (the selected configuration applies to all four alarm output lines). The four alarm outputs are available from the rear-panel **Alarm Output** connector.

If you select the negative/falling edge, 0V (TTL low) indicates an alarm. If you select the positive/rising edge, +5V (TTL high) indicates an alarm.

NOTE

 Changing the slope of the output lines may cause the lines to change state.

Used With:

- 34921A through 34925A Multiplexer Modules
- 34950A Digital I/O Module (digital input and counter channels only)
- 34952A Multifunction Module (digital input and totalizer channels only)

Parameters

Name	Type	Range of Values	Default Value
<edge>	Discrete	{NEGative POSitive}	NEGative



Remarks

- A Factory Reset (***RST** command) resets the slope to the negative/falling edge.

Return Format

The query command returns "NEG" or "POS". The selected configuration applies to all four alarm output lines.

Examples

The following command selects the positive/rising edge on all four alarm output lines.

```
OUTP:ALAR:SLOP POS
```

The following query returns the slope of the four alarm output lines.

```
OUTP:ALAR:SLOPE?
```

Typical Response: **POS**

See Also

OUTPut:ALARm:MODE

OUTPut:ALARm<n>:SOURce

OUTPut:ALARM<n>:CLEar

OUTPut:ALARm<n>:SOURce

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

OUTPut:ALARm<n>:SOURce (@<ch_list>)

OUTPut:ALARm<n>:SOURce?

Description

This command assigns one of four alarm numbers to report any alarm conditions on the specified multiplexer or digital channels.

On the digital modules, you can configure the instrument to generate an alarm when a specific bit pattern or bit pattern change is detected on a digital input channel or when a specific count is reached on a totalizer channel. These channels do *not* have to be part of the active scan list to generate an alarm.

Used With:

- 34921A through 34925A Multiplexer Modules
- 34950A Digital I/O Module (digital input and counter channels only)
- 34952A Multifunction Module (digital input and totalizer channels only)

Parameters

Name	Type	Range of Values	Default Value
<n>	Discrete	{1 2 3 4}	This is a required parameter
<ch_list>	Numeric	One or more channels in the form (@sccc) . 34950A: Digital Input: s101 throughs104,s201 throughs204 Counter: s301 or s302 34952A: Digital Input: s001 through s004 Totalizer: s005	This is a required parameter

Remarks

- You can assign multiple channels to any of the four available alarms. For example, you can configure the instrument to generate an alarm on the Alarm 1 output when a limit is exceeded on any of channels 1003, 2005, or 3010. You cannot, however, assign alarms on a specific channel to more than one alarm number.
- To clear all channel assignments for a specific alarm, send the command with an empty channel list as shown in the example below:

OUTP:ALAR1:SOUR (@)

- A Factory Reset (***RST** command) clears all alarm limits and turns off all alarms. An Instrument Preset (**SYSTem:PRESet** command) or Card Reset (**SYSTem:CPON** command) does *not* clear the alarm limits and does *not* turn off alarms.

Return Format

The query command returns a series of channel numbers in **Definite-Length Block** format. The syntax is a pound sign (#) followed by a non-zero digit representing the number of digits in the decimal integer to follow. This digit is followed by a decimal integer indicating the number of 8-bit data bytes to follow. This is followed by a block of data containing the specified number of bytes.

For example:

2 digits follow
|
#217 (@1003,1013,1019)
|-----|
17 bytes follow 17 bytes of data (3 channels shown)

An empty scan list (one with no channels selected) will return "**#13(@)**".

Examples

The following command assigns Alarm 2 to report any alarm conditions on channels 3 and 13 in slot 1.

```
OUTP:ALAR2:SOUR (@1003,1013)
```

The following query returns the channels assigned to Alarm 2.

```
OUTP:ALAR2:SOUR?
```

Typical Response: **#212(@1003,1013)**

See Also

CALCulate:LIMit:LOWer

CALCulate:LIMit:UPPer

OUTPut:ALARm:MODE

OUTPut:ALARm:SLOPe

OUTPut:ALARM<n>:CLEar

OUTPut[:STATe]

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

OUTPut[:STATe] <mode>, (@<ch_list>)

OUTPut[:STATe]? (@<ch_list>)

Description

This command disables or enables the output state of the specified channels on the 34951A Isolated DAC Module. When enabled, the corresponding output relay is closed thus enabling signal outputs from the specified channels.

Parameters

Name	Type	Range of Values	Default Value
<mode>	Discrete	{OFF 0 ON 1}	This is a required parameter
<ch_list>	Numeric	One or more channels in the form (@sccc). Select from s001, s002, s003, or s004.	This is a required parameter

Remarks

- If multiple channels on the same module are specified, the outputs from these channels will be enabled at the same time. If the channels are on different modules, you may notice some timing differences between the modules.
- Since the DAC channels on 34952A Multifunction Module do not implement output relays, this command is not used with that module.
- A Factory Reset (*RST command), Instrument Preset (SYSTem:PRESet command), and Card Reset (SYSTem:CPON command) will turn off the output state.

Return Format

The query command returns "0" (OFF) or "1" (ON). Multiple responses are separated by commas.

Examples

The following command enables the output state of DAC channels 1 and 2 in slot 4.

```
OUTP ON, (@4001,4002)
```

The following query returns the output state of DAC channels 1 and 2 in slot 4.

```
OUTP? (@4001,4002)
```

Typical Response: **1,1**

See Also

SOURce:CURRent[:LEVel]

SOURce:FUNCTion:ENABle

SOURce:VOLTage[:LEVel]

ROUTe Subsystem Introduction

Command Summary

NOTE

Hold the mouse cursor over a command to view the full syntax statement.

Switch Control

ROUTe:CHANnel:ADVance:SOURce
ROUTe:CHANnel:ADVance:SOURce?
ROUTe:CHANnel:DElay
ROUTe:CHANnel:DElay?
ROUTe:CHANnel:DElay:AUTO
ROUTe:CHANnel:DElay:AUTO?
ROUTe:CHANnel:DRive:CLose:DEfault
ROUTe:CHANnel:DRive:CLose:DEfault?
ROUTe:CHANnel:DRive:OPEN:DEfault
ROUTe:CHANnel:DRive:OPEN:DEfault?
ROUTe:CHANnel:DRive:PAIRed[:MODE]
ROUTe:CHANnel:DRive:PAIRed[:MODE]?
ROUTe:CHANnel:DRive:PULSe[:MODE]
ROUTe:CHANnel:DRive:PULSe[:MODE]?
ROUTe:CHANnel:DRive:PULSe:WIDTh
ROUTe:CHANnel:DRive:PULSe:WIDTh?
ROUTe:CHANnel:DRive:STATe?
ROUTe:CHANnel:DRive:TIME:RECoverY
ROUTe:CHANnel:DRive:TIME:RECoverY?
ROUTe:CHANnel:DRive:TIME:SETTle
ROUTe:CHANnel:DRive:TIME:SETTle?
ROUTe:CHANnel:FWIRe
ROUTe:CHANnel:FWIRe?
ROUTe:CHANnel:LABel:CLEar:MODule
ROUTe:CHANnel:LABel[:DEFine]
ROUTe:CHANnel:LABel[:DEFine]?
ROUTe:CHANnel:VERify[:ENABle]
ROUTe:CHANnel:VERify[:ENABle]?
ROUTe:CHANnel:VERify:POLarity
ROUTe:CHANnel:VERify:POLarity?
ROUTe:CHANnel:VERify:POSition:STATe?
ROUTe:CLose
ROUTe:CLose:EXCLusive

ROUTe:CLOSE?
ROUTe:MODUle:BUSY?
ROUTe:MODUle:WAIT
ROUTe:MODUle:WAIT?
ROUTe:MONitor[:CHANnel]
ROUTe:MONitor[:CHANnel]?
ROUTe:MONitor[:CHANnel]:ENABLE
ROUTe:MONitor[:CHANnel]:ENABLE?
ROUTe:MONitor:DATA?
ROUTe:MONitor:MODE
ROUTe:MONitor:MODE?
ROUTe:MONitor:STATe
ROUTe:MONitor:STATe?
ROUTe:OPEN
ROUTe:OPEN?
ROUTe:OPEN:ABUS
ROUTe:OPEN:ALL
ROUTe:OPERation:OVERlap[:ENABLE]
ROUTe:OPERation:OVERlap[:ENABLE]?
ROUTe:RMODUle:BANK:DRIVE[:MODE]
ROUTe:RMODUle:BANK:DRIVE[:MODE]?
ROUTe:RMODUle:BANK:LED:DRIVE[:ENABLE]
ROUTe:RMODUle:BANK:LED:DRIVE[:ENABLE]?
ROUTe:RMODUle:BANK:LED:DRIVE:LEVel
ROUTe:RMODUle:BANK:LED:DRIVE:LEVel?
ROUTe:RMODUle:BANK:PRESet
ROUTe:RMODUle:DRIVE:LIMit
ROUTe:RMODUle:DRIVE:LIMit?
ROUTe:RMODUle:DRIVE:SOURce:BOOT
ROUTe:RMODUle:DRIVE:SOURce:BOOT?
ROUTe:RMODUle:DRIVE:SOURce[:IMMediate]
ROUTe:RMODUle:DRIVE:SOURce[:IMMediate]?
ROUTe:SCAN
ROUTe:SCAN?
ROUTe:SCAN:ADD
ROUTe:SCAN:ORDerEd
ROUTe:SCAN:ORDerEd?
ROUTe:SCAN:REMOve
ROUTe:SCAN:SIZE?

Sequence Operation

ROUTe:SEQuence:ABORt
ROUTe:SEQuence:BUSY?

ROUTe:SEQuence:CATalog?
ROUTe:SEQuence:DEFine
ROUTe:SEQuence:DEFine?
ROUTe:SEQuence:DELeTe:ALL
ROUTe:SEQuence:DELeTe[:NAME]
ROUTe:SEQuence:RUNNing:NAME?
ROUTe:SEQuence:TRIGger[:IMMediate]
ROUTe:SEQuence:TRIGger:SOURce
ROUTe:SEQuence:TRIGger:SOURce?
ROUTe:SEQuence:WAIT

ROUTe:CHANnel:ADVance:SOURce

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

ROUTe:CHANnel:ADVance:SOURce <source>

ROUTe:CHANnel:ADVance:SOURce?

Description

This command selects the source to provide the channel advance signal to the next channel in the scan list for external scanning. When the channel advance signal is received, the instrument opens the currently selected channel and closes the next channel in the scan list. The instrument will accept an external TTL trigger pulse, a software (bus) command, or an immediate (continuous) scan trigger.

NOTE

This command is valid only when the internal DMM is disabled (see [INSTrument:DMM\[:STATe\]](#) command) or removed from the Keysight 34980A.

Used With:

- 34921A through 34925A Multiplexer Modules

Parameters

Name	Type	Range of Values	Default Value
<source>	Discrete	{EXTernal BUS IMMediate}	EXTernal

Remarks

- For the *EXTernal* source, the 34980A will accept a hardware trigger applied to the rear-panel *Chan Adv Input* line (Pin 6). For an external device such as a DMM, the trigger received by the 34980A is normally sourced by the DMM's *Voltmeter Complete* output signal. The 34980A advances to the next channel in the scan list each time a low-true TTL pulse is received.
- For the *BUS* (software) source, the 34980A is triggered by the **TRG* command received over the remote interface. The **TRG* command will not be accepted unless the 34980A is in the "wait-for-trigger" state (see *INITiate* command). If the internal DMM receives an external trigger before the next "waiting for trigger" state, it will buffer one **TRG* command and then ignore any additional triggers received (no error is generated).
- For the *IMMediate* (continuous) source, the channel advance signal is always present.

- The channel advance signal is ignored unless you have initiated the scan (**INITiate** command) and have received a scan trigger (**TRIGger:SOURce** command). Although the **ROUTe:CHANnel:ADVance:SOURce** command shares some of the same signals as the **TRIGger:SOURce** command, they cannot be set to the same source (except **IMMEDIATE**). If you attempt to select the same source, an error is generated and the **TRIGger:SOURce** is reset to **IMMEDIATE**.
- When the first trigger is received, the 34980A closes the first channel in the scan list *without* waiting for the specified channel advance source. If the channel advance source is **EXTERNAL** and the 34980A receives an event before it is ready, it will buffer one event and then ignore any additional events received (no error is generated).
- After the final channel in the scan list is closed, one more channel advance event must be received to complete the scan.
- A channel advance signal is not required for digital input or totalizer channels included in the scan list. Measurements on these channels are still performed by the 34980A (no internal DMM required) and do not require synchronization with the external instrument.

Return Format

The query command returns the present channel advance source: "EXT", "BUS", or "IMM".

Examples

The following program segment configures the 34980A for scanning using an external channel advance source. In this configuration, the 34980A advances to the next channel in the scan list each time a low-true TTL pulse is received.

```
INST:DMM OFF !Disable internal DMM
ROUT:SCAN (@1001:1020) !Configure scan list
  TRIG:SOUR IMM !Set trigger source
  TRIG:COUN 5 !Set trigger count
ROUT:CHAN:ADV:SOUR EXT !Set channel advance source
```

The following query returns the channel advance source currently selected on the 34980A.

```
ROUT:CHAN:ADV:SOUR?
```

Typical Response: **EXT**

See Also

INITiate

INSTrument:DMM[:STATe]

ROUTe:CHANnel:FWIRe

TRIGger:SOURce

ROUTe:CHANnel:DElay

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

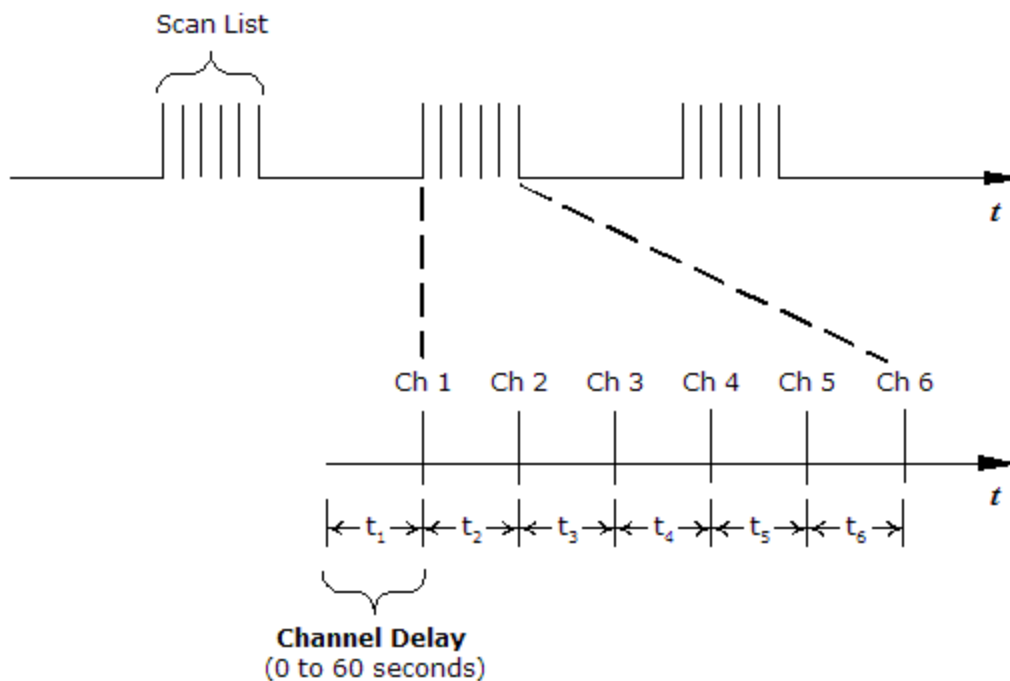
Syntax

ROUTe:CHANnel:DElay {<seconds>|MIN|MAX|DEF}, (@<ch_list>)

ROUTe:CHANnel:DElay? [{MIN|MAX},] (@<ch_list>)

Description

This command adds a delay between multiplexer channels in the scan list (useful for high-impedance or high-capacitance circuits). The delay is inserted between the relay closure and the actual measurement on *each* channel, in addition to any delay that will implicitly occur due to relay settling time. The programmed channel delay overrides the default channel delay that the instrument automatically adds to each channel.



Used With:

- 34921A through 34925A Multiplexer Modules
- 34950A Digital I/O Module (digital input and counter channels only)
- 34952A Multifunction Module (digital input and totalizer channels only)

Parameters

Name	Type	Range of Values	Default Value
<seconds>	Numeric	0 to 60 seconds, with 1 ms resolution. MIN = 0 seconds, MAX = 60 seconds	Automatic
<ch_list>	Numeric	One or more channels in the form (@sccc).	This is a required parameter

Remarks

- You can select a unique delay for each channel on the module. The default channel delay is automatic; the instrument determines the delay based on function, range, integration time, and ac filter setting.
- The channel delay is valid only while scanning. If no channels have been assigned to the scan list (see ROUTe:SCAN command), the specified channel delay is ignored (no error is generated).
- To ensure you are getting the most accurate measurements possible, use care when setting the channel delay less than the default value (Automatic). The default channel delay is designed to optimize parameters, such as settling time, for the most accurate measurements.
- The CONFigure and MEASure? commands set the channel delay to Automatic.
- The instrument sets the channel delay to Automatic after a Factory Reset (*RST command).

Return Format

The query command returns the delay in seconds in the form "+1.00000000E+00" for each channel specified. Multiple responses are separated by commas.

Examples

The following command adds a 2-second channel delay to channels 3 and 13 in slot 1.

```
ROUT:CHAN:DEL 2, (@1003,1013)
```

The following query returns the channel delay selected on channels 3 and 13 in slot 1.

```
ROUT:CHAN:DEL? (@1003,1013)
```

Typical Response: +2.00000000E+00,+2.00000000E+00

See Also

ROUTe:CHANnel:DElay:AUTO

ROUTe:SCAN

ROUTe:CHANnel:DElay:AUTO

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

ROUTe:CHANnel:DElay:AUTO <mode>, (@<ch_list>)

ROUTe:CHANnel:DElay:AUTO? (@<ch_list>)

Description

This command disables or enables an automatic channel delay on the specified multiplexer channels. If enabled, the instrument determines the delay based on function, range, integration time, and ac filter setting.

Used With:

- 34921A through 34925A Multiplexer Modules
- 34950A Digital I/O Module (digital input and counter channels only)
- 34952A Multifunction Module (digital input and totalizer channels only)

Parameters

Name	Type	Range of Values	Default Value
<mode>	Boolean	{OFF 0 ON 1}	Automatic
<ch_list>	Numeric	One or more channels in the form <u>(@sccc)</u> .	This is a required parameter

Remarks

- Selecting a specific channel delay using the **ROUTe:CHANnel:DElay** command disables the automatic channel delay.
- The default channel delays for ac measurements do not account for worst case settling delays that can occur when measuring ac signals with large dc offsets. Significant measurement errors may result. Use the **TRIGger:DElay** command (for stand-alone DMM measurements) or **ROUTe:CHANnel:DElay** command (for scanned measurements) to allow adequate settling time before the measurement.
- The CONFigure and MEASure? commands set the channel delay to Automatic.
- The instrument sets the channel delay to Automatic after a Factory Reset (***RST** command).

Return Format

The query command returns "0" (OFF) or "1" (ON) for each channel specified. Multiple responses are separated by commas.

Examples

The following command enables an automatic channel delay on channels 3 and 13 in slot 1.

```
ROUT:CHAN:DEL:AUTO ON, (@1003,1013)
```

The following query returns the automatic channel delay settings on channels 3 and 13 in slot 1.

```
ROUT:CHAN:DEL:AUTO? (@1003,1013)
```

Typical Response: 1,1

See Also

[ROUTe:CHANnel:DElay](#)

[TRIGger:DElay](#)

ROUTe:CHANnel:DRIVE:CLOSe:DEFault

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

ROUTe:CHANnel:DRIVE:CLOSe:DEFault (@<ch_list>)

ROUTe:CHANnel:DRIVE:CLOSe:DEFault? (@<ch_list>)

Description

This command configures the specified channels on the 34945A Microwave Switch/Attenuator Driver to assume a default state of *closed* following the next boot (power) cycle, Factory Reset (***RST** command), Card Reset (**SYSTem:CPON** command), or when the drive source is changed (see **ROUTe:RMOdule:DRIVE:SOURce[:IMMediate]** command).

Used With:

- 34945A Microwave Switch/Attenuator Driver

Parameters

Name	Type	Range of Values	Default Value

<ch_list>	Numeric	One or more channels in the form (<u>@srcc</u>). Ba <i>sr</i> nk 01 1: thr ou gh <i>sr</i> 08 <i>sr</i> 11 thr ou gh <i>sr</i> 18 Ba <i>sr</i> nk 21 2: thr ou gh <i>sr</i> 28 <i>sr</i> 31 thr ou gh <i>sr</i> 38 Ba <i>sr</i> nk 41 3: thr ou gh <i>sr</i> 48 <i>sr</i> 51 thr ou gh <i>sr</i> 58	This is a required parameter

		Ba sr nk 61 4: thr ou gh sr 68 sr 71 thr ou gh sr 78 s: Mainframe slot number (1 through 8) r: 34945EXT remote module (1 through 8)	

Remarks

- This command configures the specified channels to assume a default state of *closed*. Use the **ROUTe:CHANnel:DRIVe:OPEN:DEFault** command to assume a default state of *opened*.
- You will normally want to send this command with the channel drive state disabled (see **ROUTe:RMODule:DRIVe:SOURce[:IMMediate]** command). When you change the drive state, all *unverified* channels on the specified module will be reset to their user-defined default values.
- Channels that are configured for non-paired, pulsed operations with a default closed state will be pulsed once following a reset/boot.
- The Factory Default for this attribute is *open* (channels assume an open state following a reset/boot). The **ROUTe:RMODule:BANK:PRESet** and **SYSTem:RMODule:RESet** commands will reset this attribute to the Factory Default open state, which overrides any previously-configured **ROUTe:CHANnel:DRIVe:CLOSe:DEFault** configuration.
- As you reconfigure the module, be sure to keep the channels affected by the default state up-to-date. For example, when you reconfigure the drive attributes associated with a given channel, you will normally want to update the default state as well.
- The default state is stored in **non-volatile** memory on the 34945EXT remote module.

Return Format

The query command returns "0" (OFF) or "1" (ON) for each channel specified. Multiple responses are separated by commas.

Examples

The following program segment configures the default state on channels 01 and 02 on Bank 2 on 34945EXT remote module #2 (slot 3).

```
ROUT:CHAN:DRIV:CLOS:DEF (@3201,3202) !Set default state  
ROUT:RMOD:DRIV:SOUR INT, (@3200) !Drive channels closed
```

The following query returns the default state of channels 01 and 02 on Bank 2 on 34945EXT remote module #2 (slot 3).

```
ROUT:CHAN:DRIV:CLOS:DEF? (@3201,3202)
```

Typical Response: 1,1

See Also

***RST**

ROUTe:CHANnel:DRIVe:OPEN:DEFault

ROUTe:RMODule:BANK:PRESet

ROUTe:RMODule:DRIVe:SOURce[:IMMediate]

SYSTem:CPON

SYSTem:RMODule:RESet

ROUTe:CHANnel:DRIVe:OPEN:DEFault

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

ROUTe:CHANnel:DRIVe:OPEN:DEFault (@<ch_list>)

ROUTe:CHANnel:DRIVe:OPEN:DEFault? (@<ch_list>)

Description

This command configures the specified channels on the 34945A Microwave Switch/Attenuator Driver to assume a default state of *open* following the next boot (power) cycle, Factory Reset (***RST** command), Card Reset (**SYSTem:CPON** command), or when the drive source is changed (see **ROUTe:RMODule:DRIVe:SOURce[:IMMediate]** command).

Used With:

- 34945A Microwave Switch/Attenuator Driver

Parameters

Name	Type	Range of Values	Default Value

<ch_list>	Numeric	One or more channels in the form (<u>@srcc</u>). Ba <i>sr</i> nk 01 1: thr ou gh <i>sr</i> 08 <i>sr</i> 11 thr ou gh <i>sr</i> 18 Ba <i>sr</i> nk 21 2: thr ou gh <i>sr</i> 28 <i>sr</i> 31 thr ou gh <i>sr</i> 38 Ba <i>sr</i> nk 41 3: thr ou gh <i>sr</i> 48 <i>sr</i> 51 thr ou gh <i>sr</i> 58	This is a required parameter

		Ba <i>sr</i> nk 61 4: thr ou gh <i>sr</i> 68 <i>sr</i> 71 thr ou gh <i>sr</i> 78 s: Mainframe slot number (1 through 8) r: 34945EXT remote module (1 through 8)	

Remarks

- This command configures the specified channels to assume a default state of *opened*. Use the **ROUTe:CHANnel:DRIVe:CLOSe:DEFAult** command to assume a default state of *closed*.
- You will normally want to send this command with the channel drive state disabled (see **ROUTe:RMOdule:DRIVe:SOURce[:IMMediate]** command). When you change the drive state, all *unverified* channels on the specified module will be reset to their user-defined default values.
- For channels that are configured for non-paired, pulsed operations with a default open state, no action will be taken (these channels may only be closed).
- The Factory Default for this attribute is *open* (channels assume an open state following a reset/boot). The **ROUTe:RMOdule:BANK:PRESet** and **SYSTem:RMOdule:RESet** commands will reset this attribute to the Factory Default open state.
- As you reconfigure the module, be sure to keep the channels affected by the default state up-to-date. For example, when you reconfigure the drive attributes associated with a given channel, you will normally want to update the default state as well.
- The default state is stored in **non-volatile** memory on the 34945EXT remote module.

Return Format

The query command returns "0" (OFF) or "1" (ON) for each channel specified. Multiple responses are separated by commas.

Examples

The following program segment configures the default state on channels 01 and 02 on Bank 2 on 34945EXT remote module #2 (slot 3).

```
ROUT:CHAN:DRIV:OPEN:DEF (@3201,3202) !Set default state  
ROUT:RMOD:DRIV:SOUR INT, (@3200) !Drive channels opened
```

The following query returns the default state of channels 01 and 02 on Bank 2 on 34945EXT remote module #2 (slot 3).

```
ROUT:CHAN:DRIV:OPEN:DEF? (@3201,3202)
```

Typical Response: 1,1

See Also

***RST**

ROUTe:CHANnel:DRIVe:CLOSe:DEFault

ROUTe:RMODule:BANK:PRESet

ROUTe:RMODule:DRIVe:SOURce[:IMMediate]

SYStem:RMODule:RESet

ROUTe:CHANnel:DRIVe:PAIRed[:MODE]

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

ROUTe:CHANnel:DRIVe:PAIRed[:MODE] <mode>, (@<ch_list>)

ROUTe:CHANnel:DRIVe:PAIRed[:MODE]? (@<ch_list>)

Description

This command enables or disables the paired mode on the specified channels on the 34945A Microwave Switch/Attenuator Driver. When enabled, the module automatically pairs channel *n* (as specified by this command) with channel *n+10* for two-coil (SP2T) operations. When disabled, the specified channels are configured for non-paired one-coil (SPST) operations.

Used With:

- 34945A Microwave Switch/Attenuator Driver

Parameters

Name	Type	Range of Values	Default Value
<mode>	Boolean	{OFF 0 ON 1}	OFF (paired mode disabled)

<ch_list>	Numeric	One or more channels in the form <u>(@srcc)</u>. For paired operations, channel <i>n</i> is automatically paired with channel <i>n+10</i> (e.g., 01 with 11, 21 with 31, 41 with 51, etc.). With this command, specify the <i>lower</i> numbered channel in the pair. <pre> Ba sr nk 01 1: thr ou gh sr 08 Ba sr nk 21 2: thr ou gh sr 28 Ba sr nk 41 3: thr ou gh sr 48 Ba sr nk 61 4: thr ou gh sr 68 </pre> s: Mainframe slot number (1 through 8) r: 34945EXT remote module (1 through 8)	This is a required parameter

Remarks

- In order to change the paired state, you must disable the channel drive state (see **ROUTE:RMOdule:DRIVE:SOURce[:IMMediate]** command). When you subsequently enable the channel drive state (by specifying EXTeRnal or INTeRnal), all *unverified* channels on the specified module will be reset to their user-defined default values (see **ROUTE:CHANnel:DRIVE:CLOSe:DEFault** and **ROUTE:CHANnel:DRIVE:OPeN:DEFault** commands).
- When pairing is enabled, both channels in each pair assume the existing attributes of the lower numbered channel as shown in the table below.

Attribute	Paired State
ROUTE:CHANnel:DRIVE:PULSe[:MODE]	ON (automatically enabled in paired mode)
ROUTE:CHANnel:DRIVE:PULSe:WIDTh	Assumes lower channel state
ROUTE:CHANnel:DRIVE:TIME:RECovery	Assumes lower channel state
ROUTE:CHANnel:DRIVE:TIME:SETTle	Assumes lower channel state
ROUTE:CHANnel:VERify[:ENABle]	Assumes lower channel state
ROUTE:CHANnel:VERify:POLarity	Assumes lower channel state

- As shown in the table above, when pairing is enabled the *pulsed* mode is automatically enabled (see **ROUTE:CHANnel:DRIVE:PULSe[:MODE]** command). The pulse width specified on the lower channel (see **ROUTE:CHANnel:DRIVE:PULSe:WIDTh** command) is applied to the upper channel.
- When pairing is enabled, the upper channel will retain its default state (see **ROUTE:CHANnel:DRIVE:CLOSe:DEFault** and **ROUTE:CHANnel:DRIVE:OPeN:DEFault** commands). However, while channels are paired the default state of the upper channel is irrelevant and only the lower channel's default state will apply.
- Since the TTL or open collector drive current mode is set on a *per-bank* basis (see **ROUTE:RMOdule:BANK:DRIVE[:MODE]** command), this attribute will always be the same between paired channels.
- When the paired mode is *disabled* with the pulsed mode enabled (see **ROUTE:CHANnel:DRIVE:PULSe[:MODE]** command), you cannot query the open/closed state of the associated channels unless verification is enabled (see **ROUTE:CHANnel:VERify[:ENABle]** command). While in this mode (one-coil operation), only "close" operations are allowed on the channels ("open" operations are not allowed).
- If you disable pairing on two previously paired channels, both channels will independently assume the attributes (pulse mode, pulse width, etc.) that they collectively had as paired channels. The default state that the upper channel had prior to pairing (see **ROUTE:CHANnel:DRIVE:CLOSe:DEFault** and **ROUTE:CHANnel:DRIVE:OPeN:DEFault** commands) will become relevant again.
- The paired mode setting is stored in **non-volatile** memory on the 34945EXT remote module.

Return Format

The query command returns "0" (OFF) or "1" (ON) for each channel specified. Multiple responses are separated by commas. You can query the paired state whether the channel drive state is enabled or disabled.

Examples

The following program segment enables the paired mode on channels 01 and 02 on Bank 2 on 34945EXT remote module #2 (slot 3). Channel 01 is paired with channel 11 and channel 02 is paired with channel 12.

```
ROUT:RMOD:DRIV:SOUR OFF, (@3200) !Must disable channel drive  
ROUT:CHAN:DRIV:PAIR ON, (@3201, 3202) !Enable paired mode
```

The following query returns the paired state of channels 01 and 02 on Bank 2 on 34945EXT remote module #2 (slot 3).

```
ROUT:CHAN:DRIV:PAIR? (@3201, 3202)
```

Typical Response: 1,1

See Also

[ROUTe:CHANnel:DRIVe:CLOSe:DEFault](#)

[ROUTe:CHANnel:DRIVe:OPeN:DEFault](#)

[ROUTe:CHANnel:DRIVe:PULSe\[:MODE\]](#)

[ROUTe:CHANnel:DRIVe:PULSe:WIDTh](#)

[ROUTe:CHANnel:VERify\[:ENABLe\]](#)

[ROUTe:CHANnel:VERify:POLarity](#)

[ROUTe:RMODule:DRIVe:SOURce\[:IMMediate\]](#)

ROUTe:CHANnel:DRIVe:PULSe[:MODE]

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Syntax

ROUTe:CHANnel:DRIVe:PULSe[:MODE] <mode>, (@<ch_list>)

ROUTe:CHANnel:DRIVe:PULSe[:MODE]? (@<ch_list>)

Description

This command enables or disables the pulsed drive mode on the specified channels on the 34945A Microwave Switch/Attenuator Driver. When the pulsed mode is disabled, the continuous drive mode is enabled (sometimes referred to as the *level control* mode). The continuous drive mode is useful for driving non-latching devices.

Used With:

- 34945A Microwave Switch/Attenuator Driver

Parameters

Name	Type	Range of Values	Default Value
<mode>	Boolean	{OFF 0 ON 1}	ON (pulsed mode enabled)

<ch_list>	Numeric	One or more channels in the form (<u>@srcc</u>).	This is a required parameter
		Ba sr nk 01 1: thr ou gh sr 08 sr 11 thr ou gh sr 18 Ba sr nk 21 2: thr ou gh sr 28 sr 31 thr ou gh sr 38 Ba sr nk 41 3: thr ou gh sr 48 sr 51 thr ou gh sr 58	

		Ba <i>sr</i> nk 61 4: thr ou gh <i>sr</i> 68 <i>sr</i> 71 thr ou gh <i>sr</i> 78 s: Mainframe slot number (1 through 8) r: 34945EXT remote module (1 through 8)	

Remarks

- In order to change the pulsed state, you must disable the channel drive state (see **ROUTe:RMOdule:DRIVE:SOURce[:IMMediate]** command). When you subsequently enable the channel drive state (by specifying EXTeRnal or INTeRnal), all *unverified* channels on the specified module will be reset to their user-defined default values (see **ROUTe:CHANnel:DRIVE:CLOSe:DEFault** and **ROUTe:CHANnel:DRIVE:OPEN:DEFault** commands).
- When channel *pairing* is enabled (see **ROUTe:CHANnel:DRIVE:PAIRed[:MODE]** command), an error will be generated if you attempt to disable the pulsed mode.
- For the continuous (non pulsed) mode, it is recommended that you operate with the channel drive source set to EXTeRnal (see **ROUTe:RMOdule:DRIVE:SOURce[:IMMediate]** command). Since most non-latching devices require more power than the 34980A internal power supply can deliver, using an EXTeRnal channel drive source will avoid an overload error condition.
- When the pulsed mode is enabled, you can set the channel coil drive pulse width using the **ROUTe:CHANnel:DRIVE:PULSe:WIDTh** command and the minimum power supply recovery time using the **ROUTe:CHANnel:DRIVE:TIME:RECOvery** command.
- When channel *pairing* is disabled (see **ROUTe:CHANnel:DRIVE:PAIRed[:MODE]** command) with the pulsed mode enabled, you cannot query the open/closed state of the associated channels unless verification is enabled (see **ROUTe:CHANnel:VERify[:ENABle]** command). While in this mode (single drive operation), only "close" operations are allowed on the channels ("open" operations are not allowed).
- The pulsed mode setting is stored in **non-volatile** memory on the 34945EXT remote module.

Return Format

The query command returns "0" (OFF) or "1" (ON) for each channel specified. Multiple responses are separated by commas. You can query the pulsed state whether the channel drive state is enabled or disabled.

Examples

The following program segment enables the pulsed mode on channels 01 and 02 on Bank 2 on 34945EXT remote module #2 (slot 3).

```
ROUT:RMOD:DRIV:SOUR OFF, (@3200) !Must disable channel drive  
ROUT:CHAN:DRIV:PULS ON, (@3201, 3202) !Enable pulsed mode
```

The following query returns the pulsed state of channels 01 and 02 on Bank 2 on 34945EXT remote module #2 (slot 3).

```
ROUT:CHAN:DRIV:PULS? (@3201, 3202)
```

Typical Response: 1,1

See Also

[ROUTe:CHANnel:DRIVe:PAIRed\[:MODE\]](#)

[ROUTe:CHANnel:DRIVe:PULSe:WIDTh](#)

[ROUTe:CHANnel:DRIVe:TIME:RECoverY](#)

[ROUTe:CHANnel:VERify\[:ENABLE\]](#)

[ROUTe:RMODule:DRIVe:SOURce\[:IMMediate\]](#)

ROUTe:CHANnel:DRIVe:PULSe:WIDTh

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

ROUTe:CHANnel:DRIVe:PULSe:WIDTh {<seconds>|MIN|MAX|DEF}, (@<ch_list>)

ROUTe:CHANnel:DRIVe:PULSe:WIDTh? [{MIN|MAX},] (@<ch_list>)

Description

This command sets the coil drive pulse width duration on the specified channels on the 34945A Microwave Switch/Attenuator Driver. Applies only if pulsed mode is enabled (see [ROUTe:CHANnel:DRIVe:PULSe\[:MODE\]](#) command).

Used With:

- 34945A Microwave Switch/Attenuator Driver

Parameters

Name	Type	Range of Values	Default Value
<seconds>	Discrete	Desired pulse width in seconds between 1 ms and 255 ms, with 1 ms resolution. MIN = 1 ms, MAX = 255 ms	15 ms

<ch_list>	Numeric	One or more channels in the form <u>(@srcc)</u> . Ba sr nk 01 1: thr ou gh sr 08 sr 11 thr ou gh sr 18 Ba sr nk 21 2: thr ou gh sr 28 sr 31 thr ou gh sr 38 Ba sr nk 41 3: thr ou gh sr 48 sr 51 thr ou gh sr 58	This is a required parameter

		Ba <i>sr</i> nk 61 4: thr ou gh <i>sr</i> 68 <i>sr</i> 71 thr ou gh <i>sr</i> 78 <i>s</i> : Mainframe slot number (1 through 8) <i>r</i> : 34945EXT remote module (1 through 8)	

Remarks

- The overall time to required drive a channel is the sum of the pulse width and the power supply recovery time (see **ROUTe:CHANnel:DRIVe:TIME:RECOvery** command). Note that if both values are set to their upper limits (255 ms each) for all channels, the time required to reset/preset (or boot) the module will be significant – as shown below, the time may exceed 30 seconds:

$$64 \text{ Channels} \times (255 \text{ ms Pulse Width} + 255 \text{ ms Recovery Time}) = \sim 33 \text{ seconds}$$

- The pulse width setting is stored in **non-volatile** memory on the 34945EXT remote module. The default pulse width of 15 ms is set by the **SYSTem:RMOdule:RESet** and **ROUTe:RMOdule:BANK:PRESet** commands.
- For pulse widths greater than 255 ms, disable the channel pulse mode (see **ROUTe:CHANnel:DRIVe:PULSe[:MODE]** command) and manually create a pulse in the continuous drive mode (see **Examples** below).

Return Format

The query command returns the pulse width in seconds in the form "+1.00000000E+00" for each channel specified. Multiple responses are separated by commas.

Examples

The following program segment sets the pulse width to 13 ms on channels 01 and 02 on Bank 2 on 34945EXT remote module #2 (slot 3).

```
ROUT:CHAN:DRIV:PULS ON, (@3201,3202) !Enable pulsed mode
ROUT:RMOD:DRIV:SOUR INT, (@3200) !Select internal drive source
ROUT:CHAN:DRIV:PULS:WIDT .013, (@3201,3202) !Set pulse width
```

The following program segment sets the pulse width to 500 ms on channels 01 and 02 on Bank 2 on 34945EXT remote module #2 (slot 3). Note that for this example the pulsed mode is disabled (the ROUTe:CHANnel:DRIVE:PULSe:WIDTh is *not* used) and the pulse is created manually using the continuous drive mode.

```
ROUT:CHAN:DRIV:PULS OFF, (@3205) !Disable pulsed mode
ROUT:RMOD:DRIV:SOUR INT, (@3200) !Select internal drive source
ROUT:CLOS (@3205);:SYST:DELAY 0.0500;:ROUT:OPEN (@3205) !Set 500 ms pulse
```

The following query returns the pulse width on channels 01 and 02 on Bank 2 on 34945EXT remote module #2 (slot 3).

```
ROUT:CHAN:DRIV:PULS:WIDT? (@3201,3202)
```

Typical Response: +1.30000000E-02,+1.30000000E-02

See Also

ROUTe:CHANnel:DRIVE:PULSe[:MODE]

ROUTe:CHANnel:DRIVE:TIME:RECovery

ROUTe:CHANnel:DRIVe:STATe?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

ROUTe:CHANnel:DRIVe:STATe? (@<ch_list>)

Description

This command returns the current drive state of the specified channels on the 34945A Microwave Switch/Attenuator Driver. This command is provided specifically for the *verified, single-coil, non-pulsed* channel drive configuration, where the results from the **ROUTe:CLOSe?** command reports the verified position indicator state, which may not be the same as the current drive state. The response from the ROUTe:CHANnel:DRIVe:STATe? command indicates whether or not the specified channels are currently being driven.

Used With:

- 34945A Microwave Switch/Attenuator Driver

Parameters

Name	Type	Range of Values	Default Value

<ch_list>	Numeric	One or more channels in the form <u>(@srcc).</u>	This is a required parameter
		Ba sr nk 01 1: thr ou gh sr 08 sr 11 thr ou gh sr 18 Ba sr nk 21 2: thr ou gh sr 28 sr 31 thr ou gh sr 38 Ba sr nk 41 3: thr ou gh sr 48 sr 51 thr ou gh sr 58	

		Ba sr nk 61 4: thr ou gh sr 68 sr 71 thr ou gh sr 78 s: Mainframe slot number (1 through 8) r: 34945EXT remote module (1 through 8)	

Remarks

- For channels that are configured for the *pulsed* drive mode (see **ROUTe:CHANnel:DRIVe:PULSe[:MODE]** command), this command will always return "0" indicating that the channels are not being driven. Note that previous pulsed operations will have completed before the ROUTe:CHANnel:DRIVe:STATe? query is evaluated.
- For channels that are configured for the *non-verified, single-coil, non-pulsed* drive mode (see **ROUTe:CHANnel:VERify[:ENABLE]**, **ROUTe:CHANnel:DRIVe:PAIRed[:MODE]**, and **ROUTe:CHANnel:DRIVe:PULSe[:MODE]** commands), the **ROUTe:CLOSe?** command can also be used to accurately determine the current drive state.

Return Format

The command returns "1" if the specified channel is being driven or "0" if the specified channel is not being driven. Multiple responses are separated by commas.

Example

The following program segment queries the channel drive state for channels 01 through 05 on Bank 2 on 34945EXT remote module #2 (slot 3).

```
ROUT:RMOD:DRIV:SOUR OFF, (@3200) !Must disable channel drive
ROUT:CHAN:DRIV:PAIR:MODE OFF, (@3201:3205) !Disable paired-coil mode
ROUT:CHAN:DRIV:PULS:MODE OFF, (@3201:3205) !Enable continuous mode
ROUT:CHAN:VER:ENAB ON, (@3201:3205) !Enable verification
ROUT:RMOD:DRIV:SOUR EXT, (@3200) !Enable channel drive
```

```
ROUT:CLOS (@3201:3205) !Continuous drive close operation  
ROUT:CHAN:DRIV:STAT? (@3201:3205) !Query drive state
```

Typical Response: 1,1,1,1,1

See Also

[ROUTe:CHANnel:DRIVe:PAIRed\[:MODE\]](#)

[ROUTe:CHANnel:DRIVe:PULSe\[:MODE\]](#)

[ROUTe:CHANnel:VERify\[:ENABLE\]](#)

[ROUTe:CLOSe?](#)

[ROUTe:RMOdule:DRIVe:SOURce\[:IMMediate\]](#)

ROUTe:CHANnel:DRIVE:TIME:RECover

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

ROUTe:CHANnel:DRIVE:TIME:RECover {<seconds>|MIN|MAX|DEF}, (@<ch_list>)

ROUTe:CHANnel:DRIVE:TIME:RECover? [{MIN|MAX},] (@<ch_list>)

Description

This command sets the minimum recovery time for the drive power supply on the specified channels on the 34945A Microwave Switch/Attenuator Driver. The specified recovery time is inserted prior to driving a channel. For *pulsed* operations (see **ROUTe:CHANnel:DRIVE:PULSe[:MODE]** command), the recovery time begins with the falling edge of the drive pulse. For *non-pulsed* (continuous) operations, the recovery time begins with the initiation of the drive signal. See the Keysight 34980A *User's Guide* for more information.

Used With:

- 34945A Microwave Switch/Attenuator Driver

Parameters

Name	Type	Range of Values	Default Value
<seconds>	Discrete	Desired recovery time in seconds between 0 seconds and 255 ms, with 1 ms resolution. MIN = 0 seconds, MAX = 255 ms	0 seconds

<ch_list>	Numeric	One or more channels in the form <u>(@srcc)</u> .	This is a required parameter
		Ba sr nk 01 1: thr ou gh sr 08 sr 11 thr ou gh sr 18 Ba sr nk 21 2: thr ou gh sr 28 sr 31 thr ou gh sr 38 Ba sr nk 41 3: thr ou gh sr 48 sr 51 thr ou gh sr 58	

		Ba nk 4: sr 61 thr ou gh sr 68 sr 71 thr ou gh sr 78 s: Mainframe slot number (1 through 8) r: 34945EXT remote module (1 through 8)	

Remarks

- The overall time required to drive a channel is the sum of the pulse width (see **ROUTe:CHANnel:DRIVE:PULSe:WIDTh** command) and the power supply recovery time. Note that if both values are set to their upper limits (255 ms each) for all channels, the time required to reset/preset (or boot) the module will be significant – as shown below, the time may exceed 30 seconds:

$$64 \text{ Channels} \times (255 \text{ ms Pulse Width} + 255 \text{ ms Recovery Time}) = \sim 33 \text{ seconds}$$

- If you are operating the 34945EXT Master module from the INTernal (mainframe) drive source (see **ROUTe:RMOdule:DRIVE:SOURce[:IMMediate]** command), the specified recovery time is the *minimum* time to be imposed between channel operations. If necessary, the 34945EXT Master module will insert an additional delay to maintain the 34980A's power supply limitations.
- The **ROUTe:RMOdule:DRIVE:LIMit** command sets the number of simultaneous coil activations allowed on a given 34945EXT remote mode. The specified limit will be temporarily suspended to allow for any channel that has an associated non-zero recovery time.
- If you are using a settling time (see **ROUTe:CHANnel:DRIVE:TIME:SETTle** command) in conjunction with a recovery time, the module will use the longer of the two to determine when the channel operation is considered "done" and when the verification operation will begin.
- The recovery time setting is stored in **non-volatile** memory on the 34945EXT remote module. The default recovery time of 0 seconds is set by the **SYSTem:RMOdule:RESet** and **ROUTe:RMOdule:BANK:PRESet** commands.

Return Format

The query command returns the recovery time in seconds in the form "+1.00000000E+00" for each channel specified. Multiple responses are separated by commas.

Examples

The following command sets the recovery time to 8 ms on channels 01 and 02 on Bank 2 on 34945EXT remote module #2 (slot 3).

```
ROUT:CHAN:DRIV:TIME:REC .008, (@3201, 3202)
```

The following query returns the recovery time on channels 01 and 02 on Bank 2 on 34945EXT remote module #2 (slot 3).

```
ROUT:CHAN:DRIV:TIME:REC? (@3201, 3202)
```

Typical Response: +8.00000000E-03,+8.00000000E-03

See Also

[ROUTe:CHANnel:DRIVe:PULSe\[:MODE\]](#)

[ROUTe:CHANnel:DRIVe:PULSe:WIDTh](#)

[ROUTe:RMODule:DRIVe:LIMit](#)

[ROUTe:RMODule:DRIVe:SOURce\[:IMMediate\]](#)

[ROUTe:CHANnel:DRIVe:TIME:SETTle](#)

ROUTe:CHANnel:DRIVe:TIME:SETTle

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

ROUTe:CHANnel:DRIVe:TIME:SETTle {<seconds>|MIN|MAX|DEF}, (@<ch_list>)

ROUTe:CHANnel:DRIVe:TIME:SETTle? [{MIN|MAX},] (@<ch_list>)

Description

This command defines a settling time on the specified channels on the 34945A Microwave Switch/Attenuator Driver. For *pulsed* operations (see **ROUTe:CHANnel:DRIVe:PULSe[:MODE]** command), the settling time begins with the falling edge of the drive pulse. For *non-pulsed* (continuous) operations, the settling time begins with the initiation of the drive signal. See the Keysight 34980A *User's Guide* for more information.

Used With:

- 34945A Microwave Switch/Attenuator Driver

Parameters

Name	Type	Range of Values	Default Value
<seconds>	Discrete	Desired settling time in seconds between 0 seconds and 255 ms, with 1 ms resolution. MIN = 0 seconds, MAX = 255 ms	0 seconds

<ch_list>	Numeric	One or more channels in the form <u>(@srcc)</u> . Ba sr nk 01 1: thr ou gh sr 08 sr 11 thr ou gh sr 18 Ba sr nk 21 2: thr ou gh sr 28 sr 31 thr ou gh sr 38 Ba sr nk 41 3: thr ou gh sr 48 sr 51 thr ou gh sr 58	This is a required parameter

		Ba <i>sr</i> nk 61 4: thr ou gh <i>sr</i> 68 <i>sr</i> 71 thr ou gh <i>sr</i> 78 <i>s</i> : Mainframe slot number (1 through 8) <i>r</i> : 34945EXT remote module (1 through 8)	

Remarks

- The settling time establishes when an open/close operation on a channel should be considered complete. On the 34945A module, a series of open/close operations are not considered complete until the settling time has elapsed following the final channel closure.
- Unlike the power supply recovery time (see **ROUTe:CHANnel:DRIVE:TIME:RECOvery** command), the settling time has no effect on how many channels can be driven simultaneously when an open/close operation is executed with a list of channels.
- This command affects the *busy time* for the module in the specified slot. See the **ROUTe:MODule:BUSY?** and **ROUTe:MODule:WAIT** commands for more information.
- The specified settling time is acknowledged, regardless of whether verification is enabled or disabled (see **ROUTe:CHANnel:VERify[:ENABLE]** command).
- The **ROUTe:RMODule:DRIVE:LIMit** command sets the number of simultaneous coil activations allowed on a given 34945EXT remote mode. Settling times do not affect the behavior of driving multiple channels at once.
- If you are using a settling time in conjunction with a power supply recovery time (see **ROUTe:CHANnel:DRIVE:TIME:RECOvery** command), the module will use the longer of the two to determine when the channel operation is considered "done" and when the verification operation will begin.
- The settling time value is stored in **non-volatile** memory on the 34945EXT remote module. The default settling time of 0 seconds is set by the **SYSTem:RMODule:RESet** and **ROUTe:RMODule:BANK:PRESet** commands.

Return Format

The query command returns the settling time in seconds in the form "+1.00000000E+00" for each channel specified. Multiple responses are separated by commas.

Examples

The following command defines a settling time of 5 ms on channels 01 and 02 on Bank 2 on 34945EXT remote module #2 (slot 3).

```
ROUT:CHAN:DRIV:TIME:SETTLE .005, (@3201, 3202)
```

The following query returns the settling time on channels 01 and 02 on Bank 2 on 34945EXT remote module #2 (slot 3).

```
ROUT:CHAN:DRIV:TIME:SETTLE? (@3201, 3202)
```

Typical Response: +5.00000000E-03,+5.00000000E-03

See Also

[ROUTe:CHANnel:DRIVe:PULSe\[:MODE\]](#)

[ROUTe:CHANnel:DRIVe:TIME:RECovery](#)

[ROUTe:CHANnel:VERify\[:ENABLE\]](#)

[ROUTe:MODule:BUSY?](#)

[ROUTe:MODule:WAIT](#)

[ROUTe:RMODule:DRIVe:LIMit](#)

ROUTe:CHANnel:FWIRe

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

ROUTe:CHANnel:FWIRe <mode>, (@<ch_list>)

ROUTe:CHANnel:FWIRe? (@<ch_list>)

Description

This command configures the specified channels for 4-wire external scanning without the internal DMM.

NOTE

This command is valid only when the internal DMM is disabled (see **INSTrument:DMM[:STATe]** command) or removed from the Keysight 34980A.

Used With:

- 34921A Armature Multiplexer
- 34922A Armature Multiplexer
- 34923A Reed Multiplexer (differential mode only)
- 34924A Reed Multiplexer
- 34925A FET Multiplexer (differential mode only)

Parameters

Name	Type	Range of Values	Default Value
<mode>	Boolean	{OFF 0 ON 1}	This is a required parameter
<ch_list>	Numeric	One or more channels in the form (@sccc) .	This is a required parameter

Remarks

- For 4-wire resistance measurements, the instrument automatically pairs channel *n* in Bank 1 with channel *n+20* in Bank 2 (34921A, 34923A, 34925A) or *n+35* (34922A, 34924A) to provide the source and sense connections. For example, make the source connections to the HI and LO terminals on channel 2 in Bank 1 and the sense connections to the HI and LO terminals on channel 22 (or 37) in Bank 2. Specify the paired channel in Bank 1 (source) as the <ch_list> channel (channels in Bank 2 are not allowed in the <ch_list>).
- The **ROUTe:CLOSe**, **ROUTe:CLOSe:EXCLusive**, and **ROUTe:OPEN** commands ignore the current ROUTe:CHANnel:FWIRe setting (if no channels are in the scan list).

- Four-wire measurements are not allowed on the multiplexer modules configured for the single-ended mode (see **SYSTem:MODule:WIRE:MODE** command).

Return Format

The query command returns "0" (OFF) or "1" (ON) for each channel specified. Multiple responses are separated by commas.

Examples

The following command configures channels 3 and 13 in slot 1 for 4-wire external scanning.

```
INST:DMM OFF !Disable internal DMM  
ROUT:CHAN:FWIR ON, (@1003,1013) !Enable 4-wire configuration
```

The following query returns the 4-wire configuration selected on channels 3 and 13 in slot 1.

```
ROUT:CHAN:FWIR? (@1003,1013)
```

Typical Response: **1,1**

See Also

INSTrument:DMM[:STATe]

ROUTe:CHANnel:ADVance:SOURce

ROUTe:CHANnel:LABel:CLEar:MODule

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

ROUTe:CHANnel:LABel:CLEar:MODule {<slot>|ALL}

Description

This command clears all user-defined labels on all channels in the specified slot, or on all modules installed in the 34980A, and restores the factory-default labels to the front panel and Web Interface. Clearing labels using this command also clears Analog Bus relay labels in the specified slot.

NOTE

User-defined channel labels are available for identification purposes *only* and cannot be used in place of a channel number within a command string.

Used With:

- All 34980A Modules

Parameters

Name	Type	Range of Values	Default Value
<slot>	Discrete	{1-8 SLOT1-SLOT8 ALL}	This is a required parameter

Remarks

- This command does not clear the factory-default channel labels from the front panel (e.g., "MUX CH BANK 1", "MATRIX1 ROW3 COL4", etc.) or Web Interface (e.g., "1001", "3020"). The factory-default labels are always preserved.
- To clear user-defined labels on an individual channel or range of channels (and reassign the factory-default labels), specify a null string for the <label> parameter in the **ROUTe:CHANnel:LABel[:DEFine]** command. However, note that since the Analog Bus relays are ignored if they are included in a *range* of channels, you must list these channels individually as shown below:

```
ROUT:CHAN:LAB "",(@1001:1020,1911,1912,1913,1914)
```

- The instrument keeps a record of what module types are installed in each slot. If a different module type is detected in a specific slot at power on, all user-defined channel labels for that slot are discarded. If an empty slot is detected at power-on, any previously-defined labels for that slot are preserved and will be restored if the same module type is installed later; however, if a module of a different type is installed in that slot, the previously-defined labels will be discarded.

- All user-defined channel labels are stored in **non-volatile** memory, and do not change when power has been off, after a Factory Reset (***RST** command), after an Instrument Preset (**SYSTem:PRESet** command), or after a stored state is recalled (***RCL** command).

Examples

The following command clears all user-defined channel labels on the module in slot 1. The factory-default labels are assigned to all channels on the module in slot 1.

```
ROUT:CHAN:LAB:CLEAR:MOD 1 or ROUT:CHAN:LAB:CLEAR:MOD SLOT1
```

The following command clears all user-defined labels on all modules installed in the 34980A. The factory-default labels are assigned to all channels on all installed modules.

```
ROUT:CHAN:LAB:CLEAR:MOD ALL
```

See Also

ROUTe:CHANnel:LABel[:DEFine]

ROUTe:CHANnel:LABel[:DEFine]

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

```
ROUTe:CHANnel:LABel[:DEFine] "<label>" , (@<ch_list>)
```

```
ROUTe:CHANnel:LABel[:DEFine]? [<type> , ] (@<ch_list>)
```

Description

This command assigns a user-defined label to the specified channels for use with the 34980A front panel and Web Interface. You can assign a user-defined label to any channel, including Analog Bus channels on the multiplexer and matrix modules.

NOTE

User-defined channel labels are available for identification purposes *only* and cannot be used in place of a channel number within a command string.

Used With:

- All 34980A Modules

Parameters

Name	Type	Range of Values	Default Value
<label>	Quoted ASCII String	A string of up to 18 characters enclosed in quotes. You can use letters (A-Z), numbers (0-9), and special characters like "@", "%", "*", etc. Use the "#" character to display a degree symbol (°) on the front panel (displayed as "#" from the Web Interface).	This is a required parameter
<ch_list>	Numeric	One or more channels in the form (@sccc) . You can assign labels to any channel, including Analog Bus channels.	This is a required parameter
<type>	Discrete	{USER FACTory}	USER (read the user-defined label on the specified channels).

Remarks

- When shipped from the factory, each channel is assigned a unique factory-default label (cannot be overwritten). From the front panel, the factory-default labels are shown on the upper line of the display (e.g., "MUX CH BANK 1", "MATRIX1 ROW3 COL4", "DIO BYTE 1", etc.). From the Web Interface, the factory-default labels are displayed as the channel number (e.g., "1001", "3020", etc.).
- If desired, you can assign the same user-defined label to multiple channels within the same module or on different modules (i.e., channel labels are not required to be unique).
- If you specify a label with more than the allowed 18 characters, it will be truncated (no error is generated).
- From the Web Interface, a limited number of characters can be displayed due to space constraints in the browser window. If the user-defined label is too long to be displayed properly, it will be truncated (no error is generated).
- To clear user-defined labels on an individual channel or range of channels (and reassign the factory-default labels), specify a null string for the <label> parameter (see **Examples** below). Note that since the Analog Bus relays are ignored if they are included in a *range* of channels, you must list these channels individually as shown below:

ROUT:CHAN:LAB "" ,(@1001:1020,1911,1912,1913,1914)

- Use the **ROUTe:CHANnel:LABel:CLEar:MODule** command to clear all user-defined labels on all channels in a specified slot, or on all modules installed in the 34980A, and restores the factory-default labels to the front panel and Web Interface.
- The instrument keeps a record of what module types are installed in each slot. If a different module type is detected in a specific slot at power on, all user-defined channel labels for that slot are discarded. If an empty slot is detected at power-on, any previously-defined labels for that slot are preserved and will be restored if the same module type is installed later; however, if a module of a different type is installed in that slot, the previously-defined labels will be discarded.
- All user-defined channel labels are stored in **non-volatile** memory, and do not change when power has been off, after a Factory Reset (***RST** command), after an Instrument Preset (**SYSTem:PRESet** command), or after a stored state is recalled (***RCL** command).

Return Format

The query command reads the user-defined or factory-default label assigned to the specified channels and returns a comma-separated list of strings enclosed in double quotes. If you have not assigned a user-defined label to a channel, a null string (" ") is returned for that channel.

If you specify the optional **USER** parameter (default), this command returns the user-defined labels assigned to the specified channels.

If you specify the optional **FACTory** parameter, this command returns the factory-defined channel labels assigned to the specified channels (e.g., "MUX CH BANK 1", "MATRIX1 ROW3 COL4", "DIO BYTE 1", etc.).

Examples

The following command assigns a label ("TEST_PT_1") to channels 3 and 5 in slot 1.

```
ROUT:CHAN:LAB "TEST_PT_1", (@1003,1005) or ROUT:CHAN:LAB 'TEST_PT_1',  
(@1003,1005)
```

The following command clears the user-defined label previously assigned to channel 19 in slot 4. The channel will now be identified by its factory default label (e.g., "MUX CH BANK 1", "MATRIX1 ROW3 COL4", "DIO BYTE 1", etc.).

```
ROUT:CHAN:LAB "", (@4019)
```

The following query returns the user-defined labels assigned to channels 3 through 7 in slot 1. Note that channels 4 and 6 have no user-defined label assigned to them (a null string is returned).

```
ROUT:CHAN:LAB? (@1003:1007)
```

Typical Response: "TEST_PT_1","",DUT_ACV","",CLOSE_FIXTURE

The following query returns the factory-default labels for channels 10 and 32 in slot 6.

```
ROUT:CHAN:LAB? FACT, (@6010,6032)
```

Typical Response: "MUX CH IN BANK 1","MUX CH IN BANK 2"

See Also

[ROUTe:CHANnel:LABel:CLEar:MODule](#)

ROUTe:CHANnel:VERify[:ENABle]

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

ROUTe:CHANnel:VERify[:ENABle] <mode>, (@<ch_list>)

ROUTe:CHANnel:VERify[:ENABle]? (@<ch_list>)

Description

This command enables or disables verification, which senses the actual hardware state of the specified channels following a **ROUTe:CLOSe** or **ROUTe:OPeN** operation (and reset operations). By default, verification is disabled because not all external microwave devices have verify lines and verification will slow switching performance.

Used With:

- 34945A Microwave Switch/Attenuator Driver
- 34946A Dual 1x2 SPDT Terminated Microwave Switch
- 34947A Triple 1x2 SPDT Underminated Microwave Switch

Parameters

Name	Type	Range of Values	Default Value
<mode>	Boolean	{OFF 0 ON 1}	OFF (verification disabled)

<ch_list> 34945A	Numeric	One or more channels in the form (<u>@srcc</u>).	This is a required parameter
		Ba <i>sr</i> nk 01 1: thr ou gh <i>sr</i> 08 <i>sr</i> 11 thr ou gh <i>sr</i> 18 Ba <i>sr</i> nk 21 2: thr ou gh <i>sr</i> 28 <i>sr</i> 31 thr ou gh <i>sr</i> 38 Ba <i>sr</i> nk 41 3: thr ou gh <i>sr</i> 48 <i>sr</i> 51 thr ou gh <i>sr</i> 58	

		Ba sr nk 61 4: thr ou gh sr 68 sr 71 thr ou gh sr 78 s: Mainframe slot number (1 through 8) r: 34945EXT remote module (1 through 8)	
<ch_list> 34946A/47A	Numeric	One or more channels in the form <u>(@sccc)</u> . 34946A: s101, s102, s201, s202 34947A: s101, s102, s201, s202, s301, s302	This is a required parameter

Remarks

- When verification is enabled, the actual hardware state of each relay is sensed for the correct state. If a switch operation appears to have failed, an error will be generated at the time the **ROUTe:CLOSe** or **ROUTe:OPEN** command is executed. If you send a ROUTe:CLOSe or ROUTe:OPEN command with a channel list (i.e., multiple channels), the verification is performed after all open/close operations have been completed. An error will be generated for each channel operation that did not properly verify.
- On the 34945EXT remote modules, if verification is enabled on one or more channels, the entire verified state of the associated channels is refreshed following any switch operations on the module. This is done to ensure that the module state displayed on the 34980A front panel (and Web Interface) is accurate.
- The verification process will affect the operation of the **ROUTe:CLOSe?** and **ROUTe:OPEN?** commands. If verification is enabled, these commands will check the actual hardware state of the specified channels, rather than just reporting the presumed state.
- Verification will slow switching performance. Specifically, if you have enabled the command overlap function (see **ROUTe:OPERation:OVERlap[:ENABLE]** command), the verification will be performed at the end of each close/open operation, before processing the next command.

- When verification is enabled on the 34945A, the channels are verified following a reset/boot. Errors are limited to a single message for each slot containing a 34945A. Each consolidated error message indicates the first channel on which a verification error was found, and gives an indication of whether more verification errors exist.
- The **ROUTe:CHANnel:DRIVE:TIME:SETTle** command (34945A only) configures a settling time for switching operations after which the verification operation is complete. The specified settling time is acknowledged, regardless of whether verification is enabled or disabled.
- For paired operations on the 34945A (see **ROUTe:CHANnel:DRIVE:PAIRed[:MODE]** command), when you enable verification on either paired channel, verification will be enabled on *both* channels. In addition, the module checks for complementary position indicators on the lower and upper channels of the pair (i.e., the position indicators should indicate *opposite* states). If the state of the lower and upper position indicators are found to be in the same state (due to a hardware issue), an error is generated and the state of the lower channel is assumed.
- When the paired mode is disabled on a 34945A channel with the pulsed mode enabled (see **ROUTe:CHANnel:DRIVE:PULSe[:MODE]** command), you cannot query the open/closed state of that channel unless verification is enabled (see **ROUTe:CHANnel:VERify[:ENABLE]** command).
- If you enable verification on a non-paired (one coil), non-pulsed channel on the 34945A, the **ROUTe:CLOSe?** and **ROUTe:OPeN?** commands return the *state of the verified device*, rather than the *drive state* of the specified channel. You can use the **ROUTe:CHANnel:VERify:POSition:STATe?** command to determine exactly which channels are currently being driven.
- The **SYSTem:RMOdule:RESet** command (34945A only) will restore the default verification state (OFF) on all channels.
- On the 34946A/47A, when you enable verification on either channel in a bank, verification will be enabled on *both* channels.
- The verification setting for each channel is stored in **non-volatile** memory. On the 34945A, the state is stored on the 34945EXT remote module.

Return Format

The query command returns "0" (OFF) or "1" (ON) for each channel specified. Multiple responses are separated by commas.

Examples

The following command enables verification on channels 101 and 201 on the module in slot 2 (assumes 34946/47A).

```
ROUT:CHAN:VER ON, (@2101, 2201)
```

The following command enables verification on channels 01 and 02 on Bank 2 on 34945EXT remote module #2 (slot 3).

```
ROUT:CHAN:VER ON, (@3201, 3202)
```

The following query returns whether verification is enabled on channels 101 and 201 on the module in slot 2 (assumes 34946/47A).

```
ROUT:CHAN:VER? (@2101,2201)
```

Typical Response: 1,1

See Also

ROUTe:CHANnel:DRIVE:TIME:SETTle (34945A only)

ROUTe:CHANnel:VERify:POLarity (34945A only)

ROUTe:CHANnel:VERify:POSition:STATe? (34945A only)

ROUTe:CLOSe

ROUTe:OPeN

ROUTe:OPeRation:OVerlap[:ENABle]

ROUTe:CHANnel:VERify:POLarity

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

ROUTe:CHANnel:VERify:POLarity <polarity>, (@<ch_list>)

ROUTe:CHANnel:VERify:POLarity? (@<ch_list>)

Description

This command sets the logic polarity of the position indicator lines on the specified channels on the 34945A Microwave Switch/Attenuator Driver. The verification feature relies on the position indicator lines to indicate the state of the switch. You can specify the polarity as "normal" (active high, indicating "closed") or "inverted" (active low, indicating "closed").

Used With:

- 34945A Microwave Switch/Attenuator Driver

Parameters

Name	Type	Range of Values	Default Value
<polarity>	Discrete	{NORMal INVerted}	Depends on the Distribution Board type (see "Remarks" below).

<ch_list>	Numeric	One or more channels in the form <u>(@srcc).</u>	This is a required parameter
		Ba nk 1: thr ou gh sr 08 sr 11 thr ou gh sr 18 Ba nk 2: thr ou gh sr 28 sr 31 thr ou gh sr 38 Ba nk 3: thr ou gh sr 48 sr 51 thr ou gh sr 58	

		Ba nk 4: sr 61 thr ou gh sr 68 sr 71 thr ou gh sr 78 s: Mainframe slot number (1 through 8) r: 34945EXT remote module (1 through 8)	

Remarks

- Use the **ROUTe:CHANnel:VERify[:ENABLE]** command to enable verification when channels are opened or closed.
- The default logic polarity is evaluated when the following commands are issued:
 - a. The **ROUTe:RMOdule:BANK:PRESet** command restores the polarity to its default for the Distribution Board type in use. See the Keysight 34980A *User's Guide* for more information.
 - b. The **SYSTem:RMOdule:RESet** command restores the polarity to NORMal for all channels.
- When two channels are paired, both channels of the pair assume the polarity of the lower numbered channel.
- The logic polarity setting for each channel is stored in **non-volatile** memory on the 34945EXT remote module.

Return Format

The query command returns "NORM" or "INV" for the specified channels. Multiple responses are separated by commas.

Examples

The following command selects an inverted polarity (active low) for channels 01 and 05 on Bank 2 on 34945EXT remote module #2 (slot 3).

```
ROUT:CHAN:VER:POL INV, (@3201, 3205)
```

The following query returns the polarity for channels 01 and 05 on Bank 2 on 34945EXT remote module #2 (slot 3).

```
ROUT:CHAN:VER:POL? (@3201,3205)
```

Typical Response: **INV,INV**

See Also

ROUTe:CHANnel:VERify[:ENABle]

ROUTe:RMOdule:BANK:PRESet

SYSTem:RMOdule:RESet

ROUTe:CHANnel:VERify:POSition:STATe?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

ROUTe:CHANnel:VERify:POSition:STATe? (@<ch_list>)

Description

This command returns the position indicator state of the specified channels on the 34945A Microwave Switch/Attenuator Driver. This command is useful when verification is disabled on a channel (see [ROUTe:CHANnel:VERify\[:ENABLE\]](#) command).

Used With:

- 34945A Microwave Switch/Attenuator Driver

Parameters

Name	Type	Range of Values	Default Value

<ch_list>	Numeric	One or more channels in the form <u>(@srcc).</u>	This is a required parameter
		Ba sr nk 01 1: thr ou gh sr 08 sr 11 thr ou gh sr 18 Ba sr nk 21 2: thr ou gh sr 28 sr 31 thr ou gh sr 38 Ba sr nk 41 3: thr ou gh sr 48 sr 51 thr ou gh sr 58	

		Ba sr nk 61 4: thr ou gh sr 68 sr 71 thr ou gh sr 78 s: Mainframe slot number (1 through 8) r: 34945EXT remote module (1 through 8)	

Remarks

- This command returns the same results as the **ROUTe:CLOSe?** query *if* verification is enabled (see **ROUTe:CHANnel:VERify[:ENABLE]** command). Note, however, that there may be situations where you will want to disable verification while troubleshooting or in order to increase switching performance.

Return Format

The command returns "1" if the specified channel is closed or "0" if the specified channel is open. Multiple responses are separated by commas.

Example

The following program segment queries the state of the position indicators on channels 01 through 05 on Bank 2 on 34945EXT remote module #2 (slot 3).

```
ROUT:CHAN:VER:ENAB OFF, (@3201:3205) !Disable verification
ROUT:CHAN:VER:POS:STAT? (@3201:3205) !Query state of position indicators
```

Typical Response: 1,0,1,1,0

See Also

ROUTe:CHANnel:VERify[:ENABLE]

ROUTe:CLOSe?

ROUTe:CLOSE

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

ROUTe:CLOSE (@<ch_list>)

ROUTe:CLOSE? (@<ch_list>)

Description

This command closes the specified channels on a multiplexer or switch module.

Used With:

- 34921A through 34925A Multiplexer Modules
- 34931A through 34934A Matrix Modules
- 34937A through 34939A GP Switch Modules
- 34941A and 34942A RF Multiplexer Modules
- 34945A Microwave Switch/Attenuator Driver
- 34946A and 34947A Microwave Switch Modules
- 34959A Breadboard Module

Parameters

Name	Type	Range of Values	Default Value
<ch_list>	Numeric	One or more channels in the form (@sccc) .	This is a required parameter

Remarks

- To protect the FET switches on the 34925A multiplexer module, only one channel per bank can be closed at a time. If multiple channels are specified, they will be opened/closed in succession to ensure *break-before-make* operation (the last channel closed in each bank will remain closed).
- For the matrix modules (34931A, 34932A, and 34933A), the channel number represents the intersection of the desired row and column. For example, channel 2304 represents the intersection of row 3 and column 4 on the module in slot 2 (assumes two-wire mode). For more information, see the [simplified schematics](#).

- The 34923A, 34924A, and 34933A modules use *non-latching* reed relays. Due to power dissipation issues, there is a limit to the number of relays that can be closed at a time on these modules (you cannot close all channels simultaneously). The mainframe can drive up to **40** coils at one time per slot on these modules (a single coil drives one channel relay or one Analog Bus relay). Note that when in the 2-wire mode (see **SYSTem:MODUle:WIRE:MODE** command), two coils are required to drive each channel relay. An error will be generated if you attempt to close more than the maximum number of allowed channels.
 - a. In the 2-wire mode on the 34923A and 34924A multiplexers, no more than **20** channels can be closed simultaneously per module (up to **10** channels per bank). Note that Analog Bus relays count half as much as channel relays in that total. Therefore, with one Analog Bus relay closed, you can close up to a maximum of 19 channel relays.
 - b. In the 1-wire mode on the 34923A multiplexer, no more than **40** channels can be closed simultaneously per module (up to **20** channels per bank). Therefore, with one Analog Bus relay closed, you can close up to a maximum of 39 channel relays.
 - c. In the 2-wire mode on the 34933A matrix, no more than **20** channels can be closed simultaneously per module. Note that Analog Bus relays count half as much as channel relays in that total. Therefore, with one Analog Bus relay closed, you can close up to a maximum of 19 channel relays.
 - d. In the 1-wire mode on the 34933A matrix, no more than **40** channels can be closed simultaneously per module. Therefore, with one Analog Bus relay closed, you can close up to a maximum of 39 channel relays.
- When closing channels on the 34934A matrix, use channel lists rather than specifying an individual channel per command to increase cumulative relay switching speeds. See **SYSTem:MODUle:ROW:PROTection** for more information.
- The channel addressing scheme used by the 34934A is dependent upon the matrix configuration. See **34934A Channel Addressing** for more information.
- The RF Multiplexer modules (34941A, 34942A) and Microwave Switch modules (34946A, 34947A) will *not* respond to the **ROUTe:OPEN** command (an error is generated). To "open" a channel on these modules, send the **ROUTe:CLOSe** command to a different channel in the same bank.
- As part of the scan setup, the **ROUTe:SCAN** command examines the scan list and determines which channel relays and Analog Bus relays will be impacted by the scan. The following rules will apply once the scan is initiated and will impact what relays can be manually opened and closed.
 - a. When the scan is initiated, the instrument will open all channels in banks that contain one or more channels in the scan list. In order to guarantee that no signals are connected to the Analog Buses prior to the scan, the instrument will also open all ABus1 relays (applies to all banks in all slots). In addition, if one or more channels configured for 4-wire measurements are included in the scan list, the instrument will also open all ABus2 relays (applies to all banks in all slots). The state of the ABus3 and ABus4 relays is not altered and these relays remain active during the scan.
 - b. While the scan is running, the instrument prohibits use of all channels in banks that contain one or more channels in the specified <ch_list> (these channels are dedicated to the scan). In addition, the instrument prohibits use of all ABus1 relays (and ABus2 relays if applicable) while the scan is running.

- c. Although the ABus3 and ABus 4 relays remain active during the scan, use *CAUTION* when closing these relays on a bank involved in a scan. While the scan is running, any signals present on ABus3 and/or ABus4 will be joined with the scanned measurement on ABus1 and ABus2.
 - d. At the end of the scan, the last channel that was scanned will be opened (as well as any Analog Bus relays used during the scan). Any channels that were opened during the scan will remain opened at the completion of the scan.
- If this command closes a channel currently being monitored (see **ROUTe:MONitor[:CHANnel]** command), the Monitor operation will be disabled on that channel.
 - On the 34945A Microwave Switch/Attenuator Driver, this command places the specified channels in the "normally closed" position. The module will never assume that a channel is already closed and will always drive the channel (as long as the channel drive is not OFF; see **ROUTe:RMOdule:DRIVE:SOURce[:IMMediate]** command).
 - a. For non-paired (single drive) *pulsed* operations, this command simply pulses the specified channels. For non-paired, *non-pulsed* operations, this command continuously drives the specified channels.
 - b. When verification is enabled (see **ROUTe:CHANnel:VERify[:ENABLE]** command), the actual hardware state of each relay is sensed for the correct state. If a switch operation appears to have failed, an error will be generated at the time the ROUTe:CLOSe command is executed. If you send a ROUTe:CLOSe command with a channel list (i.e., multiple channels), the verification is performed after all close operations have been completed. An error will be generated for each channel operation that did not properly verify.
 - c. For paired operations, an error is generated if you specify the upper channel of a pair with this command. If an upper channel of a pair is found within a range of channels, the range expansion will ignore the upper channel and no error is generated.
 - To open and close the output relays on the 34951A Isolated DAC Module, use the **OUTPut[:STATe]** command.

Return Format

The query command returns "1" if the specified channel is closed or "0" if the specified channel is open. Multiple responses are separated by commas.

If verification is enabled (see **ROUTe:CHANnel:VERify[:ENABLE]** command) on the 34945A, 34946A, or 34947A modules, the query command returns the actual hardware state of the specified channels.

For non-paired (single drive) *pulsed* operations on the 34945A, with verification disabled, the query command will return an error. Use the **ROUTe:CHANnel:DRIVE:STATe?** command to query the actual current drive state.

Examples

The following command closes channels 3 and 13 in slot 1 (no Analog Bus connections are made).

```
ROUT:CLOS (@1003,1013)
```

The following command closes channel 203 on the matrix module in slot 7 which connects Row 2 to Column 3 on Matrix 1.

```
ROUT:CLOS (@7203)
```

The following query reads the state of channels 3 and 13 in slot 1 (1 = closed; 0 = open).

```
ROUT:CLOS? (@1003,1013)
```

Typical Response: **1,1**

See Also

[DIAGnostic:RELAy:CYCLes?](#)

[OUTPut\[:STATe\]](#)

[ROUTe:CHANnel:DRIVE:STATe?](#)

[ROUTe:CHANnel:VERify\[:ENABle\]](#)

[ROUTe:CLOSe:EXCLusive](#)

[ROUTe:OPEN](#)

[ROUTe:OPEN:ABUS](#)

[ROUTe:OPEN:ALL](#)

[SYSTem:MODUle:WIRE:MODE](#)

ROUTe:CLOSe:EXCLusive

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

ROUTe:CLOSe:EXCLusive (@<ch_list>)

Description

This command opens all channels on a multiplexer or switch module and then closes the specified channels. On the multiplexer modules, if any channel in a bank is defined to be part of the scan list, attempting to close another channel (including Analog Bus channels) within the same bank will result in an error. Channel closures in the other bank are allowed as long as no channels are part of the scan list; however, Analog Bus relay closures are not allowed.

Used With:

- 34921A through 34925A Multiplexer Modules
- 34931A through 34934A Matrix Modules
- 34937A through 34939A GP Switch Modules
- 34941A and 34942A RF Multiplexer Modules
- 34946A and 34947A Microwave Switch Modules

Parameters

Name	Type	Range of Values	Default Value
<ch_list>	Numeric	One or more channels in the form (@sccc) .	This is a required parameter

Remarks

- To protect the FET switches on the 34925A multiplexer module, only one channel per bank can be closed at a time. If multiple channels are specified, they will be opened/closed in succession to ensure *break-before-make* operation (the last channel closed in each bank will remain closed).
- For the matrix modules (34931A, 34932A, 34933A and 34934A), the channel number represents the intersection of the desired row and column. For example, channel 2304 represents the intersection of row 3 and column 4 on the module in slot 2 (assumes two-wire mode). For more information, see the [simplified schematics](#). For channel numbering information for the 34934A, see [34934A Channel Addressing](#).
- Any channels specified by this command that were previously closed will remain closed when execution of the command is completed. The state of the channels **during** command execution however is not guaranteed (i.e. that a channel currently closed will remain closed during execution).

- The 34923A, 34924A, 34933A, and 34934A modules use *non-latching* reed relays. Due to power dissipation issues, there is a limit to the number of relays that can be closed at a time on these modules (you cannot close all channels simultaneously). The mainframe can drive up to **40** coils at one time per slot on these modules (a single coil drives one channel relay or one Analog Bus relay). Note that when in the 2-wire mode (see **SYSTem:MODule:WIRE:MODE** command), two coils are required to drive each channel relay. An error will be generated if you attempt to close more than the maximum number of allowed channels.
 - a. In the 2-wire mode on the 34923A and 34924A multiplexers, no more than **20** channels can be closed simultaneously per module (up to **10** channels per bank). Note that Analog Bus relays count half as much as channel relays in that total. Therefore, with one Analog Bus relay closed, you can close up to a maximum of 19 channel relays.
 - b. In the 1-wire mode on the 34923A multiplexer, no more than **40** channels can be closed simultaneously per module (up to **20** channels per bank). Therefore, with one Analog Bus relay closed, you can close up to a maximum of 39 channel relays.
 - c. In the 2-wire mode on the 34933A matrix, no more than **20** channels can be closed simultaneously per module. Note that Analog Bus relays count half as much as channel relays in that total. Therefore, with one Analog Bus relay closed, you can close up to a maximum of 19 channel relays.
 - d. In the 1-wire mode on the 34933A matrix, no more than **40** channels can be closed simultaneously per module. Therefore, with one Analog Bus relay closed, you can close up to a maximum of 39 channel relays.
 - e. In the 1-wire mode on the 34934A matrix, the maximum number of channels (relays) per slot that may be closed on the module is 64. For 2-wire mode, the maximum number is 32. This includes any previously closed channels and row protection relay FIXEd mode (see SYSTem:MODule:ROW:PROTection).
- The RF Multiplexer modules (34941A, 34942A) and Microwave Switch modules (34946A, 34947A) will *not* respond to the **ROUTe:OPEN** command (an error is generated). To "open" a channel on these modules, send the ROUTe:CLOSe:EXCLusive command to a different channel in the same bank.
- If this command closes a channel currently being monitored (see **ROUTe:MONitor[:CHANnel]** command), the Monitor operation will be disabled on that channel.
- This command does not apply to channels on the 34945A Microwave Switch/Attenuator Driver.
- To open and close the output relays on the 34951A Isolated DAC Module, use the **OUTPut[:STATe]** command.

Examples

The following command opens all channels and then closes only channels 3 and 13 in slot 1 (no Analog Bus connections are made).

```
ROUT:CLOS:EXCL (@1003,1013)
```

The following command opens all channels and then closes channel 203 on the matrix module in slot 7 which connects Row 2 to Column 3 on Matrix 1.

```
ROUT:CLOS:EXCL (@7203)
```

See Also

`OUTPut[:STATe]`

`ROUTe:CLOSe`

`ROUTe:OPEN`

`SYSTem:MODule:WIRE:MODE`

ROUTe:CLOSe:PAIR

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

ROUTe:CLOSe:PAIR (@<ch_list>)

ROUTe:CLOSe:PAIR? (@<ch_list>)

Description

This command performs a 2-wire close of the specified channel and its paired channel. The query form of the command returns '1' if both channels in the pair are closed.

Used With:

- 34934A High-Density Matrix Module

Parameters

Name	Type	Range of Values	Default Value
<ch_list>	Numeric	One or more channels in the form defined in the section 34934A Channel Addressing . Only the channels corresponding to the high (H) terminals of the matrix are specified.	This is a required parameter

Remarks

- This command is valid for the 4x32, 4x64, and 8x32 configurations. For these configurations, the matrix high channels (H terminals) are paired with their corresponding matrix low channels (L terminals).
- Both channels in the pair are closed after the command completes, regardless of the initial state of the individual channels.
- An error occurs (card does not support requested operation) if the command is executed while the module is in the 4x128, 8x64, or 16x32 configuration as these modes do not contain high/low channel pairs.
- The 34934A module uses *non-latching* reed relays. Due to power dissipation issues, the maximum number of channels per slot that may be closed on the module is 64 1-wire channels or 32 2-wire channel pairs. An error is generated if you attempt to cumulatively close more than the maximum number of channels allowed.
- To close/query 1-wire channels of all matrix configurations, use the ROUTe:CLOSe and ROUTe:CLOSe? commands.

- When closing channels on the 34934A matrix, use channel lists rather than specifying an individual channel per command to increase cumulative relay switching speeds. See **SYSTem:MODule:ROW:PROTection** for more information.
- Channel numbering - the channel addressing scheme used by the 34934A is dependent upon the matrix configuration. See **34934A Channel Addressing** for more information.

Return Format

The query command returns "1" if **both** channels of the pair are closed, or "0" if either or both channels of the pair are open. If the paired channels are in different states, an error is generated in addition to the "0" returned. The states of multiple channels queried are separated by commas.

Examples

The following command closes channel 1505 and its paired channel 1537 on row 5 in slot 1. The module is configured as a dual 8x32 matrix. Note that only the channel of the high matrix (MH) is specified.

```
ROUT:CLOS:PAIR (@1505)
```

The following command closes channels 2301 and 2302 **and their paired** channels 2365 and 2366 on row 2 in slot 2. The module is configured as a 4x64 matrix. Note that only the channels of the high matrix (MH) are specified.

```
ROUT:CLOS:PAIR (@2301, 2302)
```

The following queries read the state of the channels closed in the above examples (1 = closed; 0 = either or both channels in pair is open). Only the channels in the upper matrix are specified.

```
ROUT:CLOS:PAIR? (@1505)
```

Typical Response: 1

```
ROUT:CLOS:PAIR? (@2301, 2302)
```

Typical Response: 1,1

See Also

DIAGnostic:RELAy:CYCLes?

ROUTe:CLOSe:EXCLusive

ROUTe:CLOSe

ROUTe:MODUle:BUSY?

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

ROUTe:MODUle:BUSY? {<slot>|ANY}

Description

This command queries the busy/not-busy status of overlapped switching operations on the specified slot (or any slot in the instrument). The primary utility of this command is when operating in the overlapped switching mode (see **ROUTe:OPERation:OVERlap[:ENABLE]** command).

Used With:

- 34921A through 34925A Multiplexer Modules
- 34931A through 34934A Matrix Modules
- 34937A through 34939A GP Switch Modules
- 34941A and 34942A RF Multiplexer Modules
- 34945A Microwave Switch/Attenuator Driver
- 34946A and 34947A Microwave Switch Modules

Parameters

Name	Type	Range of Values	Default Value
<slot>	Discrete	{1-8 SLOT1-SLOT8 ANY}	ANY (1 or more modules in the instrument)

Remarks

- This command returns the busy/not-busy status immediately and does *not* wait for the module to complete its overlapped switching operations (contrast with the **ROUTe:MODUle:WAIT?** command which waits for completion).
- Since the instrument supports scanning and multiple remote interfaces, it is possible that by the time this command returns "0" (i.e., not busy) there may be another operation in progress from another thread of operation. Additionally, it is possible that this command may never appear to be done if another application (or scanning operation) is continually placing the module in the busy state.

Return Format

The command returns "1" to the output buffer if the specified module (or *any* module in the instrument) has pending overlapped switching operations and is therefore busy. The command returns "0" if there are *not* any modules busy.

Examples

The following command queries the busy/not-busy status of overlapped switching operations on the module in slot 3.

```
ROUT:OPER:OVER:ENAB ON  
ROUT:MOD:BUSY? 3
```

Typical Response: 1

The following command queries the entire instrument to determine if one or more modules are currently busy.

```
ROUT:OPER:OVER:ENAB ON  
ROUT:MOD:BUSY? ANY
```

Typical Response: 1

See Also

ROUTe:MODule:WAIT

ROUTe:OPERation:OVERlap[:ENABle]

ROUTe:MODule:WAIT

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

ROUTe:MODule:WAIT {<slot>|ALL}

ROUTe:MODule:WAIT? {<slot>|ALL}

Description

This command waits for the module in the specified slot (or *all* slots) to complete all overlapped switching operations before continuing (similar to the ***WAI** command, except that this command does *not* wait for measurement operations such as scanning to complete).

The query command waits for completion of all overlapped switching operations and then returns "1" to the output buffer (similar to the ***OPC?** command for non-overlapped operations). The primary utility of this command is when operating in the overlapped switching mode (see **ROUTe:OPERation:OVERlap[:ENABle]** command).

Used With:

- 34921A through 34925A Multiplexer Modules
- 34931A through 34934A Matrix Modules
- 34937A through 34939A GP Switch Modules
- 34941A and 34942A RF Multiplexer Modules
- 34945A Microwave Switch/Attenuator Driver
- 34946A and 34947A Microwave Switch Modules

Parameters

Name	Type	Range of Values	Default Value
<slot>	Discrete	{1-8 SLOT1-SLOT8 ALL}	ALL (all installed modules)

Remarks

- The non-query command waits for the specified module to complete its overlapped switching operations before processing any other commands (contrast with the **ROUTe:MODule:BUSY?** command which returns the busy/not-busy status immediately).

- The query command waits for completion of all overlapped switching operations and then returns "1" to the output buffer. This may be useful for blocking an application until all overlapped operations on the specified modules are complete.
- Since the instrument supports scanning and multiple remote interfaces, it is possible that by the time this command returns "0" (i.e., not busy) there may be another operation in progress from some other thread of operation.
- Using this command with modules involved in an active scan may affect overall performance of the scan.

Return Format

The query command returns "1" to the output buffer when the module in the specified slot (or *all* slots) has completed all overlapped switching operations.

Examples

The following command waits for channels 1 through 5 (slot 2) to fully close before opening channel 9.

```
ROUT:OPER:OVER:ENAB ON
ROUT:CLOS (@2001:2005); ROUT:MOD:WAIT 2 ; ROUT:OPEN (@2009)
```

The following command returns "1" to the output buffer when all modules have completed their overlapped switching operations.

```
ROUT:OPER:OVER:ENAB ON
ROUT:MOD:WAIT? ALL
```

See Also

***WAI**

ROUTe:CLOSe

ROUTe:MODule:BUSY?

ROUTe:OPEN

ROUTe:OPERation:OVERlap[:ENABle]

ROUTe:MONitor[:CHANnel]

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

ROUTe:MONitor[:CHANnel] (@<channel>)

ROUTe:MONitor[:CHANnel]?

Description

This command selects the channel to be displayed on the front panel in the Monitor mode. Only one channel can be monitored at a time.

Used With:

- 34921A through 34925A Multiplexer Modules
- 34950A Digital I/O Module (digital input and counter channels only)
- 34952A Multifunction Module (digital input and totalizer channels only)

Parameters

Name	Type	Range of Values	Default Value
<channel>	Numeric	One channel in the form (@sccc) .	This is a required parameter

Remarks

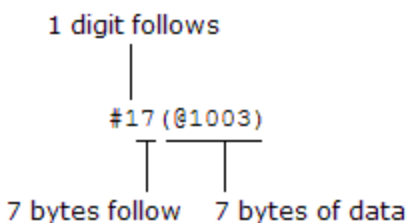
- Channels do *not* have to be part of an active scan list to be monitored; however, the channel must be configured for a measurement in order to be monitored (see [CONFigure](#) and [SENSe](#) commands).
- A scan always has priority over the Monitor function (see [ROUTe:SCAN](#) command).
- Use the [ROUTe:MONitor\[:CHANnel\]:ENABLE](#) command to enable monitor operations on the desired channels. Once the desired channels are configured, use the [ROUTe:MONitor:STATe](#) command to turn on the Monitor mode.
- Any channel that can be "read" by the instrument can be monitored. This includes any combination of temperature, voltage, resistance, current, frequency, or period measurements on multiplexer channels. You can also monitor a digital input channel or the totalizer count on the digital modules.
- Mx+B scaling and alarm limits are applied to the selected channel during a Monitor and all alarm data is stored in the alarm queue (which will be cleared if power fails).

- For monitor operations using a multiplexer module, an error is generated if the internal DMM is disabled (see **INSTrument:DMM[:STATe]** command) or not installed in the mainframe. The internal DMM is *not* required for monitor operations on the digital modules.
- For monitor operations using the internal DMM independent of any channels, use the **ROUTe:MONit-or:MODE** command.
- For 4-wire resistance measurements, the instrument automatically pairs channel *n* in Bank 1 with channel *n+20* in Bank 2 (34921A, 34923A, 34925A) or *n+35* (34922A, 34924A) to provide the source and sense connections. Monitor operations are not allowed on paired channels in Bank 2 while in the 4-wire mode (no error is generated).
- The count on a totalizer channel is *not* reset when it is being monitored (the Monitor ignores the totalizer reset mode).

Return Format

The query command returns the Monitor channel in **Definite-Length Block** format. The syntax is a pound sign (#) followed by a non-zero digit representing the number of characters to follow. This digit is followed by a decimal integer indicating the number of data bytes to follow. This is followed by a block of data containing the specified number of bytes. If you do not specify a channel, the channel currently displayed on the front panel is returned.

For example:



Examples

The following program segment configures channel 3 in slot 1 for dc voltage measurements, enables monitoring on the channel, and turns on the Monitor mode.

```
CONF:VOLT:DC (@1003)
ROUT:MON:CHAN (@1003)
ROUT:MON:CHAN:ENAB ON, (@1003)
ROUT:MON:STAT ON
```

The following command queries the channel currently selected as the Monitor channel.

```
ROUT:MON:CHAN?
```

Typical Response: **#17(@1003)**

See Also

`ROUTe:MONitor[:CHANnel]:ENABle`

`ROUTe:MONitor:MODE`

`ROUTe:MONitor:STATe`

ROUTe:MONitor[:CHANnel]:ENABle

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

ROUTe:MONitor[:CHANnel]:ENABle <mode>, (@<ch_list>)

ROUTe:MONitor[:CHANnel]:ENABle? (@<ch_list>)

Description

This command disables or enables the Monitor mode on the specified channels without modifying the active scan list. Readings acquired during a Monitor are *not* stored in memory but they are displayed on the front panel; however, all readings from a scan in progress at the same time are stored in memory.

Used With:

- 34921A through 34925A Multiplexer Modules
- 34950A Digital I/O Module (digital input and counter channels only)
- 34952A Multifunction Module (digital input and totalizer channels only)

Parameters

Name	Type	Range of Values	Default Value
<mode>	Boolean	{OFF 0 ON 1}	OFF
<ch_list>	Numeric	One or more channels in the form (@sccc) .	This is a required parameter

Remarks

- Channels do *not* have to be part of an active scan list to be monitored; however, the channel must be configured for a measurement in order to be monitored (see [CONFigure](#) and [SENSe](#) commands). Once a channel is configured for a measurement, the monitor mode is automatically enabled on that channel.
- The Monitor mode is automatically enabled on all channels that are part of the active scan list (see [ROUTe:SCAN](#) command). If you define the scan list *after* monitoring has already been enabled, any channels that are not part of the active scan list will be ignored during the monitor operation (no error is generated).
- A scan always has priority over the Monitor function (see [ROUTe:SCAN](#) command).
- Use the [ROUTe:MONitor\[:CHANnel\]](#) command to select which channel will be displayed on the front panel in the Monitor mode. Once the desired channels are configured, use the [ROUTe:MONitor:STATe](#) command to turn on the Monitor mode.

- Any channel that can be "read" by the instrument can be monitored. This includes any combination of temperature, voltage, resistance, current, frequency, or period measurements on multiplexer channels. You can also monitor a digital input channel or the totalizer count on the digital modules.
- Mx+B scaling and alarm limits are applied to the selected channel during a Monitor and all alarm data is stored in the alarm queue (which will be cleared if power fails).
- For monitor operations using a multiplexer module, an error is generated if the internal DMM is disabled (see **INSTRument:DMM[:STATe]** command) or not installed in the mainframe. The internal DMM is *not* required for monitor operations on the digital modules.
- For 4-wire resistance measurements, the instrument automatically pairs channel *n* in Bank 1 with channel *n+20* in Bank 2 (34921A, 34923A, 34925A) or *n+35* (34922A, 34924A) to provide the source and sense connections. Monitor operations are not allowed on paired channels in Bank 2 while in the 4-wire mode (no error is generated).
- The count on a totalizer channel is *not* reset when it is being monitored (the Monitor ignores the totalizer reset mode).
- If a channel that is currently being monitored is closed (see **ROUTe:CLOSe** command) or opened (see **ROUTe:OPeN** command), the Monitor operation will be disabled on that channel.

Return Format

The query command returns "0" (OFF) or "1" (ON) for each channel specified. Multiple responses are separated by commas.

Examples

The following program segment configures channel 3 in slot 1 for dc voltage measurements, enables monitoring on the channel, and turns on the Monitor mode.

```
CONF:VOLT:DC (@1003)
ROUT:MON:CHAN (@1003)
ROUT:MON:CHAN:ENAB ON, (@1003)
ROUT:MON:STAT ON
```

The following query returns the state of the Monitor mode on channel 3 in slot 1.

```
ROUT:MON:CHAN:ENAB?
```

Typical Response: 1

See Also

ROUTe:CLOSe

ROUTe:MONitor[:CHANnel]

ROUTe:MONitor:STATe

ROUTe:OPEN

ROUTe:SCAN

ROUTe:MONitor:DATA?

Syntax | Description | Parameters | Remarks | Return Format | Example

Syntax

ROUTe:MONitor:DATA?

Description

This command reads the data from the channel currently selected for the Monitor mode (**ROUTe:MONitor[:CHANnel]** command) or from the internal DMM. One reading is returned each time this command is executed.

Used With:

- 34921A through 34925A Multiplexer Modules
- 34950A Digital I/O Module (digital input and counter channels only)
- 34952A Multifunction Module (digital input and totalizer channels only)

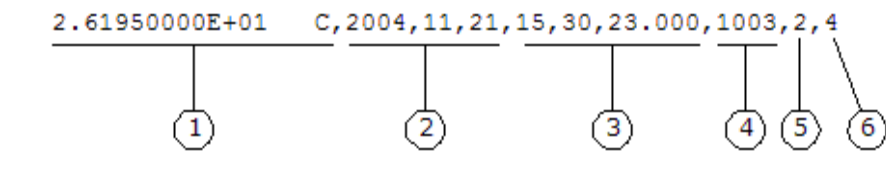
Remarks

- Each reading is returned with measurement units, time stamp, channel number, and alarm status information (independent of the present settings by the **FORMat:READIng** commands). The time stamp is stored in absolute time format (time of day with date), which is based on the instrument's real-time clock as set by the **SYSTem:DATE** and **SYSTem:TIME** commands.
- Use the **ROUTe:MONitor:MODE** command to select whether the Monitor mode uses a module channel or the internal DMM.
- If the Monitor mode is not currently enabled, this command returns the result from the previous Monitor operation.
- Readings acquired during a Monitor are *not* stored in memory but they are displayed on the front panel; however, all readings from a scan in progress at the same time are stored in memory.

Return Format

The command returns one reading for the Monitor channel. If no data is available for the specified channel, "0" is returned for each field.

For example:



1 Reading with Units (26.195 °C)	4 Channel Number
2 Date (November 21, 2004)	5 Alarm Limit Threshold Crossed (0 = No Alarm, 1 = LO, 2 = HI)
3 Time of Day (3:30:23.000 PM)	

Example

The following command returns one reading from the Monitor channel.

```
ROUT:MON:DATA?
```

Typical Response: +1.84280000E-05 VDC,2004,11,21,14,54,33.104,1008,0

See Also

[ROUTe:MONitor\[:CHANnel\]](#)

[ROUTe:MONitor:MODE](#)

[ROUTe:MONitor:STATe](#)

ROUTe:MONitor:MODE

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

ROUTe:MONitor:MODE <mode>

ROUTe:MONitor:MODE?

Description

This command selects whether the Monitor mode uses a channel on one of the modules listed below or the internal DMM.

Used With:

- 34921A through 34925A Multiplexer Modules
- 34950A Digital I/O Module (digital input and counter channels only)
- 34952A Multifunction Module (digital input and totalizer channels only)

Parameters

Name	Type	Range of Values	Default Value
<mode>	Discrete	{CHANnel DMM}	CHAN (the Monitor mode uses a module channel)

Remarks

- Channels do *not* have to be part of an active scan list to be monitored; however, the channel must be configured for a measurement in order to be monitored (see **CONFigure** and **SENSe** commands).
- Use the **ROUTe:MONitor[:CHANnel]** command to select which channel will be displayed on the front panel in the Monitor mode. Use the **ROUTe:MONitor[:CHANnel]:ENABLE** command to enable monitor operations on the desired channels.
- For monitor operations using a multiplexer module, an error is generated if the internal DMM is disabled (see **INSTrument:DMM[:STATe]** command) or not installed in the mainframe. The internal DMM is *not* required for monitor operations on the digital modules.

Return Format

The query command returns "CHAN" or "DMM".

Examples

The following program segment configures channel 3 in slot 1 for dc voltage measurements, enables monitoring on the channel, and turns on the Monitor mode.

```
CONF:VOLT:DC (@1003)
ROUT:MON:CHAN (@1003)
ROUT:MON:MODE CHAN
ROUT:MON:CHAN:ENAB ON, (@1003)
ROUT:MON:STAT ON
```

The following program segment configures the internal DMM for 2-wire resistance measurements and turns on the Monitor mode.

```
CONF:VOLT:RES
ROUT:MON:MODE DMM
ROUT:MON:STAT ON
```

The following query returns which Monitor mode is currently enabled.

```
ROUT:MON:MODE?
```

Typical Response: **CHAN**

See Also

ROUTe:MONitor[:CHANnel]

ROUTe:MONitor[:CHANnel]:ENABLE

ROUTe:MONitor:DATA?

ROUTe:MONitor:STATe

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

ROUTe:MONitor:STATe <mode>

ROUTe:MONitor:STATe?

Description

This command disables or enables the Monitor mode. The Monitor mode is equivalent to making continuous measurements on a single channel with an infinite scan count. Only one channel can be monitored at a time but you can change the channel being monitored at any time. This feature is useful for troubleshooting your system before a test or for watching an important signal.

Used With:

- 34921A through 34925A Multiplexer Modules
- 34950A Digital I/O Module (digital input and counter channels only)
- 34952A Multifunction Module (digital input and totalizer channels only)

Parameters

Name	Type	Range of Values	Default Value
<mode>	Boolean	{OFF 0 ON 1}	OFF

Remarks

- Channels do *not* have to be part of an active scan list to be monitored; however, the channel must be configured for a measurement in order to be monitored (see **CONFigure** and **SENSe** commands).
- The Monitor mode is automatically enabled on all channels that are part of the active scan list (see **ROUTe:SCAN** command).
- A scan always has priority over the Monitor function (see **ROUTe:SCAN** command).
- The Monitor mode ignores all trigger settings (see **TRIGger:SOURce** command) and takes continuous readings on the selected channel using the IMMEDIATE (continuous) source.
- Use the **ROUTe:MONitor:MODE** command to select whether the Monitor mode uses a module channel or the internal DMM.
- Use the **ROUTe:MONitor[:CHANnel]** command to select which channel will be displayed on the front panel in the Monitor mode. Use the **ROUTe:MONitor[:CHANnel]:ENABLE** command to enable monitor operations on the desired channels.

- Any channel that can be "read" by the instrument can be monitored. This includes any combination of temperature, voltage, resistance, current, frequency, or period measurements on multiplexer channels. You can also monitor a digital input channel or the totalizer count on the digital modules.
- Mx+B scaling and alarm limits are applied to the selected channel during a Monitor and all alarm data is stored in the alarm queue (which will be cleared if power fails).
- For monitor operations using a multiplexer module, an error is generated if the internal DMM is disabled (see **INSTRument:DMM[:STATe]** command) or not installed in the mainframe. The internal DMM is *not* required for monitor operations on the digital modules.
- The count on a totalizer channel is *not* reset when it is being monitored (the Monitor ignores the totalizer reset mode).
- If a channel that is currently being monitored is manually closed (see **ROUTe:CLOSe** command) or opened (see **ROUTe:OPeN** command), the Monitor operation will be disabled on that channel.
- Readings acquired during a Monitor are *not* stored in memory but they are displayed on the front panel; however, all readings from a scan in progress at the same time are stored in memory.

Return Format

The query command returns "0" (OFF) or "1" (ON).

Examples

The following program segment configures channel 3 in slot 1 for dc voltage measurements, enables monitoring on the channel, and turns on the Monitor mode.

```
CONF:VOLT:DC (@1003)
ROUT:MON:CHAN (@1003)
ROUT:MON:CHAN:ENAB ON, (@1003)
ROUT:MON:STAT ON
```

The following query returns the state of the Monitor mode.

```
ROUT:MON:STAT?
```

Typical Response: 1

See Also

ROUTe:CLOSe

ROUTe:MONitor[:CHANnel]

ROUTe:MONitor[:CHANnel]:ENABle

ROUTe:MONitor:MODE

ROUTe:MONitor:DATA?

ROUTe:OPEN

ROUTe:OPEN

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

ROUTe:OPEN (@<ch_list>)

ROUTe:OPEN? (@<ch_list>)

Description

This command opens the specified channels on a multiplexer or switch module.

Used With:

- 34921A through 34925A Multiplexer Modules
- 34931A through 34934A Matrix Modules
- 34937A through 34939A GP Switch Modules
- 34945A Microwave Switch/Attenuator Driver
- 34959A Breadboard Module

Parameters

Name	Type	Range of Values	Default Value
<ch_list>	Numeric	One or more channels in the form (@sccc) .	This is a required parameter

Remarks

- For the matrix modules (34931A, 34932A, and 34933A), the channel number represents the intersection of the desired row and column. For example, channel 2304 represents the intersection of row 3 and column 4 on the module in slot 2 (assumes two-wire mode). For more information, see the [simplified schematics](#).
- The RF Multiplexer modules (34941A, 34942A) and Microwave Switch modules (34946A, 34947A) will *not* respond to the ROUTe:OPEN command (an error is generated). To "open" a channel on these modules, send the **ROUTe:CLoSe** command to a different channel in the same bank.
- As part of the scan setup, the **ROUTe:SCAN** command examines the scan list and determines which channel relays and Analog Bus relays will be impacted by the scan. The following rules will apply once the scan is initiated and will impact what relays can be manually opened and closed.

- a. When the scan is initiated, the instrument will open all channels in banks that contain one or more channels in the scan list. In order to guarantee that no signals are connected to the Analog Buses prior to the scan, the instrument will also open all ABus1 relays (applies to all banks in all slots). In addition, if one or more channels configured for 4-wire measurements are included in the scan list, the instrument will also open all ABus2 relays (applies to all banks in all slots). The state of the ABus3 and ABus4 relays is not altered and these relays remain active during the scan.
 - b. While the scan is running, the instrument prohibits use of all channels in banks that contain one or more channels in the specified <ch_list> (these channels are dedicated to the scan). In addition, the instrument prohibits use of all ABus1 relays (and ABus2 relays if applicable) while the scan is running.
 - c. Although the ABus3 and ABus 4 relays remain active during the scan, use *CAUTION* when closing these relays on a bank involved in a scan. While the scan is running, any signals present on ABus3 and/or ABus4 will be joined with the scanned measurement on ABus1 and ABus2.
 - d. At the end of the scan, the last channel that was scanned will be opened (as well as any Analog Bus relays used during the scan). Any channels that were opened during the scan will remain opened at the completion of the scan.
- If this command opens a channel currently being monitored (see **ROUTe:MONitor[:CHANnel]** command), the Monitor operation will be disabled on that channel.
 - The channel addressing scheme used by the 34934A is dependent upon the matrix configuration. See **34934A Channel Addressing** for more information.
 - On the 34945A Microwave Switch/Attenuator Driver, this command places the specified channels in the "normally open" position. The module will never assume that a channel is already open and will always drive the channel (as long as the channel drive is not OFF; see **ROUTe:RMOdule:DRIVE:SOURce[:IMMediate]** command).
 - a. For non-paired (single drive), *pulsed* operations, "open" operations are not allowed on the specified channels (only "close" operations are allowed).
 - b. For non-paired, *non-pulsed* operations, this command stops driving the specified channels.
 - c. When verification is enabled (see **ROUTe:CHANnel:VERify[:ENABLE]** command), the actual hardware state of each relay is sensed for the correct state. If a switch operation appears to have failed, an error will be generated at the time the ROUTe:OPEN command is executed. If you send a ROUTe:OPEN command with a channel list (i.e., multiple channels), the verification is performed after all open operations have been completed. An error will be generated for each channel operation that did not properly verify.
 - d. For paired operations, an error is generated if you specify the upper channel of a pair with this command. If an upper channel of a pair is found within a range of channels, the range expansion will ignore the upper channel and no error is generated.
 - To open and close the output relays on the 34951A Isolated DAC Module, use the **OUTPut[:STATE]** command.

Return Format

The query command returns "1" if the specified channel is open or "0" if the specified channel is closed. Multiple responses are separated by commas.

If verification is enabled (see **ROUTe:CHANnel:VERify[:ENABLE]** command) on the 34945A, 34946A, or 34947A modules, the query command returns the actual hardware state of the specified channels.

For non-paired (single drive) *pulsed* operations on the 34945A, with verification disabled, the query command will return an error. Use the **ROUTe:CHANnel:DRIVE:STATe?** command to query the actual current drive state.

Examples

The following command opens channels 3 and 13 in slot 1.

```
ROUT:OPEN (@1003,1013)
```

The following command opens channel 203 on the matrix module in slot 7 which disconnects Row 2 from Column 3 on Matrix 1.

```
ROUT:OPEN (@7203)
```

The following command opens all channels on Matrix 1 on the matrix module in slot 7 (assumes 34931A).

```
ROUT:OPEN (@7101:7408)
```

The following query reads the state of channels 3 and 13 in slot 1 (1 = open; 0 = closed).

```
ROUT:OPEN? (@1003,1013)
```

Typical Response: 1,1

See Also

OUTPut[:STATe]

ROUTe:CHANnel:DRIVE:STATe?

ROUTe:CHANnel:VERify[:ENABLE]

ROUTe:CLOSe

ROUTe:OPEN:ABUS

ROUTe:OPEN:ALL

ROUTe:MONitor[:CHANnel]

ROUTe:OPEN:ABUS

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

ROUTe:OPEN:ABUS [{<abus>|ALL}]

Description

This command opens all connections to the specified Analog Bus in all eight slots. Alternately by specifying the "ALL" parameter, this command opens all connections to all four Analog Buses on all installed modules (see exceptions below).

Used With:

- 34921A through 34925A Multiplexer Modules
- 34931A through 34933A Matrix Modules

Parameters

Name	Type	Range of Values	Default Value
<abus>	Discrete	{1-4 ABUS1-ABUS4 ALL}	ALL (open connections to all four Analog Buses on all modules)

Remarks

- The following rules apply while an active scan is running on the multiplexer modules (i.e., an **INITiate**, **MEASure?**, or **READ?** command has been issued):
 - a. If "ABUS1" or "ABUS2" is specified, this command opens the corresponding relays (all slots) provided that the Analog Bus is not involved in an active scan. If the specified Analog Bus is involved in an active scan, an error will be generated and no relays will be opened.
 - b. If "ABUS3" or "ABUS4" is specified, this command opens the corresponding relays (all slots). Note that these Analog Buses are not used for scanning.
 - c. If "ALL" is specified, this command opens all four Analog Bus relays (all slots) provided that an active scan is not in progress. If the instrument is currently scanning, an error will be generated and no relays will be opened.
- If there is a Monitor operation in progress (see **ROUTe:MONitor[:CHANnel]** command) that will be impacted by opening the specified Analog Bus relays, monitoring will be turned off and the Analog Bus relay will open.
- Modules that do not have access to the Analog Buses are not effected by this command.
- This command has no effect on the internal DMM's Analog Bus relays.

Examples

The following command opens all connections to Analog Bus 2.

```
ROUT:OPEN:ABUS 2 or ROUT:OPEN:ABUS ABUS2
```

The following command opens all connections to all four Analog Buses on all modules installed in the 34980A.

```
ROUT:OPEN:ABUS ALL
```

See Also

[ROUTe:CLOSe](#)

[ROUTe:OPEN:ALL](#)

[ROUTe:MONitor\[:CHANnel\]](#)

ROUTe:OPEN:ALL

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

ROUTe:OPEN:ALL [{<slot>|ALL}]

Description

This command opens all channel relays and Analog Bus relays on the specified multiplexer or switch module. Alternately by specifying the "ALL" parameter, this command opens all channels on all installed modules (see exceptions below).

Used With:

- 34921A through 34925A Multiplexer Modules
- 34931A through 34934A Matrix Modules
- 34937A through 34939A GP Switch Modules
- 34959A Breadboard Module

Parameters

Name	Type	Range of Values	Default Value
<slot>	Discrete	{1-8 SLOT1-SLOT8 ALL}	ALL (open all channel relays and Analog Bus relays on all modules)

Remarks

- The following rules apply while an active scan is running on the multiplexer modules (i.e., an **INITiate**, **MEASure?**, or **READ?** command has been issued):
 - a. If a <slot> is specified, this command opens all relays on the module provided that no channels are involved in an active scan. If channels in any bank on the module are being scanned, an error will be generated and no relays will be opened.
 - b. If "ALL" is specified, this command opens all relays on all modules provided that no channels are involved in an active scan (i.e., the scan list is empty). If any channels on any module are being scanned, an error will be generated and no relays will be opened.
- The RF Multiplexer modules (34941A, 34942A) and Microwave Switch modules (34946A, 34947A) will *not* respond to the ROUTe:OPEN:ALL command. To "open" a channel on these modules, send the **ROUTe:CLOSe** command to a different channel in the same bank. An error may or may not be generated depending on which parameter you specify:

- a. If a <slot> is specified, this command will generate an error and no relays will change position.
- b. If "ALL" is specified, this command will *not* generate an error but no relays will change position.
- If this command opens a channel that is currently being monitored (see **ROUTe:MONitor[:CHANnel]** command), the Monitor operation will be disabled on that channel.
- This command does not apply to channels on the 34945A Microwave Switch/Attenuator Driver.
- To open and close the output relays on the 34951A Isolated DAC Module, use the **OUTPut[:STATe]** command.

Examples

The following command opens all channels (channel relays and Analog Bus relays) on the module in slot 1.

```
ROUT:OPEN:ALL 1 or ROUT:OPEN:ALL SLOT1
```

The following command opens all channels (channel relays and Analog Bus relays) on all modules installed in the 34980A.

```
ROUT:OPEN:ALL ALL
```

See Also

OUTPut[:STATe]

ROUTe:CLOSe

ROUTe:OPEN:ABUS

ROUTe:MONitor[:CHANnel]

ROUTe:OPEN:PAIR

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

ROUTe:OPEN:PAIR (@<ch_list>)

ROUTe:OPEN:PAIR? (@<ch_list>)

Description

This command performs a 2-wire open of the specified channel and its paired channel. The query form of the command returns '1' if both channels in the pair are opened.

Used With:

- 34934A High-Density Matrix Module

Parameters

Name	Type	Range of Values	Default Value
<ch_list>	Numeric	One or more channels in the form defined in the section 34934A Channel Addressing . Only the channels corresponding to the high (H) terminals of the matrix are specified.	This is a required parameter

Remarks

- This command is valid for the 4x32, 4x64, and 8x32 configurations. For these configurations, the matrix high channels (H terminals) are paired with their corresponding matrix low channels (L terminals).
- Both channels in the pair are opened after the command completes, regardless of the initial state of the individual channels.
- An error occurs (card does not support requested operation) if the command is executed while the module is in the 4x128, 8x64, or 16x32 configuration as these modes do not contain high/low channel pairs.
- To open/query 1-wire channels of all matrix configurations, use the ROUTe:OPEN and ROUTe:OPEN? commands.
- Channel numbering – the channel addressing scheme used by the 34934A is dependent upon the matrix configuration. See [34934A Channel Addressing](#) for more information.

Return Format

The query command returns "1" if **both** channels of the pair are open, or "0" if either or both channels of the pair are closed. If the paired channels are in different states, an error is generated in addition to the "0" returned. The states of multiple channels queried are separated by commas.

Examples

The following command opens channel 1520 and its paired channel 1584 on row 3 in slot 1. The module is configured as a dual 4x64 matrix. Note that only the channel of the high matrix (MH) is specified.

```
ROUT:OPEN:PAIR (@1520)
```

The following command opens channels 2610 and 2611 and **their** paired channels 2642 and 2643 on row 6 in slot 2. The module is configured as a 8x32 matrix. Note that only the channels of the high matrix (MH) are specified.

```
ROUT:OPEN:PAIR (@2610, 2611)
```

The following query reads the state of the channels opened in the above examples (1 = open; 0 = either or both channels in pair is closed). Only the channels in the upper matrix are specified.

```
ROUT:OPEN:PAIR? (@1520)
```

Typical Response: 1

```
ROUT:OPEN:PAIR? (@2610, 2611)
```

Typical Response: 1,1

See Also

ROUTe:OPEN

ROUTe:OPEN:ALL

ROUTe:OPERation:OVERlap[:ENABle]

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

ROUTe:OPERation:OVERlap[:ENABle] <mode>

ROUTe:OPERation:OVERlap[:ENABle]?

Description

This command disables or enables the command overlap function. When enabled, subsequent commands can be processed prior to the completion of overlapped module operations on previous commands. This function affects the behavior of the ROUTe:CLOSe and ROUTe:OPEN commands for switching operations.

Used With:

- 34921A through 34925A Multiplexer Modules
- 34931A through 34934A Matrix Modules
- 34937A through 34939A GP Switch Modules
- 34941A and 34942A RF Multiplexer Modules
- 34945A Microwave Switch/Attenuator Driver
- 34946A and 34947A Microwave Switch Modules

Parameters

Name	Type	Range of Values	Default Value
<mode>	Boolean	{OFF 0 ON 1}	OFF (commands are processed in a serial fashion)

Remarks

- When the command overlap function is *disabled* (OFF, factory default), all commands are processed in a serial fashion in the exact order they are received. In this mode, the instrument ensures that all overlapped module operations are complete prior to processing the next command. As a result, overall switching performance may be degraded because operations are not overlapped in this mode. Note, however, that within a single command containing a channel list parameter (e.g., ROUTe:CLOSe (@1001:1010)), the order of the individual operations is *not* guaranteed.

- When the command overlap function is *enabled* (ON), subsequent commands can be processed prior to the completion of overlapped module operations on previous commands. In this mode, you must rely on the ***OPC**, ***OPC?**, **ROUTe:MODUle:WAIT**, and ***WAI** synchronization commands to ensure completion of the previous commands.
- The specified setting applies to the entire instrument.
- This command is used primarily with the **ROUTe:CLOSe** and **ROUTe:OPeN** commands for switching operations. Most of the other commands used by the 34980A (i.e., those that don't operate switches) will perform non-overlapped operations. For these commands, there will be no degradation in performance between the overlapped and non-overlapped modes.
- When operating switch channels on which *verification* is enabled (see **ROUTe:CHANnel:VERify[:ENABle]** command), the overlapping operation will be suspended until the verified switch operations are complete.
- The command overlap setting is stored in **volatile** memory and will be disabled (OFF) after a Factory Reset (***RST** command).

Return Format

The query command returns "0" (OFF) or "1" (ON) to indicate the overlap setting for the entire instrument.

Examples

The following command enables the command overlap function.

```
ROUT:OPER:OVER:ENAB ON
```

The following query returns the state of the command overlap function.

```
ROUT:OPER:OVER:ENAB?
```

Typical Response: 1

See Also

ROUTe:CHANnel:VERify[:ENABle]

ROUTe:CLOSe

ROUTe:MODUle:BUSY?

ROUTe:MODUle:WAIT

ROUTe:OPeN

***OPC**

***OPC?**

***WAI**

ROUTe:RMOdule:BANK:DRive[:MODE]

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

ROUTe:RMOdule:BANK:DRive[:MODE] <mode>, {<bank>|ALL}, (@<rem_ch_list>)

ROUTe:RMOdule:BANK:DRive[:MODE]? <bank>, (@<rem_ch_list>)

Description

This command selects the TTL or open collector drive current mode for the specified 34945EXT remote module connected to the 34945A Microwave Switch/Attenuator Driver. The drive current mode can be controlled on a per-bank basis.

Used With:

- 34945A Microwave Switch/Attenuator Driver

Parameters

Name	Type	Range of Values	Default Value
<mode>	Discrete	{TTL OCOLlector}	Depends on the Distribution Board type (see "Remarks" below).
<bank>	Discrete	{1-4 BANK1-BANK4 ALL} Specify an individual bank or ALL four banks on the specified 34945EXT remote module.	This is a required parameter.
<rem_ch_list>	Numeric	One or more 34945EXT remote module identifiers in the form (@sr00) . Select from s100 through s800.	This is a required parameter.

Remarks

- In the TTL drive mode, the non-driven "rest" state of the specified channels will be a low state, which can provide a current path to ground if an open-collector device is mistakenly connected. If an open-collector device is connected while configured for the TTL drive mode, the following symptoms may result:
 - a. Coils may be continuously driven while the TTL drive mode is in the resting low state. Continuously driving these devices may damage them. Some auto-commutating paired-drive devices will rapidly transition between the two states when both coils are driven simultaneously.

- b. An over-current condition can occur, which will activate the over-current protection circuitry on the 34945EXT remote modules and disable the channel drive (see **ROUTe:RMOdule:DRIVe:SOURce[:IMMe-diate]** command).
- c. Paired-drive open-collector devices operated in the TTL mode may exhibit contrary (opposite) behaviors during operation. Some external microwave devices have built-in protection to disable the coil drives when both coils are driven simultaneously. If this is the case, a pulsed TTL drive would prevent the device from being driven on the TTL pulsed line, thus causing an apparent open-collector drive on the opposite coil. This would cause the paired device to transition to the opposite state.
- You can not mix open-collector and TTL type devices on the same bank.
- The default drive mode setting is evaluated when the following commands are issued:
 - a. The **ROUTe:RMOdule:BANK:PRESet** command restores the drive mode to its default for the Distribution Board type in use. See the Keysight 34980A *User's Guide* for more information.
 - b. The **SYSTem:RMOdule:RESet** command restores the drive setting to OCOLlector.
- In order to change the drive current mode, you must disable the channel drive state (see **ROUTe:RMOdule:DRIVe:SOURce[:IMMe-diate]** command). When you subsequently enable the channel drive state (by specifying EXTeRnal or INTeRnal), all *unverified* channels on the specified module will be reset to their user-defined default values (see **ROUTe:CHANnel:DRIVe:CLOSe:DEFAult** and **ROUTe:CHANnel:DRIVe:OPEN:DEFAult** commands).
- The drive mode setting is stored in **non-volatile** memory on the 34945EXT remote module.

Return Format

The query command returns "TTL" or "OCOL" for the specified channels. Multiple responses are separated by commas.

Examples

The following program segment selects the TTL drive mode on 34945EXT remote module #2 (slot 3).

```
ROUT:RMOD:DRIV:SOUR OFF, (@3200) !Must disable channel drive
ROUT:RMOD:BANK:DRIV:MODE TTL, BANK2, (@3200) !Select drive mode
```

The following command returns the drive mode on 34945EXT remote module #2 (slot 3).

```
ROUT:RMOD:BANK:DRIV:MODE? BANK2, (@3200)
```

Typical Response: TTL

See Also

ROUTe:RMOdule:BANK:PRESet

ROUTe:CHANnel:DRIVe:CLOSe:DEFAult

ROUTe:CHANnel:DRIVe:OPEN:DEFAult

ROUTe:RMODule:DRIVe:SOURce[:IMMediate]

SYSTem:RMODule:RESet

ROUTe:RMOdule:BANK:LED:DRIVE[:ENABLE]

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

ROUTe:RMOdule:BANK:LED:DRIVE[:ENABLE] <mode>, {<bank>|ALL}, (@<rem_ch_list>)

ROUTe:RMOdule:BANK:LED:DRIVE[:ENABLE]? <bank>, (@<rem_ch_list>)

Description

This command disables or enables the LED drives on the specified 34945EXT remote module connected to the 34945A Microwave Switch/Attenuator Driver. The LED drives can be controlled only on a per-bank basis.

Used With:

- 34945A Microwave Switch/Attenuator Driver

Parameters

Name	Type	Range of Values	Default Value
<mode>	Boolean	{OFF 0 ON 1}	ON (enabled)
<bank>	Discrete	{1-4 BANK1-BANK4 ALL} Specify an individual bank or ALL four banks on the specified 34945EXT remote module.	This is a required parameter.
<rem_ch_list>	Numeric	One or more 34945EXT remote module identifiers in the form (@sr00) . Select from s100 through s800.	This is a required parameter.

Remarks

- Each channel on the 34945EXT remote modules has an LED drive, which reflects the position indicator state (as supported by the external device connected). Note that the LEDs are *not* supplied with the modules; see the Keysight 34980A *User's Guide* for more information on connecting LEDs to the Distribution Board connectors.
- Use the [ROUTe:RMOdule:BANK:LED:DRIVE:LEVel](#) to control the current level for the LED drives on a per-bank basis.

- Use the **ROUTe:CHANnel:VERify:POLarity** command to set the logic polarity of the verification lines. You can specify the polarity as "NORMal" (active high, default) or "INVerted" (active low).
- The LED drive setting can be overridden by the **ROUTe:RMOdule:DRIVe:SOURce[:IMMediate]** command, which selects the power source for the 34945EXT remote module (OFF, INTERNAL, or EXTERNAL power). When selecting a power source other than OFF, the LED drive state configured by this command dictates whether current is applied to the bank's LED lines.
- &&is automatically enabled.
- The LED drive setting is stored in **non-volatile** memory on the 34945EXT remote module. The default state (ON) is restored by the **SYSTem:RMOdule:RESet** command.

Return Format

The query command returns "0" (OFF) or "1" (ON). Multiple responses are separated by commas.

Examples

The following program segment enables the LED drive on 34945EXT remote module #2 (slot 3).

```
ROUT:RMOD:BANK:LED:DRIV:LEVEL 0.01,BANK2,(@3200) !Drive is 10 mA on Bank 2
ROUT:RMOD:BANK:LED:DRIV:ENAB ON,BANK2,(@3200) !Enable drive on Bank 2
ROUT:RMOD:DRIV:SOUR INT,(@3200) !Enable channel drive
```

The following command returns the LED drive state on 34945EXT remote module #2 (slot 3).

```
ROUT:RMOD:BANK:LED:DRIV:ENAB? BANK2,(@3200)
```

Typical Response: 1

See Also

ROUTe:CHANnel:VERify:POLarity

ROUTe:RMOdule:BANK:LED:DRIVe:LEVel

ROUTe:RMOdule:DRIVe:SOURce[:IMMediate]

SYSTem:RMOdule:RESet

ROUTe:RMOdule:BANK:LED:DRIVe:LEVel

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

ROUTe:RMOdule:BANK:LED:DRIVe:LEVel {<amps>|MIN|MAX|DEF}, {<bank>|ALL}, (@<rem_ch_list>)

ROUTe:RMOdule:BANK:LED:DRIVe:LEVel? [{MIN|MAX},] <bank>, (@<rem_ch_list>)

Description

This command controls the current level for the LED drives on the specified 34945EXT remote module connected to the 34945A Microwave Switch/Attenuator Driver. The current level can be varied at the bank level, which allows you to vary the LED brightness for each bank.

Used With:

- 34945A Microwave Switch/Attenuator Driver

Parameters

Name	Type	Range of Values	Default Value
<amps>	Numeric	Desired current in amps between 1 mA and 20 mA, with 1 mA resolution. MIN = 1 mA, MAX = 20 mA	5 mA
<bank>	Discrete	{1-4 BANK1-BANK4 ALL} Specify an individual bank or ALL four banks on the specified 34945EXT remote module.	This is a required parameter.
<rem_ch_list>	Numeric	One or more 34945EXT remote module identifiers in the form (sr00) . Select from s100 through s800.	This is a required parameter.

Remarks

- Each channel on the 34945EXT remote modules has an LED drive, which reflects the position indicator state (as supported by the external device connected). Note that the LEDs are *not* supplied with the modules; see the Keysight 34980A *User's Guide* for more information on connecting LEDs to the Distribution Board connectors.

- Use the **ROUTe:RMOdule:BANK:LED:DRIVe[:ENABle]** command to enable the current drives on a per-bank basis.
- The current drive level setting is stored in **non-volatile** memory on the 34945EXT remote module. The default level (5 mA) is restored only by the **SYSTem:RMOdule:RESet** command.

Return Format

The query command returns the current drive level in the form "+1.00000000E-01" for the specified banks. Multiple responses are separated by commas.

Examples

The following program segment sets the current drive level to 10 mA on 34945EXT remote module #2 (slot 3).

```
ROUT:RMOD:BANK:LED:DRIV:LEVEL 0.01,BANK2,(@3200) !Drive is 10 mA on Bank 2
ROUT:RMOD:BANK:LED:DRIV:ENAB ON,BANK2,(@3200) !Enable drive on Bank 2
```

The following command returns the current drive level on 34945EXT remote module #2 (slot 3).

```
ROUT:RMOD:BANK:LED:DRIV:LEVEL? BANK2,(@3200)
```

Typical Response: **+1.00000000E-02**

See Also

ROUTe:RMOdule:BANK:LED:DRIVe[:ENABle]

SYSTem:RMOdule:RESet

ROUTe:RMOdule:BANK:PRESet

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

ROUTe:RMOdule:BANK:PRESet {<bank>|ALL}, (@<rem_ch_list>)

Description

This command immediately reconfigures the specified bank on the 34945A Microwave Switch/Attenuator Driver to a preset state. The preset configuration is a predefined state for each Distribution Board type in use. See the Keysight 34980A *User's Guide* for more information on the preset state for each Distribution Board. The following table summarizes the preset state.

Attribute	Preset State
At the Bank Level:	
ROUTe:RMOdule:BANK:DRIVE[:MODE]	Distribution Board specific*
ROUTe:RMOdule:BANK:LED:DRIVE[:ENABLE]	No change
ROUTe:RMOdule:BANK:LED:DRIVE:LEVel	No change
All Channels:	
ROUTe:CHANnel:DRIVE:PAIRed[:MODE]	Distribution Board specific*
ROUTe:CHANnel:DRIVE:PULSe[:MODE]	Distribution Board specific*
ROUTe:CHANnel:DRIVE:PULSe:WIDTh	Distribution Board specific*
ROUTe:CHANnel:DRIVE:TIME:RECoverY	Distribution Board specific*
ROUTe:CHANnel:DRIVE:TIME:SETTle	Distribution Board specific*
ROUTe:CHANnel:DRIVE:OPEN:DEFault	OPEN selected
ROUTe:CHANnel:VERify[:ENABLE]	OFF
ROUTe:CHANnel:VERify:POLarity	NORMal

* See the Keysight 34980A *User's Guide* for more information.

Used With:

- 34945A Microwave Switch/Attenuator Driver

Parameters

Name	Type	Range of Values	Default Value
<bank>	Discrete	{1-4 BANK1-BANK4 ALL} Specify an individual bank or ALL four banks on the specified 34945EXT remote module.	This is a required parameter.
<rem_ch_list>	Numeric	One or more 34945EXT remote module identifiers in the form <u>(@sr00)</u> . Select from s100 through s800.	This is a required parameter.

Remarks

- In order to issue a preset, you must disable the channel drive state (see **ROUTe:RMOdule:DRIVe:SOURce[:IMMediate]** command) on the specified bank. When you subsequently enable the channel drive state (by specifying EXTeRnal or INTeRnal), all *unverified* channels on the specified module will be reset to their user-defined default values (see **ROUTe:CHANnel:DRIVe:CLOSe:DEFAult** and **ROUTe:CHANnel:DRIVe:OPeN:DEFAult** commands).
- Issuing a preset to banks with no Distribution Boards attached will configure the associated channels to the same state as the Y1155A screw terminal distribution board. See the Keysight 34980A *User's Guide* for more information.
- A preset will overwrite all user-defined channel labels on the associated banks with generated labels that are appropriate for the distribution board (see **ROUTe:CHANnel:LABel[:DEFine]** command).
- The **SYSTem:RMOdule:RESet** command resets all 34945EXT remote modules associated with a specific slot. With this command, all bank-level attributes are reset without regard to which distribution boards are installed.
- The ***RST** and **SYSTem:PRESet** commands drive all channels on a remote module to their default switch positions as specified by the **ROUTe:CHANnel:DRIVe:OPeN:DEFAult** command and set all channel drives to the specified boot state (see **ROUTe:RMOdule:DRIVe:SOURce:BOOT** command). In addition, when the *RST and SYSTem:PRESet commands are executed, the 34945A automatically re-evaluates all external remote module connections to determine what is connected, what is powered, etc. No other settings are changed.
- The **SYSTem:CPON** command has nearly the same effect as the ***RST** and **SYSTem:PRESet** commands (see above). However, when the SYSTem:CPON command is executed, the 34945A does *not* re-evaluate the external remote module connections.

Example

The following program segment presets Bank 2 on 34945EXT remote module #2 (slot 3).

```
ROUT:RMOD:DRIV:SOUR OFF, (@3200) !Must disable channel drive  
ROUT:RMOD:BANK:PRES BANK2, (@3200) !Issue preset
```

See Also

***RST**

ROUTe:RMOdule:DRIVe:SOURce[:IMMediate]

SYSTem:CPON

SYSTem:PRESet

SYSTem:RMOdule:RESet

ROUTe:RMOdule:DRIVe:LIMit

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

ROUTe:RMOdule:DRIVe:LIMit {<max_drives>|MIN|MAX|DEF}, (@<rem_ch_list>)

ROUTe:RMOdule:DRIVe:LIMit? [{MIN|MAX},] (@<rem_ch_list>)

Description

This command set the number of *simultaneous* coil drive activations to be allowed on the specified 34945EXT remote module connected to the 34945A Microwave Switch/Attenuator Driver. By specifying a value greater than one drive, you can improve cumulative switching times by allowing the 34945EXT to overlap channel drives.

Used With:

- 34945A Microwave Switch/Attenuator Driver

Parameters

Name	Type	Range of Values	Default Value
<max_drives>	Numeric	Desired number of simultaneous coil drive activations allowed. MIN = 1 drive, MAX = 8 drives	1 drive
<rem_ch_list>	Numeric	One or more 34945EXT remote module identifiers in the form (@sr00) . Select from s100 through s800.	This is a required parameter.

Remarks

- Use discretion when specifying a value greater than one drive when configured for an INTERNAL (mainframe) drive source (see **ROUTe:RMOdule:DRIVe:SOURce[:IMMediate]** command). The INTERNAL drive provides a very limited power source for driving channels, and driving multiple channels can cause the over-current protection circuitry on the 34945EXT remote module to be activated. An error will be generated and the operation will fail.
- The **ROUTe:CHANnel:DRIVe:TIME:RECoverY** command sets the minimum recovery time for the drive power supply on specific channels. If you set the recovery time to any value greater than 0 seconds, the overlapping behavior of the ROUTe:RMOdule:DRIVe:LIMit command may be temporarily suspended when those channels are operated.

- If you reduce the number of simultaneous coil drive activations, the time required to complete a reset/preset will increase (also see **ROUTe:CHANnel:DRIVe:PULSe:WIDTh** command) and power supply recovery time (see **ROUTe:CHANnel:DRIVe:TIME:RECovery** command).
- The drive setting is stored in **non-volatile** memory on the 34945EXT remote module.

Return Format

The query command returns the drive limit on the specified 34945EXT remote module. Multiple responses are separated by commas.

Examples

The following command sets a drive limit of five simultaneous coil drive activations on 34945EXT remote module #2 (slot 3).

```
ROUT:RMOD:DRIV:LIM 5, (@3200)
```

The following command returns the drive limit on 34945EXT remote module #2 (slot 3).

```
ROUT:RMOD:DRIV:LIM? (@3200)
```

Typical Response: **5**

See Also

ROUTe:CHANnel:DRIVe:PULSe:WIDTh

ROUTe:CHANnel:DRIVe:TIME:RECovery

ROUTe:RMOdule:DRIVe:SOURce[:IMMediate]

ROUTe:RMOdule:DRIVe:SOURce:BOOT

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

ROUTe:RMOdule:DRIVe:SOURce:BOOT <source>, (@<rem_ch_list>)

ROUTe:RMOdule:DRIVe:SOURce:BOOT? (@<rem_ch_list>)

Description

This command selects the power source to be used following the next boot (power) cycle or Factory Reset (***RST** command) on the specified 34945EXT remote module connected to the 34945A Microwave Switch/Attenuator Driver. The INTernal source is available only for the 34945EXT Master module, which can be powered directly by the 34980A. Each of the 34945EXT Slave modules must be powered by an EXTernal source that you apply to the module. For more information on connecting an external power source to the module, see the Keysight 34980A *User's Guide*.

Used With:

- 34945A Microwave Switch/Attenuator Driver

Parameters

Name	Type	Range of Values	Default Value
<source>	Discrete	{OFF INTernal EXTernal}	OFF (all switching is tri-state)
<rem_ch_list>	Numeric	One or more 34945EXT remote module identifiers in the form (@sr00) . Select from s100 through s800.	This is a required parameter.

Remarks

- If the boot drive source is configured to be OFF, then no channels will be driven on that module during reset operations.
- The factory default state is set to OFF to ensure that no external microwave devices will be driven until you specifically enable the desired power source. To enable the channel drives again after a boot, use the **ROUTe:RMOdule:DRIVe:SOURce[:IMMediate]** command.
- If you have selected the INTernal source but the specified module is not a 34945EXT Master module, a boot error will be generated and the *channel* drive source will be set to OFF. Note, however, that the *boot* drive source is not changed.

- If you change the source from OFF to INTernal (or EXTernal), the time required to complete a boot/reset/preset may be significant depending on the specified pulse width (see **ROUTe:CHANnel:DRIVe:PULSe:WIDTh** command) and power supply recovery time (see **ROUTe:CHANnel:DRIVe:TIME:RECovery** command). If both values are set to their upper limits (255 ms each) for all channels, the time required to reset/preset (or boot) the module may exceed 30 seconds:

$$64 \text{ Channels} \times (255 \text{ ms Pulse Width} + 255 \text{ ms Recovery Time}) = \sim 33 \text{ seconds}$$

- This command ensures that if a 34945EXT Slave module is ever attached to a "master" position, it will continue to be driven by the EXTernal supply. This will prevent any external microwave devices from possibly damaging the 34980A's INTernal 24V supply.
- If a 34945EXT Master module is configured to boot with the INTernal source and is reconnected as a "slave" module, an error will be generated and the channel drive source will be set to OFF. Once the module is reconnected as the "master" module, you will have to send this command again to specify the INTernal source.
- The drive source setting is stored in **non-volatile** memory on the 34945EXT remote module.

Return Format

The query command returns "OFF", "INT", or "EXT" for the specified channels. Multiple responses are separated by commas.

Examples

The following command selects the EXTernal source on 34945EXT remote module #2 (slot 3).

```
ROUT:RMOD:DRIV:SOUR:BOOT EXT, (@3200)
```

The following command returns the drive source on 34945EXT remote module #2 (slot 3).

```
ROUT:RMOD:DRIV:SOUR:BOOT? (@3200)
```

Typical Response: **EXT**

See Also

ROUTe:CHANnel:DRIVe:PULSe:WIDTh

ROUTe:CHANnel:DRIVe:TIME:RECovery

ROUTe:RMOdule:DRIVe:SOURce[:IMMediate]

ROUTe:RMOdule:DRIVe:SOURce[:IMMediate]

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

ROUTe:RMOdule:DRIVe:SOURce[:IMMediate] <source>, (@<rem_ch_list>)

ROUTe:RMOdule:DRIVe:SOURce[:IMMediate]? (@<rem_ch_list>)

Description

This command selects the power source for driving channels on the specified 34945EXT remote module connected to the 34945A Microwave Switch/Attenuator Driver. The INTERNAL source is available only for the 34945EXT Master module, which can be powered directly by the 34980A. Each of the 34945EXT Slave modules must be powered by an EXTERNAL source that you apply to the module. For more information on connecting an external power source to the module, see the Keysight 34980A *User's Guide*.

Used With:

- 34945A Microwave Switch/Attenuator Driver

Parameters

Name	Type	Range of Values	Default Value
<source>	Discrete	{OFF INTERNAL EXTERNAL}	OFF (all switching is tri-state)
<rem_ch_list>	Numeric	One or more 34945EXT remote module identifiers in the form (@sr00) . Select from s100 through s800.	This is a required parameter.

Remarks

- Use the **ROUTe:RMOdule:DRIVe:SOURce:BOOT** command to define which channel drive source will be used following the next boot (power) cycle or Factory Reset (***RST** command).
- When you change from one channel drive source to another (including from OFF to INTERNAL or EXTERNAL), all *unverified* channels on the specified module will be reset to their user-defined default values (see **ROUTe:CHANnel:DRIVe:CLOSe:DEFault** and **ROUTe:CHANnel:DRIVe:OPEN:DEFault** commands).
- Channels on which verification is enabled (see **ROUTe:CHANnel:VERify[:ENABle]** command) are *not* driven when the ROUTe:RMOdule:DRIVe:SOURce[:IMMediate] command is sent with the INTERNAL or EXTERNAL source. In this case, the verified state is simply assumed by the module.

- If a number of channels are configured for long pulse widths (see **ROUTe:CHANnel:DRIVE:PULSe:WIDTh** command) and recovery times (see **ROUTe:CHANnel:DRIVE:TIME:RECoverY** command), this command can take as long as 30 seconds to complete.
- The factory default state is set to OFF to ensure that no external microwave devices will be driven until you specifically enable the desired power source.
- By setting the channel drive source to OFF, all channel drives go to a tri-state mode regardless of whether the outputs are configured for the TTL or open-collector mode. An error will be generated if you attempt to operate channels while the power source is OFF.
- When the channel drive source is set to OFF, the position indicator LED drives are also disabled (see **ROUTe:RMOdule:BANK:LED:DRIVE[:ENABle]** command).
- The following commands require that the channel drive source be OFF in order to allow reconfiguration:

ROUTe:CHANnel:DRIVE:PAIRed[:MODE]
ROUTe:CHANnel:DRIVE:PULSe[:MODE]
ROUTe:RMOdule:BANK:DRIVE[:MODE]
ROUTe:RMOdule:BANK:PRESet

Return Format

The query command returns "OFF", "INT", or "EXT" for the specified channels. Multiple responses are separated by commas.

Examples

The following command selects the EXternal source on 34945EXT remote module #2 (slot 3).

```
ROUT:RMOD:DRIV:SOUR EXT, (@3200)
```

The following command returns the drive source on 34945EXT remote module #2 (slot 3).

```
ROUT:RMOD:DRIV:SOUR? (@3200)
```

Typical Response: **EXT**

See Also

ROUTe:CHANnel:DRIVE:PAIRed[:MODE]
ROUTe:CHANnel:DRIVE:PULSe[:MODE]
ROUTe:CHANnel:DRIVE:PULSe:WIDTh
ROUTe:CHANnel:DRIVE:TIME:RECoverY
ROUTe:CHANnel:VERify[:ENABle]
ROUTe:RMOdule:BANK:DRIVE[:MODE]

ROUTe:RMODule:BANK:LED:DRIVe[:ENABle]

ROUTe:RMODule:BANK:PRESet

ROUTe:RMODule:DRIVe:SOURce:BOOT

ROUTe:SCAN

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

ROUTe:SCAN (@<scan_list>)

ROUTe:SCAN?

Description

This command is used in conjunction with the **CONFigure** commands to set up an automated scan. The specified channels supersede any channels previously defined to be part of the scan list. To start the scan, use the **INITiate** or **READ?** command.

Used With:

- 34921A through 34925A Multiplexer Modules
- 34950A Digital I/O Module (digital input and counter channels only)
- 34952A Multifunction Module (digital input and totalizer channels only)

NOTE

To remove all channels from the present scan list, send "**ROUT:SCAN (@)**". With an empty scan list, many commands will be directed to the internal DMM.

Parameters

Name	Type	Range of Values	Default Value
<scan_list>	Numeric	One or more channels in the form (@sccc) . The specified channels will redefine the present scan list.	This is a required parameter

Remarks

- By default, the instrument scans the list of channels in ascending order from slot 1 through slot 8 (channels are reordered as needed). If your application requires non-ordered scanning of the channels in the present scan list, you can use the **ROUTe:SCAN:ORDERed** command to enable the non-sequential scanning mode. In either mode, channels which are not in the scan list are skipped during the scan.
 - a. For *sequential* scanning (default, **ROUT:SCAN:ORDERED ON**), the specified channels are reordered as needed and duplicate channels are eliminated. For example, (@2001,1003,1001,1003) will be interpreted as (@1001,1003,2001).

- b. For *non-sequential* scanning (ROUT:SCAN:ORDERED **OFF**), the channels remain in the order presented in the scan list (see exception below). Multiple occurrences of the same channel are allowed. For example, (@2001,2001,2001) and (@3010,1003,1001,1005) are valid and the channels will be scanned in the order presented.

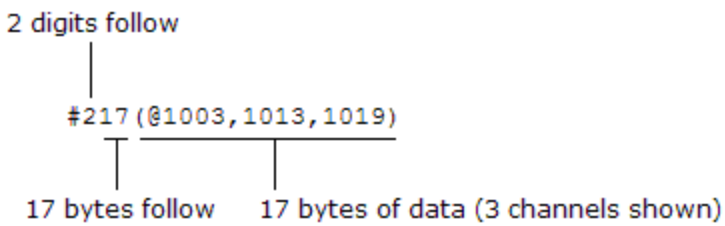
Note: Non-sequential scan lists are *not* stored as part of the instrument state by the ***SAV** command.

- c. When you specify a *range* of channels in the scan list, the channels are always sorted in ascending order, regardless of the ROUTe:SCAN:ORDERed setting. Therefore, (@1009:1001) will always be interpreted as 1001, 1002, 1003, etc.
- The Analog Bus relays are automatically opened and closed as required during the scan to connect to the internal DMM for the measurement. For example, all 2-wire measurements use the ABus1 (MEAS) relays; for 4-wire measurements, the ABus2 (SENS) relays are used in addition to the ABus1 relays.
 - You can use either the internal DMM or an external instrument to make measurements of your configured channels. However, the 34980A allows only one scan list at a time; you cannot scan some channels using the internal DMM and others using an external instrument. Readings are stored in 34980A memory only when the internal DMM is used.
 - You can store at least 500,000 readings in memory and all readings are automatically time stamped. If memory overflows, a status register bit is set and new readings will overwrite the first (oldest) readings stored. The most recent readings are always preserved. You can read the contents of memory at any time, even during a scan. Reading memory is *not* cleared when you read it.
 - Each time you start a new scan, the instrument clears all readings (including alarm data) stored in reading memory from the previous scan. Therefore, the contents of memory are always from the most recent scan.
 - If you abort a scan that is running (see **ABORT** command), the instrument will terminate any reading in progress (readings are not cleared from memory). If a scan is in progress when the command is received, the scan will not be completed and you cannot resume the scan from where it left off. Note that if you initiate a new scan, all readings are cleared from memory.
 - The CONFigure and MEASure? commands do not modify the scan list.
 - To add channels to the present scan list, use the **ROUTe:SCAN:ADD** command. To remove channels from the present scan list, use the **ROUTe:SCAN:REMove** command.
 - The Monitor mode is automatically enabled on all channels that are part of the active scan list (see **ROUTe:MONitor[:CHANnel]:ENABle** command).
 - The present scan list is stored in **volatile** memory and will be lost when power is turned off or after a Factory Reset (***RST** command).

Return Format

The query command returns a list of channel numbers in **Definite-Length Block** format. The syntax is a pound sign (#) followed by a non-zero digit representing the number of characters to follow. This digit is followed by a decimal integer indicating the number of data bytes to follow. This is followed by a block of data containing the specified number of bytes. An empty scan list (one with no channels selected) will be indicated by **"#13(@)"**

For example:



Note that the order of the channels in the string returned may or may not be sequential, depending on the **ROUTe:SCAN:ORDer** setting.

Examples

The following program segment shows how to use the **CONF** command to configure two channels for dc voltage measurements. The **ROUTe:SCAN** command puts the two channels into the scan list (and redefines the scan list). The **INITiate** command places the instrument in the "wait-for-trigger" state and then sends the readings to memory. The **FETCh?** command transfers the readings from memory to the instrument's output buffer.

```
CONF:VOLT:DC 10,0.003, (@1003,1008)
ROUT:SCAN (@1003,1008)
INIT
FETCh?
```

Typical Response: **+4.27150000E-03,+1.32130000E-03**

The following command clears the present scan list.

```
ROUT:SCAN (@)
```

The following query returns a list of channels in the present scan list (assumes sequential mode).

```
ROUT:SCAN?
```

Typical Response: **#212(@1003,1008)**

See Also

ABORt

INITiate

OUTPut[:STATe]

READ?

ROUTe:MONitor[:CHANnel]:ENABLE

ROUTe:SCAN:ADD

ROUTe:SCAN:ORDerEd

ROUTe:SCAN:REMove

ROUTe:SCAN:SIZE?

ROUTe:SCAN:ADD

Syntax | Description | Parameters | Remarks | Return Format | Example

Syntax

ROUTe:SCAN:ADD (@<ch_list>)

Description

This command adds the specified channels to the current scan list.

Used With:

- 34921A through 34925A Multiplexer Modules
- 34950A Digital I/O Module (digital input and counter channels only)
- 34952A Multifunction Module (digital input and totalizer channels only)

Parameters

Name	Type	Range of Values	Default Value
<ch_list>	Numeric	One or more channels in the form <u>(@sccc)</u> .	This is a required parameter

Remarks

- By default, the instrument scans the list of channels in ascending order from slot 1 through slot 8 (channels are reordered as needed). If your application requires non-ordered scanning of the channels in the present scan list, you can use the **ROUTe:SCAN:ORDERed** command to enable the non-sequential scanning mode.
 - a. For *sequential* scanning (default, ROUT:SCAN:ORDERED **ON**), the specified channels are added, the scan list is reordered as needed, and duplicate channels are eliminated. For example, (@2001,1003,1001,1003) will be interpreted as (@1001,1003,2001).
 - b. For *non-sequential* scanning (ROUT:SCAN:ORDERED **OFF**), the specified channels are added to the end of the present scan list. Multiple occurrences of the same channel are allowed. For example, (@2001,2001,2001) and (@3010,1003,1001,1005) are valid and the channels will be scanned in the order presented.
- For *sequential* scanning, if you specify a channel that is already part of the present scan list, the command is ignored and no error is generated. For *non-sequential* scanning, the channel is added to the end of the present scan list.

Example

The following command adds channel 3 (slot 1) to the present scan list.

ROUT:SCAN:ADD (@1003)

See Also

[ROUTe:SCAN](#)

[ROUTe:SCAN:ORDered](#)

[ROUTe:SCAN:REMove](#)

ROUTe:SCAN:ORDERed

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

ROUTe:SCAN:ORDERed <mode>

ROUTe:SCAN:ORDERed?

Description

By default, the instrument scans the list of channels in ascending order from slot 1 through slot 8 (channels are reordered as needed). If your application requires non-ordered scanning of the channels in the present scan list, you can use this command to enable a non-sequential scanning mode.

Used With:

- 34921A through 34925A Multiplexer Modules
- 34950A Digital I/O Module (digital input and counter channels only)
- 34952A Multifunction Module (digital input and totalizer channels only)

Parameters

Name	Type	Range of Values	Default Value
<mode>	Boolean	{OFF 0 ON 1}	ON (enabled)

Remarks

- This command applies to the entire mainframe and cannot be selectively used on individual modules.
- When sequential scanning is enabled (default, ON), the channels in the scan list are placed in ascending order from slot 1 through slot 8. Duplicate channels are not allowed. For example, (@2001,1003,1001,1003) will be interpreted as (@1001,1003,2001).
- When sequential scanning is disabled (OFF), the channels remain in the order presented in the scan list (see exception below). Multiple occurrences of the same channel are allowed. For example, (@2001,2001,2001) and (@3010,1003,1001,1005) are valid and the channels will be scanned in the order presented.
- When you specify a *range* of channels in the scan list, the channels are always sorted in ascending order, regardless of the scan order setting. Therefore, (@1009:1001) will always be interpreted as 1001, 1002, 1003, etc.
- If you define a scan list with the sequential mode enabled and later disable the mode, the scan list will not be reordered; however, the scan list will be treated as a non-sequential list thereafter.

- If you have defined a scan list with the sequential mode disabled (OFF) and later enable the mode, the channels will be reordered.
- Non-sequential scan lists are *not* stored as part of the instrument state by the ***SAV** command; in this case, the ordered mode will be enabled and the scan list will be empty when the instrument state is restored (***RCL** command).
- The scan order setting is stored in **volatile** memory and the ordered mode will be enabled when power is turned off or after a Factory Reset (***RST** command).

Return Format

The query command returns "0" (OFF, non-sequential mode) or "1" (ON, sequential mode).

Examples

The following command disables the sequential scanning mode.

```
ROUT:SCAN:ORD OFF
```

The following query returns the scan order setting.

```
ROUT:SCAN:ORD?
```

Typical Response: **0**

See Also

ROUTe:SCAN

ROUTe:SCAN:ADD

ROUTe:SCAN:REMove

ROUTe:SCAN:SIZE?

ROUTe:SCAN:REMove

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

ROUTe:SCAN:REMove (@<ch_list>)

Description

This command removes the specified channels from the present scan list.

Used With:

- 34921A through 34925A Multiplexer Modules
- 34950A Digital I/O Module (digital input and counter channels only)
- 34952A Multifunction Module (digital input and totalizer channels only)

Parameters

Name	Type	Range of Values	Default Value
<ch_list>	Numeric	One or more channels in the form (@sccc) .	This is a required parameter

Remarks

- By default, the instrument scans the list of channels in ascending order from slot 1 through slot 8 (channels are reordered as needed). If your application requires non-ordered scanning of the channels in the present scan list, you can use the [ROUTe:SCAN:ORDERed](#) command to enable the non-sequential scanning mode.
 - a. For *sequential* scanning (default, ROUT:SCAN:ORDERED **ON**), the specified channels are removed from the present scan list.
 - b. For *non-sequential* scanning (ROUT:SCAN:ORDERED **OFF**), all occurrences of the specified channels are removed from the present scan list.
- If you specify a channel that is not part of the present scan list, the command is ignored and no error is generated.

Example

The following command removes all occurrences of channel 3 (slot 1) from the present scan list.

```
ROUT:SCAN:REM (@1003)
```


See Also

[ROUTe:SCAN](#)

[ROUTe:SCAN:ADD](#)

[ROUTe:SCAN:ORDered](#)

ROUTe:SCAN:SIZE?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

ROUTe:SCAN:SIZE?

Description

This command returns the number of channels in the scan list as defined by the **ROUTe:SCAN** command.

Used With:

- 34921A through 34925A Multiplexer Modules
- 34950A Digital I/O Module (digital input and counter channels only)
- 34952A Multifunction Module (digital input and totalizer channels only)

Remarks

- The present scan list is stored in **volatile** memory and will be lost when power is turned off or after a Factory Reset (***RST** command).

Return Format

The command returns a value between 0 and the maximum number of scanned channels in the 34980A (up to 640 channels). Since the non-sequential scanning mode allows duplicate channels in the scan list (see **ROUTe:SCAN:ORDered** command), each occurrence of a channel is counted and included in the returned value.

Example

The following command returns the number of channels in the scan list.

```
ROUT:SCAN (@1001:1020)
ROUT:SCAN:SIZE?
```

Typical Response: **+20**

See Also

ROUTe:SCAN

ROUTe:SCAN:ADD

ROUTe:SCAN:ORDered

ROUTe:SCAN:REMove

ROUTe:SEQuence:ABORt

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

ROUTe:SEQuence:ABORt

Description

This command aborts the sequence currently executing. If no sequence is current executing, the command is ignored (no error is generated).

Remarks

- When the sequence is terminated, the resultant instrument state will be determined by how much of the sequence had been executed when the ABORt/Device Clear was received. An **ABORt** command (system abort) executed from *within* a sequence will *not* terminate the sequence. The ***RST** and **SYSTem:PRESet** commands will also abort a sequence execution prior to performing their own actions.

Example

The following command aborts the sequence currently executing.

```
ROUT:SEQ:ABOR
```

See Also

[ROUTe:SEQuence:DEFine](#)

[ROUTe:SEQuence:TRIGger:SOURce](#)

ROUTe:SEQUence:BUSY?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

ROUTe:SEQUence:BUSY?

Description

This command immediately returns the busy/not-busy status of sequence operations.

Remarks

- To abort a sequence execution, use the **ROUTe:SEQUence:ABORt** command or a Device Clear. When the sequence is terminated, the resultant instrument state will be determined by how much of the sequence had been executed when the ABORt/Device Clear was received.
- If the command overlap function is enabled (see **ROUTe:OPERation:OVERlap[:ENABle]** command), all switching operations within the sequence follow the overlapping rules. If the command overlap function is disabled, all commands within the sequence are processed in a serial fashion in the exact order in which they are received. Note, however, that within a single command containing a <ch_list> parameter (e.g., **ROUT:CLOSE (@1001:1010)**), the order of the individual switch operations is *not* guaranteed.

Return Format

The command returns "1" to the output buffer if a sequence is *not* finished executing (busy). The command returns "0" if a sequence is finished executing (not busy).

Example

The following command executes a sequence named "MYSEQ_1" and then queries the status.

```
ROUT:SEQ:TRIG MYSEQ_1 !Execute sequence
ROUT:SEQ:BUSY? !Query status
```

Typical Response: 1

See Also

[ROUTe:OPERation:OVERlap\[:ENABle\]](#)

[ROUTe:SEQUence:WAIT](#)

ROUTe:SEQuence:CATalog?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

ROUTe:SEQuence:CATalog?

Description

This command returns a list of user-defined sequence names currently stored in **non-volatile** memory.

Remarks

- When stored in memory, the sequence names are converted to all uppercase letters. For example, when stored "MySeq_1" is converted to "MYSEQ_1".
- Up to 500 unique sequences can be stored in non-volatile memory. Each sequence is limited to 1024 bytes.
- When a sequence is defined, the specified commands are checked for proper syntax and absolute parameter range limits. If an error is detected during compilation, the entire sequence will be discarded.
- To delete stored sequences, use the **ROUTe:SEQuence:DELeTe[:NAME]** command.

Return Format

This command returns the sequence names currently stored and returns a comma-separated list. If no sequence names have been stored, a null string (" ") is returned.

Example

The following command returns a list of sequence names currently stored (the quotes are also returned).

```
ROUT:SEQ:CAT?
```

Typical Response: "MYSEQ_1","PATH_DUT1","SW_PATH2"

See Also

ROUTe:SEQuence:DEFine

ROUTe:SEQuence:DELeTe:ALL

ROUTe:SEQuence:DELeTe[:NAME]

ROUTe:SEQuence:DEFine

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

```
ROUTe:SEQuence:DEFine <name>, "<commands>"
```

```
ROUTe:SEQuence:DEFine? <name>
```

Description

This command defines a series of SCPI commands that will be associated with the specified **sequence**. The commands associated with the sequence are compiled when defined and are then stored in a compressed format in **non-volatile** memory. The following SCPI commands are allowed in a sequence definition (all other commands will generate an error):

ABORt

DISPlay:TEXT '<string>'

OUTPut[:STATe] {OFF|0|ON|1}, (@<ch_list>)

ROUTe:CLOSe (@<ch_list>)

ROUTe:CLOSe:EXCLusive (@<ch_list>)

ROUTe:MODule:WAIT {1-8|SLOT1-SLOT8|ALL}

ROUTe:OPEN (@<ch_list>)

ROUTe:OPEN:ABUS [{1-4|ABUS1-ABUS4|ALL}]

ROUTe:OPEN:ALL [{1-8|SLOT1-SLOT8|ALL}]

ROUTe:SEQuence:TRIGger[:IMMediate] <name>

[SENSe:]TOTAlize:CLEAr:IMMediate (@<ch_list>)

SOURce:CURRent[:LEVel] {<current>|MIN|MAX|DEF}, (@<ch_list>)

SOURce:DIGital:DATA[:{BYTE|1|WORD|2|LWORD|4}] <data>, (@<ch_list>)

SOURce:DIGital:DATA:BIT {0|1}, <bit>, (@<ch_list>)

SOURce:FUNCTion:TRIGger:IMMediate (@<ch_list>)

SOURce:VOLTagE[:LEVel] {<voltage>|MIN|MAX|DEF}, (@<ch_list>)

SYSTem:BEEPer

SYSTem:DELay[:IMMediate] <time>

Parameters

Name	Type	Range of Values	Default Value

<name>	ASCII String	A sequence name consisting of up to 30 characters. The first character must be a letter (A-Z), but the remaining 29 characters can be letters, numbers (0-9), or an underscore (_). Blank spaces are not allowed.	This is a required parameter
<commands>	Quoted ASCII String	A string of valid SCPI commands (see list above) separated by semicolons. A semicolon or <new line> character is not required after the last command in the string.	This is a required parameter

Remarks

- When a sequence is defined, the specified commands are checked for proper syntax and absolute parameter range limits. If an error is detected during compilation, the entire sequence will be discarded. During compilation, the sequence commands do *not* have to be valid for the current instrument configuration; this allows you to define sequences without regard to compatibility with the current set of installed modules. More extensive error checking, such as channel range expansion and validation, is performed when the sequence is executed (see **ROUTE:SEquence:TRIGger[:IMMediate]** command).
- If you define a sequence with a name already in use by another sequence, the new definition will overwrite the previous definition (no error is generated).
- When stored in memory, the user-defined sequence names are converted to all uppercase letters. For example, when stored "MySeq_1" is converted to "MYSEQ_1".
- A sequence may invoke another sequence (see **ROUTE:SEquence:TRIGger[:IMMediate]** command), but may not invoke itself recursively. In addition, the number of invocations is limited to four levels of nesting and this is enforced at the time of execution. Exceeding the limit will abort the sequence and an error will be generated.
- At the time of sequence definition, a sequence may reference another undefined sequence; however, at the time of execution an error will be generated if an undefined sequence is invoked.
- Up to 500 unique sequences can be stored in non-volatile memory. Each sequence is limited to 1024 bytes.
- While a scan is running (see **ROUTE:SCAN** command), the instrument prevents use of all channels in banks that contain one or more channels in the specified scan list (these channels are dedicated to the scan). Therefore, if a sequence attempts to operate a channel in a scanned bank, an error is generated and the entire sequence will be discarded.

- If the command overlap function is enabled (see **ROUTe:OPERation:OVERlap[:ENABle]** command), all switching operations within the sequence follow the overlapping rules. If the command overlap function is disabled, all commands within the sequence are processed in a serial fashion in the exact order in which they are received. Note, however, that within a single command containing a <ch_list> parameter (e.g., **ROUT:CLOSE (@1001:1010)**), the order of the individual switch operations is *not* guaranteed.
- To abort a sequence execution, use the **ROUTe:SEQuence:ABORt** command or a Device Clear. When the sequence is terminated, the resultant instrument state will be determined by how much of the sequence had been executed when the ABORt/Device Clear was received. An **ABORt** command (system abort) executed from *within* a sequence will *not* terminate the sequence. The ***RST** and **SYSTem:PRESet** commands will also abort a sequence execution prior to performing their own actions.

Return Format

The query command returns a string containing the SCPI commands assigned to the specified sequence. The exact text specified in the original sequence definition is *not* preserved when the sequence is compressed/stored in memory. Therefore, the string returned may not be identical to the original string, but it will be functionally equivalent. If the specified sequence name is not currently stored in memory, an error is generated.

The query command always returns the short form of the command header in all upper-case letters (e.g., "ROUT:CLOS" is returned instead of "ROUTE:CLOSE"). Channel numbers and channel range specifiers are returned as they were specified.

Examples

The following command defines a sequence named "MYSEQ_1", which closes several channels on the module in slot 1 and opens a single channel on the module in slot 2.

```
ROUT:SEQ:DEF MYSEQ_1,"ROUT:CLOS (@1001:1009);OPEN (@2001) "
```

The following query returns a string containing the sequence definition (the quotes are also returned).

```
ROUT:SEQ:DEF? MYSEQ_1
```

Typical Response: **"ROUT:CLOS (@1001:1009);ROUT:OPEN (@2001)"**

See Also

ROUTe:OPERation:OVERlap[:ENABle]

ROUTe:SEQuence:ABORt

ROUTe:SEQuence:CATalog?

ROUTe:SEQuence:DELeTe[:NAME]

ROUTe:SEQuence:TRIGger[:IMMediate]

ROUTe:SEQuence:TRIGger:SOURce

ROUTe:SEQuence:DELeTe:ALL

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

ROUTe:SEQuence:DELeTe:ALL

Description

This command deletes all sequences from **non-volatile** memory.

Remarks

- If you attempt to delete a sequence while it is executing, an error will be generated. To abort a sequence execution, use the **ROUTe:SEQuence:ABORt** command or a Device Clear.
- Deleting a sequence will remove its association with an alarm if used (see **ROUTe:SEQuence:TRIGger:SOURce** command).
- To delete a specific sequence, use the **ROUTe:SEQuence:DELeTe[:NAME]** command.

Example

The following command deletes all sequences from memory.

```
ROUT:SEQ:DEL:ALL
```

See Also

ROUTe:SEQuence:ABORt

ROUTe:SEQuence:CATalog?

ROUTe:SEQuence:DEFine

ROUTe:SEQuence:DELeTe[:NAME]

ROUTe:SEQuence:DELeTe[:NAME]

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

ROUTe:SEQuence:DELeTe[:NAME] <name>

Description

This command deletes the specified sequence from **non-volatile** memory. Deleting a sequence also frees up space in memory previously allocated for the sequence.

Parameters

Name	Type	Range of Values	Default Value
<name>	ASCII String	A previously-defined sequence name consisting of up to 30 characters (see ROUTe:SEQuence:DEFine command).	This is a required parameter

Remarks

- If the specified sequence name is not currently stored in memory, an error will be generated.
- If you attempt to delete a sequence while it is executing, an error will be generated. To abort a sequence execution, use the **ROUTe:SEQuence:ABORt** command or a Device Clear.
- Deleting a sequence will remove its association with an alarm if used (see **ROUTe:SEQuence:TRIGger:SOURce** command).
- To delete *all* sequences currently stored memory, use the **ROUTe:SEQuence:DELeTe:ALL** command.

Example

The following command deletes the sequence named "MYSEQ_1".

```
ROUT:SEQ:DEL MYSEQ_1
```

See Also

ROUTe:SEQuence:ABORt

ROUTe:SEQuence:CATalog?

ROUTe:SEQuence:DEFine

ROUTe:SEQuence:DELeTe:ALL

ROUTe:SEQuence:RUNNing:NAME?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

ROUTe:SEQuence:RUNNing:NAME?

Description

This command returns the name of the sequence currently executing.

Remarks

- When stored in memory, the user-defined sequence names are converted to all uppercase letters. For example, when stored "MySeq_1" is converted to "MYSEQ_1".
- To abort a sequence execution, use the **ROUTe:SEQuence:ABORt** command or a Device Clear. When the sequence is terminated, the resultant instrument state will be determined by how much of the sequence had been executed when the ABORt/Device Clear was received. An **ABORt** command (system abort) executed from *within* a sequence will *not* terminate the sequence. The ***RST** and **SYSTem:PRESet** commands will also abort a sequence execution prior to performing their own actions.

Return Format

This command returns the name of the sequence currently executing. If no sequence is executing, a null string (" ") is returned.

Example

The following command returns the name of the sequence currently executing (the quotes are also returned).

```
ROUT:SEQ:RUNN:NAME?
```

Typical Response: "MYSEQ_1"

See Also

ROUTe:SEQuence:ABORt

ROUTe:SEQuence:DEFine

ROUTe:SEQuence:TRIGger[:IMMediate]

ROUTe:SEQuence:TRIGger[:IMMediate]

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

ROUTe:SEQuence:TRIGger[:IMMediate] <name>

Description

This command executes the specified sequence from **non-volatile** memory. If the specified sequence name is not currently stored in memory, an error will be generated.

Parameters

Name	Type	Range of Values	Default Value
<name>	ASCII String	A previously-defined sequence name consisting of up to 30 characters (see ROUTe:SEQuence:DEFine command).	This is a required parameter

Remarks

- If you attempt to trigger a sequence while one is already executing, the trigger will be placed in a queue. When the trigger queue is full, a "trigger ignored" error will be generated.
- To abort a sequence execution, use the **ROUTe:SEQuence:ABORT** command or a Device Clear. When the sequence is terminated, the resultant instrument state will be determined by how much of the sequence had been executed when the ABORT/Device Clear was received. An **ABORT** command (system abort) executed from *within* a sequence will *not* terminate the sequence. The ***RST** and **SYSTem:PRESet** commands will also abort a sequence execution prior to performing their own actions.
- When a sequence is defined (see **ROUTe:SEQuence:DEFine** command), the specified commands are checked for proper syntax and absolute parameter range limits. If an error is detected during compilation, the entire sequence will be discarded. More extensive error checking, such as channel range expansion and validation, is performed when the sequence is executed.
- A sequence may invoke another sequence. but may not invoke itself recursively. In addition, the number of invocations is limited to four levels of nesting and this is enforced at the time of execution. Exceeding the limit will abort the sequence and an error will be generated.
- You can also execute a sequence when an alarm condition is reached (see **ROUTe:SEQuence:TRIGger-:SOURce** command). Regardless of whether or not an alarm association is configured, you can always execute a sequence using the ROUTe:SEQuence:TRIGger[:IMMediate] command.

- While a scan is running (see **ROUTe:SCAN** command), the instrument prevents use of all channels in banks that contain one or more channels in the specified scan list (these channels are dedicated to the scan). Therefore, if a sequence attempts to operate a channel in a scanned bank, an error is generated and the entire sequence will be discarded.

Example

The following command executes a sequence named "MYSEQ_1", which closes several channels on the module in slot 1 and opens a single channel on the module in slot 2.

```
ROUT:SEQ:DEF MYSEQ_1,"ROUT:CLOS (@1001:1009);OPEN (@2001)" !Define sequence
ROUT:SEQ:TRIG MYSEQ_1 !Execute sequence
```

See Also

ROUTe:SEQuence:ABORt

ROUTe:SEQuence:CATalog?

ROUTe:SEQuence:DEFine

ROUTe:SEQuence:TRIGger:SOURce

ROUTe:SEQuence:TRIGger:SOURce

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

ROUTe:SEQuence:TRIGger:SOURce <name>, <source>

ROUTe:SEQuence:TRIGger:SOURce? <name>

Description

This command executes the specified sequence from **non-volatile** memory when a reading crosses an alarm limit on a channel (see **OUTPut:ALARm<n>:SOURce** command). The specified sequence will execute *once* when an alarm occurs on the specified alarm, after which the trigger source will be automatically set to MANUAL. Regardless of whether or not an alarm association is configured, you can always execute a sequence using the **ROUTe:SEQuence:TRIGger[:IMMediate]** command. If the specified sequence name is not currently stored in memory, an error will be generated.

Assigning a sequence to an alarm will remove any other sequence's association with that alarm, as well as that alarm's association to any other sequence. Use the MANUAL parameter to remove an association without reassigning it to another alarm.

Used With:

- 34921A through 34925A Multiplexer Modules
- 34950A Digital I/O Module (digital input and counter channels only)
- 34952A Multifunction Module (digital input and totalizer channels only)

Parameters

Name	Type	Range of Values	Default Value
<name>	ASCII String	A previously-defined sequence name consisting of up to 30 characters (see ROUTe:SEQuence:DEFine command).	This is a required parameter
<source>	Discrete	{ALARm1 ALARm2 ALARm3 ALARm4 MANual}	This is a required parameter

Remarks

- The specified sequence will execute *once* when an alarm occurs, after which the trigger source will be automatically set to MANual. The sequence will not execute again until the trigger source is reassigned, the alarm has been cleared, the association of the sequence to the alarm has been re-established, and the alarm condition exists again.
- You can assign multiple channels to any of the four available alarms (numbered 1 through 4, see **OUTPut:ALARm<n>:SOURce** command). For example, you can configure the instrument to generate an alarm on the Alarm 1 output when a limit is exceeded on any of channels 1003, 2005, or 3010. You cannot, however, assign alarms on a specific channel to more than one alarm number.
- Regardless of whether or not an alarm association is configured, you can always execute a sequence using the **ROUTe:SEQuence:TRIGger[:IMMediate]** command.
- If you attempt to trigger a sequence while one is already executing, the trigger will be placed in a queue. When the trigger queue is full, a "trigger ignored" error will be generated.
- To abort a sequence execution, use the **ROUTe:SEQuence:ABORt** command or a Device Clear. When the sequence is terminated, the resultant instrument state will be determined by how much of the sequence had been executed when the ABORt/Device Clear was received. An **ABORt** command (system abort) executed from *within* a sequence will *not* terminate the sequence. The ***RST** and **SYSTem:PRESet** commands will also abort a sequence execution prior to performing their own actions.
- When a sequence is defined (see **ROUTe:SEQuence:DEFine** command), the specified commands are checked for proper syntax and absolute parameter range limits. If an error is detected during compilation, the entire sequence will be discarded. More extensive error checking, such as channel range expansion and validation, is performed when the sequence is executed.
- A sequence may invoke another sequence. but may not invoke itself recursively. In addition, the number of invocations is limited to four levels of nesting and this is enforced at the time of execution. Exceeding the limit will abort the sequence and an error will be generated.
- A Factory Reset (***RST** command) will remove all alarm associations. Redefining or deleting a sequence will also remove all alarm associations.

Return Format

The query command returns the present trigger source: "ALAR1", "ALAR2", "ALAR3", "ALAR4", or "MAN".

Examples

The following program segment selects the alarm source and configures the instrument to execute the sequence named "MYSEQ_1" when an alarm is reported on Alarm 1. The Monitor mode is used to evaluate alarm conditions on the selected channel.

```
ROUT:SEQ:DEF MYSEQ_1,"ROUT:CLOS (@1001:1009);OPEN (@2001)"  !Define sequence
CALC:LIM:UPP 10.25,(@1003)                                !Set upper alarm limit
CALC:LIM:UPP:STAT ON,(@1003)                               !Enable alarms
OUTP:ALARM1:SOUR (@1003)                                    !Report alarms on Alarm 1
ROUT:MON:CHAN (@1003)                                       !Select monitor channel
```

```
ROUT:MON:CHAN:ENAB ON, (@1003)      !Enable monitoring on selected channel
ROUT:SEQ:TRIG:SOUR MYSEQ_1,ALAR1    !Enable trigger source
ROUT:MON:STAT ON                      !Enable monitor mode
INIT                                  !Initiate measurement
```

The following query returns the trigger source currently selected.

```
ROUT:SEQ:TRIG:SOUR? MYSEQ_1
```

Typical Response: **ALAR1**

See Also

[CALCulate:LIMit:LOWer](#)

[CALCulate:LIMit:UPPer](#)

[OUTPut:ALARm<n>:SEQuence?](#)

[OUTPut:ALARm<n>:SOURce](#)

[ROUTe:SEQuence:ABORt](#)

[ROUTe:SEQuence:DEFine](#)

[ROUTe:SEQuence:TRIGger\[:IMMediate\]](#)

ROUTe:SEQuence:WAIT

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

ROUTe:SEQuence:WAIT

Description

This command waits for the current sequence to finish execution before executing any additional commands over the interface (similar to the ***WAI** command).

Remarks

- To abort a sequence execution, use the **ROUTe:SEQuence:ABORt** command or a Device Clear. When the sequence is terminated, the resultant instrument state will be determined by how much of the sequence had been executed when the ABORt/Device Clear was received.
- If the command overlap function is enabled (see **ROUTe:OPERation:OVERlap[:ENABle]** command), all switching operations within the sequence follow the overlapping rules. If the command overlap function is disabled, all commands within the sequence are processed in a serial fashion in the exact order in which they are received. Note, however, that within a single command containing a <ch_list> parameter (e.g., **ROUT:CLOSE (@1001:1010)**), the order of the individual switch operations is *not* guaranteed.

Example

The following program segment executes a sequence named "MYSEQ_1", which closes several channels on the module in slot 1 and opens a single channel on the module in slot 2. After executing the sequence, the module waits for completion prior to opening all channels on the module in slot 2.

```
ROUT:SEQ:DEF MYSEQ_1,"ROUT:CLOS (@1001:1009);OPEN (@2001)" !Define sequence
ROUT:SEQ:TRIG MYSEQ_1; :ROUT:SEQ:WAIT ;:ROUT:OPEN:ALL 1 !Execute sequence,
wait for completion
```

See Also

***WAI**

ROUTe:OPERation:OVERlap[:ENABle]

ROUTe:SEQuence:ABORt

ROUTe:SEQuence:BUSY?

SAMPlE Subsystem Introduction

Command Summary

NOTE

Hold the mouse cursor over a command to view the full syntax statement.

SAMPlE:COUNT
SAMPlE:COUNT?

SAMPlE:COUNt

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

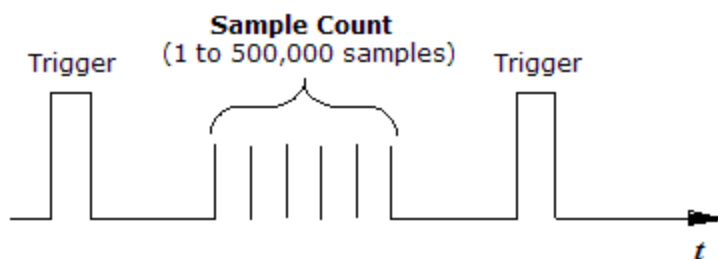
SAMPlE:COUNt {<count>|MIN|MAX|DEF}

SAMPlE:COUNt? [{MIN|MAX}]

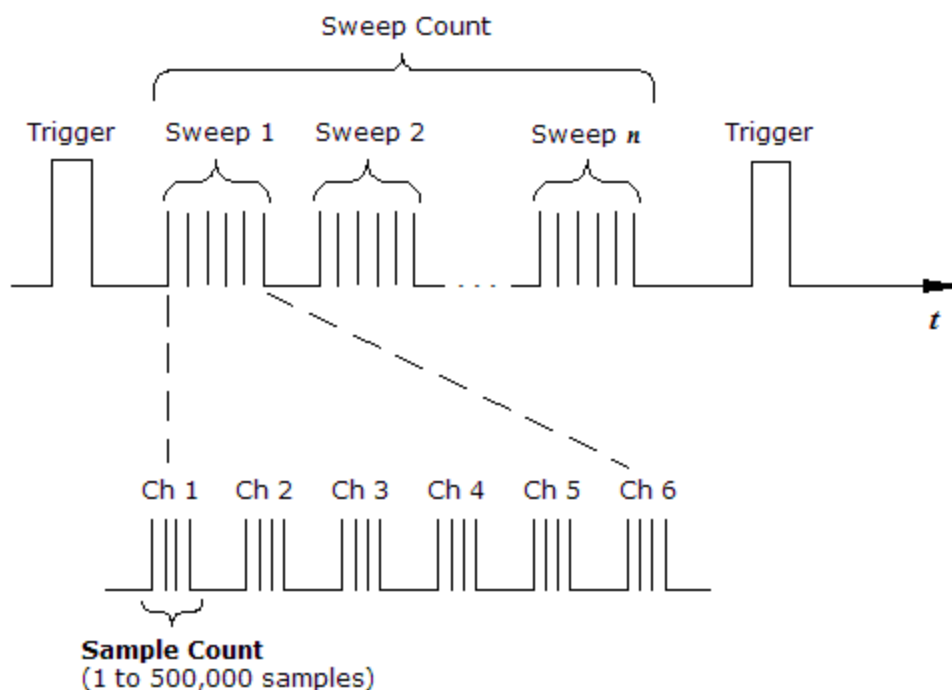
Description

This command selects the number of auto-triggered samples the internal DMM will take per channel per trigger. The sample count applies to both scanning and stand-alone DMM measurements (with no scan list). The front-panel sample annunciator ("*") turns on during each measurement.

Stand-Alone DMM Model:



Scanning Model:



Used With:

- 34921A through 34925A Multiplexer Modules
- 34950A Digital I/O Module (digital input and counter channels only)
- 34952A Multifunction Module (digital input and totalizer channels only)
- Internal DMM

Parameters

Name	Type	Range of Values	Default Value
<count>	Numeric	1 to 500,000 samples. MIN = 1 sample, MAX = 500,000 reading samples	1 sample per trigger

Remarks

- For the multiplexer modules, the internal DMM is required. An error is generated if the internal DMM is disabled (see **INSTRument:DMM[:STATe]** command) or not installed in the mainframe.
- For scanning, the specified sample count sets the number of readings per channel (same for all channels in the scan list). If no channels have been assigned to the scan list (see **ROUTe:SCAN** command), the sample count sets the number of readings per trigger for the internal DMM.

- After setting the sample count, you must place the internal DMM in the "wait-for-trigger" state using the **INITiate** or **READ?** command. A trigger will not be accepted from the selected trigger source (see **TRIGger:SOURce** command) until the internal DMM is in the "wait-for-trigger" state.
- You can specify a sample count in conjunction with a trigger count and a sweep count. The three parameters operate independent of one another, and the total number of readings returned will be the product of the three parameters.
 - a. The *trigger count* selects the number of triggers to be accepted before returning to the "idle" trigger state (see **TRIGger:COUNt** command).
 - b. The *sweep count* selects the number of sweeps per trigger event during a scan (see **SWEep:COUNt** command).
- You can store at least 500,000 readings in memory and all readings are automatically time stamped. If memory overflows, the new readings will overwrite the first (oldest) readings stored; the most recent readings are always preserved.
- The **CONFigure** and **MEASure?** commands automatically set the sample count to "1".
- The instrument sets the sample count to "1" after a Factory Reset (***RST** command). An Instrument Preset (**SYSTem:PRESet** command) or Card Reset (**SYSTem:CPON** command) does *not* change the setting.

Return Format

The query command returns the sample count in the form "**+1.00000000E+00**".

Examples

The following program segment configures the internal DMM for a ac voltage measurement (no scan list) and sets the sample count to 5. When a trigger is received from the selected trigger source, a total of five readings will be returned.

```
CONF:VOLT:AC
SAMP:COUN 5
INIT
```

The following program segment configures two channels for dc voltage measurements, puts the channels in the scan list (the scan list is redefined), and sets the sample count to 10. When a trigger is received from the selected trigger source, 10 readings will be returned for each channel in the scan list (20 readings total).

```
CONF:VOLT:DC 10,0.003, (@1003,1008)
ROUT:SCAN (@1003,1008)
SAMP:COUN 10
INIT
```

The following query returns the present sample count.

```
SAMP:COUN?
```

Typical Response: +1.00000000E+01

See Also

[ROUTe:CHANnel:DElay](#)

[ROUTe:SCAN](#)

[SWEep:COUNT](#)

[TRIGger:COUNT](#)

[TRIGger:SOURce](#)

SENSe Subsystem Introduction

Command Summary

NOTE

Hold the mouse cursor over a command to view the full syntax statement.

AC Voltage

[SENSe:]VOLTage:AC:BANDwidth
[SENSe:]VOLTage:AC:BANDwidth?
[SENSe:]VOLTage:AC:RANGe
[SENSe:]VOLTage:AC:RANGe?
[SENSe:]VOLTage:AC:RANGe:AUTO
[SENSe:]VOLTage:AC:RANGe:AUTO?

DC Voltage

[SENSe:]VOLTage[:DC]:APERTure
[SENSe:]VOLTage[:DC]:APERTure?
[SENSe:]VOLTage[:DC]:APERTure:ENABled?
[SENSe:]VOLTage[:DC]:IMPedance:AUTO
[SENSe:]VOLTage[:DC]:IMPedance:AUTO?
[SENSe:]VOLTage[:DC]:NPLC
[SENSe:]VOLTage[:DC]:NPLC?
[SENSe:]VOLTage[:DC]:RANGe
[SENSe:]VOLTage[:DC]:RANGe?
[SENSe:]VOLTage[:DC]:RANGe:AUTO
[SENSe:]VOLTage[:DC]:RANGe:AUTO?
[SENSe:]VOLTage[:DC]:RESolution
[SENSe:]VOLTage[:DC]:RESolution?
[SENSe:]VOLTage[:DC]:ZERO:AUTO
[SENSe:]VOLTage[:DC]:ZERO:AUTO?

AC Current

[SENSe:]CURRent:AC:BANDwidth
[SENSe:]CURRent:AC:BANDwidth?
[SENSe:]CURRent:AC:RANGe
[SENSe:]CURRent:AC:RANGe?
[SENSe:]CURRent:AC:RANGe:AUTO
[SENSe:]CURRent:AC:RANGe:AUTO?

DC Current

[SENSe:]CURRent[:DC]:APERTure
[SENSe:]CURRent[:DC]:APERTure?
[SENSe:]CURRent[:DC]:APERTure:ENABLEd?
[SENSe:]CURRent[:DC]:NPLC
[SENSe:]CURRent[:DC]:NPLC?
[SENSe:]CURRent[:DC]:RANGe
[SENSe:]CURRent[:DC]:RANGe?
[SENSe:]CURRent[:DC]:RANGe:AUTO
[SENSe:]CURRent[:DC]:RANGe:AUTO?
[SENSe:]CURRent[:DC]:RESolution
[SENSe:]CURRent[:DC]:RESolution?
[SENSe:]CURRent[:DC]:ZERO:AUTO
[SENSe:]CURRent[:DC]:ZERO:AUTO?

2-Wire Resistance

[SENSe:]RESistance:APERTure
[SENSe:]RESistance:APERTure?
[SENSe:]RESistance:APERTure:ENABLEd?
[SENSe:]RESistance:NPLC
[SENSe:]RESistance:NPLC?
[SENSe:]RESistance:OCOMpensated
[SENSe:]RESistance:OCOMpensated?
[SENSe:]RESistance:RANGe
[SENSe:]RESistance:RANGe?
[SENSe:]RESistance:RANGe:AUTO
[SENSe:]RESistance:RANGe:AUTO?
[SENSe:]RESistance:RESolution
[SENSe:]RESistance:RESolution?
[SENSe:]RESistance:ZERO:AUTO
[SENSe:]RESistance:ZERO:AUTO?

4-Wire Resistance

[SENSe:]FRESistance:APERTure
[SENSe:]FRESistance:APERTure?
[SENSe:]FRESistance:APERTure:ENABLEd?
[SENSe:]FRESistance:NPLC
[SENSe:]FRESistance:NPLC?
[SENSe:]FRESistance:OCOMpensated
[SENSe:]FRESistance:OCOMpensated?
[SENSe:]FRESistance:RANGe
[SENSe:]FRESistance:RANGe?

[SENSe:]FRESistance:RANGe:AUTO
[SENSe:]FRESistance:RANGe:AUTO?
[SENSe:]FRESistance:RESolution
[SENSe:]FRESistance:RESolution?

Frequency

[SENSe:]FREQuency:APERture
[SENSe:]FREQuency:APERture?
[SENSe:]FREQuency:RANGe:LOWer
[SENSe:]FREQuency:RANGe:LOWer?
[SENSe:]FREQuency:VOLTage:RANGe
[SENSe:]FREQuency:VOLTage:RANGe?
[SENSe:]FREQuency:VOLTage:RANGe:AUTO
[SENSe:]FREQuency:VOLTage:RANGe:AUTO?

Period

[SENSe:]PERiod:APERture
[SENSe:]PERiod:APERture?
[SENSe:]PERiod:VOLTage:RANGe
[SENSe:]PERiod:VOLTage:RANGe?
[SENSe:]PERiod:VOLTage:RANGe:AUTO
[SENSe:]PERiod:VOLTage:RANGe:AUTO?

Temperature

[SENSe:]TEMPerature:APERture
[SENSe:]TEMPerature:APERture?
[SENSe:]TEMPerature:APERture:ENABLEd?
[SENSe:]TEMPerature:RJUNction[:INTernal]?
[SENSe:]TEMPerature:NPLC
[SENSe:]TEMPerature:NPLC?
[SENSe:]TEMPerature:TRANsducer:FRTD:OCOMpensated
[SENSe:]TEMPerature:TRANsducer:FRTD:OCOMpensated?
[SENSe:]TEMPerature:TRANsducer:FRTD:REFerence
[SENSe:]TEMPerature:TRANsducer:FRTD:REFerence?
[SENSe:]TEMPerature:TRANsducer:FRTD:RESistance[:REFerence]
[SENSe:]TEMPerature:TRANsducer:FRTD:RESistance[:REFerence]?
[SENSe:]TEMPerature:TRANsducer:FRTD:TYPE
[SENSe:]TEMPerature:TRANsducer:FRTD:TYPE?
[SENSe:]TEMPerature:TRANsducer:RTD:OCOMpensated
[SENSe:]TEMPerature:TRANsducer:RTD:OCOMpensated?
[SENSe:]TEMPerature:TRANsducer:RTD:REFerence
[SENSe:]TEMPerature:TRANsducer:RTD:REFerence?

[SENSe:]TEMPerature:TRANsducer:RTD:RESistance[:REFerence]
 [SENSe:]TEMPerature:TRANsducer:RTD:RESistance[:REFerence]?
 [SENSe:]TEMPerature:TRANsducer:RTD:TYPE
 [SENSe:]TEMPerature:TRANsducer:RTD:TYPE?
 [SENSe:]TEMPerature:TRANsducer:TCouple:CHECK
 [SENSe:]TEMPerature:TRANsducer:TCouple:CHECK?
 [SENSe:]TEMPerature:TRANsducer:TCouple:IMPedance:AUTO
 [SENSe:]TEMPerature:TRANsducer:TCouple:IMPedance:AUTO?
 [SENSe:]TEMPerature:TRANsducer:TCouple:RJUNction
 [SENSe:]TEMPerature:TRANsducer:TCouple:RJUNction?
 [SENSe:]TEMPerature:TRANsducer:TCouple:RJUNction:EXTernal?
 [SENSe:]TEMPerature:TRANsducer:TCouple:RJUNction:TYPE
 [SENSe:]TEMPerature:TRANsducer:TCouple:RJUNction:TYPE?
 [SENSe:]TEMPerature:TRANsducer:TCouple:TYPE
 [SENSe:]TEMPerature:TRANsducer:TCouple:TYPE?
 [SENSe:]TEMPerature:TRANsducer:THERmistor:REFerence
 [SENSe:]TEMPerature:TRANsducer:THERmistor:REFerence?
 [SENSe:]TEMPerature:TRANsducer:THERmistor:TYPE
 [SENSe:]TEMPerature:TRANsducer:THERmistor:TYPE?
 [SENSe:]TEMPerature:TRANsducer:TYPE
 [SENSe:]TEMPerature:TRANsducer:TYPE?
 [SENSe:]TEMPerature:ZERO:AUTO
 [SENSe:]TEMPerature:ZERO:AUTO?

Digital I/O and Totalizer

[SENSe:]COUNter:ABORt
 [SENSe:]COUNter:DATA?
 [SENSe:]COUNter:DCYClE[:DATA]?
 [SENSe:]COUNter:FREQuency[:DATA]?
 [SENSe:]COUNter:FUNction
 [SENSe:]COUNter:FUNction?
 [SENSe:]COUNter:GATE:POLarity
 [SENSe:]COUNter:GATE:POLarity?
 [SENSe:]COUNter:GATE:SOURce
 [SENSe:]COUNter:GATE:SOURce?
 [SENSe:]COUNter:GATE:TIME[:INTernal]
 [SENSe:]COUNter:GATE:TIME[:INTernal]?
 [SENSe:]COUNter:INITiate
 [SENSe:]COUNter:PERiod[:DATA]?
 [SENSe:]COUNter:PWIDth[:DATA]?
 [SENSe:]COUNter:SLOPe
 [SENSe:]COUNter:SLOPe?
 [SENSe:]COUNter:THReshold:VOLTagE

[SENSe:]COUNter:THReshold:VOLTage?
[SENSe:]COUNter:TOTalize:CLEar:IMMediate
[SENSe:]COUNter:TOTalize[:DATA]?
[SENSe:]COUNter:TOTalize:TYPE
[SENSe:]COUNter:TOTalize:TYPE?
[SENSe:]DIGital:DATA[:<width>]?
[SENSe:]DIGital:DATA:BIT?
[SENSe:]DIGital:HANDshake:THReshold
[SENSe:]DIGital:HANDshake:THReshold?
[SENSe:]DIGital:INTerrupt[:ENABLE]
[SENSe:]DIGital:INTerrupt[:ENABLE]?
[SENSe:]DIGital:INTerrupt:MODE
[SENSe:]DIGital:INTerrupt:MODE?
[SENSe:]DIGital:INTerrupt:STATus?
[SENSe:]DIGital:MEMory:CLEar
[SENSe:]DIGital:MEMory:COMPare:ACTion
[SENSe:]DIGital:MEMory:COMPare:ACTion?
[SENSe:]DIGital:MEMory[:DATA]?
[SENSe:]DIGital:MEMory[:DATA]:ALL?
[SENSe:]DIGital:MEMory[:DATA]:FORMat
[SENSe:]DIGital:MEMory[:DATA]:FORMat?
[SENSe:]DIGital:MEMory[:DATA]:POINTs?
[SENSe:]DIGital:MEMory:ENABLE
[SENSe:]DIGital:MEMory:ENABLE?
[SENSe:]DIGital:MEMory:MATCH[:DATA]?
[SENSe:]DIGital:MEMory:SAMPLE:COUNT
[SENSe:]DIGital:MEMory:START
[SENSe:]DIGital:MEMory:STEP
[SENSe:]DIGital:MEMory:STOP
[SENSe:]DIGital:THReshold
[SENSe:]DIGital:THReshold?
[SENSe:]MODule:COUNter:GATE:THReshold[:VOLTage]
[SENSe:]MODule:COUNter:GATE:THReshold[:VOLTage]?
[SENSe:]TOTalize:CLEar:IMMediate
[SENSe:]TOTalize:DATA?
[SENSe:]TOTalize:SLOPe
[SENSe:]TOTalize:SLOPe?
[SENSe:]TOTalize:THReshold[:MODE]
[SENSe:]TOTalize:THReshold[:MODE]?
[SENSe:]TOTalize:THReshold:VOLTage
[SENSe:]TOTalize:THReshold:VOLTage?
[SENSe:]TOTalize:TYPE
[SENSe:]TOTalize:TYPE?

Miscellaneous

[SENSe:]FUNctIon

[SENSe:]FUNctIon?

[SENSe:]FUNCTION

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

[SENSe:]FUNCTION "<function>" [, (@<ch_list>)]

[SENSe:]FUNCTION? [(@<ch_list>)]

Description

This command selects the measurement function on the specified channels (all function-related measurement attributes are remembered). If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

The following table shows which measurement functions are supported by each of the multiplexer modules.

	Volta ge AC/D C	Curre nt AC/D C	Fre q/ Peri od	Oh ms 2- Wir e	Oh ms 4- Wir e	Thermoco uple	RT D 2- Wir e	RT D 4- Wir e	Thermi stor
34921 A Armatur e Multipl exer	Yes	Yes ¹	Yes	Yes	Yes	Yes ²	Yes	Yes	Yes
34922 A Armatur e Multipl exer	Yes	No	Yes	Yes	Yes	Yes ³	Yes	Yes	Yes
34923 A Reed Multipl exer (2- Wire)	Yes	No	Yes	Yes ⁵	Yes ⁵	Yes ^{3,4}	Yes ₅	Yes ₅	Yes ⁵

34923 A Reed Multipl exer (1- Wire)	Yes	No	Yes	Yes⁵	No	Yes^{3,4}	Yes₅	No	Yes⁵
34924 A Reed Multipl exer	Yes	No	Yes	Yes⁵	Yes⁵	Yes^{3,4}	Yes₅	Yes₅	Yes⁵
34925 A FET Multipl exer (2- Wire)	Yes	No	Yes	Yes⁶	Yes⁶	Yes³	No	Yes₆	No
34925 A FET Multipl exer (1- Wire)	Yes	No	Yes	Yes⁶	No	Yes³	No	No	No

¹ Direct current measurements are allowed on channels 41 through 44 only (for all other channels, external shunts are required).

² Optional 34921T Terminal Block is required for thermocouple measurements with built-in internal reference junction.

³ A fixed or external reference junction temperature is required for thermocouple measurements with this module.

⁴ Impact of higher offset voltage specification ($< 50 \mu V$) must be taken into consideration.

⁵ 1 k Ω or higher range used unless 100 Ω series resistors are bypassed on module.

⁶ 10 k Ω or higher range used for loads over approximately 300 Ω due to series resistance of FET channels.

Parameters

Name	Type	Range of Values	Default Value

<function>	Discrete	Desired function enclosed in quotes: CURRent:AC CURRent[:DC] FREQuency FREStance PERiod RESistance TEMPerature VOLTage:AC VOLTage[:DC]	DC Volts
<ch_list>	Numeric	One or more channels in the form <u>(@sccc)</u> .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.
- For 4-wire resistance measurements ("FREStance"), the instrument automatically pairs channel *n* in Bank 1 with channel *n+20* in Bank 2 (34921A, 34923A, 34925A) or *n+35* (34922A, 34924A) to provide the source and sense connections. For example, make the source connections to the HI and LO terminals on channel 2 in Bank 1 and the sense connections to the HI and LO terminals on channel 22 (or 37) in Bank 2. Specify the paired channel in Bank 1 (source) as the <ch_list> channel (channels in Bank 2 are not allowed in the <ch_list>).
- If you change the measurement function on a channel, all measurement attributes of the previous function (range, resolution, etc.) are remembered. If you return to the function, all previously-defined measurement attributes will be restored. However, when storing instrument states (see ***SAV** command), only the measurement attributes of the currently-selected function are stored.
- The instrument sets the function to dc volts after a Factory Reset (***RST** command). An Instrument Preset (**SYSTem:PRESet** command) or Card Reset (**SYSTem:CPON** command) does *not* change the setting.

Return Format

The query command returns an **ASCII string** enclosed in double quotes for each channel specified. Multiple responses are separated by commas. The short form of the function name is always returned (e.g., "CURR:AC", "FREQ", etc.).

Examples

The following commands select the ac voltage function on channels 3 and 13 in slot 1 (double or single quotes are allowed).

```
FUNC "VOLT:AC", (@1003,1013) or FUNC 'VOLT:AC', (@1003,1013)
```

The following query returns the function selected on channels 3 and 13 in slot 1 (the quotes are also returned).

```
FUNC? (@1003,1013)
```

Typical Response: "VOLT:AC","VOLT:AC"

See Also

[CONFigure Commands](#)

[SENSe:]CURRent:AC:BANDwidth

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

[SENSe:]CURRent:AC:BANDwidth {<filter>|MIN|MAX|DEF} [, (@<ch_list>)]

[SENSe:]CURRent:AC:BANDwidth? [{(@<ch_list>)|MIN|MAX}]

Description

The instrument uses three different ac filters which enable you to either optimize low frequency accuracy or achieve faster ac settling times. The instrument selects the slow (3 Hz), medium (20 Hz), or fast (200 Hz) filter based on the input frequency that you specify with this command for the selected channels. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

Used With:

- 34921A Armature Multiplexer (channels 41 through 44 only)

Parameters

Name	Type	Range of Values	Default Value
<filter>	Discrete	{3 20 200} MIN = 3 Hz (slow), MAX = 200 Hz (fast)	20 Hz (medium)
<ch_list>	Numeric	One or more channels in the form (@sccc) . Current measurements are allowed only on channels 41 through 44 on the 34921A.	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- Applies to ac current measurements only.
- For the <filter> parameter, specify the lowest frequency expected in the input signal on the specified channels. The instrument selects the appropriate filter based on the frequency you specify.

Input Frequency	Default Settling Delay	Minimum Settling Delay
3 Hz to 300 kHz (Slow)	7 seconds / reading	1.5 seconds
20 Hz to 300 kHz (Medium)	1 second / reading	200 ms
200 Hz to 300 kHz (Fast)	0.12 seconds / reading	20 ms

- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.
- The CONFigure and MEASure? commands automatically select the default 20 Hz (medium) filter.
- The instrument selects the default 20 Hz (medium) filter after a Factory Reset (***RST** command). An Instrument Preset (**SYSTem:PRESet** command) or Card Reset (**SYSTem:CPON** command) does *not* change the setting.

Return Format

The query command returns "3" (slow), "20" (medium), or "200" (fast) for each channel specified. Multiple responses are separated by commas.

Examples

The following command selects the slow filter (3 Hz) on channels 41 and 42 in slot 1.

```
CURR:AC:BAND 3, (@1041,1042)
```

The following query returns the ac filter settings on channels 41 and 42 in slot 1.

```
CURR:AC:BAND? (@1041,1042)
```

Typical Response: **3,3**

See Also

CONFigure:CURRent:AC

[SENSe:]CURRent:AC:RANGe

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

[SENSe:]CURRent:AC:RANGe {<range>|MIN|MAX|DEF} [, (@<ch_list>)]

[SENSe:]CURRent:AC:RANGe? [(@<ch_list>)|MIN|MAX]

Description

This command selects the measurement range for ac current measurements on the specified channels. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

Used With:

- 34921A Armature Multiplexer (channels 41 through 44 only)

Parameters

Name	Type	Range of Values	Default Value
<range>	Discrete	Desired range in amps: 10 mA (MIN) 100 mA 1 A (MAX)	This is a required parameter
<ch_list>	Numeric	One or more channels in the form (@sccc) . Current measurements are allowed only on channels 41 through 44 on the 34921A.	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.
- Selecting a discrete range will disable autoranging on the specified channels (see [\[SENSe:\]CURRent:AC:RANGe:AUTO](#) command).
- The CONFigure and MEASure? commands automatically enable autoranging.
- If the input signal is greater than can be measured on the selected range (manual ranging), the instrument gives an *overload indication*: "±OVLd" from the front panel or "±9.9E+37" from the remote interface.

- The instrument selects autoranging after a Factory Reset (***RST** command). An Instrument Preset (**SYSTem:PRESet** command) or Card Reset (**SYSTem:CPON** command) does not change the setting.

Return Format

The query command returns the range in the form "+1.00000000E-01" for each channel specified. Multiple responses are separated by commas.

Examples

The following command selects the 100 mA range on channels 41 and 42 in slot 1.

```
CURR:AC:RANG 0.1, (@1041,1042)
```

The following query returns the range selected on channels 41 and 42 in slot 1.

```
CURR:AC:RANG? (@1041,1042)
```

Typical Response: +1.00000000E-01,+1.00000000E-01

See Also

CONFigure:CURRent:AC

[SENSe:]CURRent:AC:RANGe:AUTO

[SENSe:]CURRent:AC:RANGe:AUTO

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

[SENSe:]CURRent:AC:RANGe:AUTO <mode> [, (@<ch_list>)]

[SENSe:]CURRent:AC:RANGe:AUTO? [(@<ch_list>)]

Description

This command disables or enables autoranging for ac current measurements on the specified channels. Autoranging is convenient because the instrument automatically selects the range for each measurement based on the input signal detected. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

Used With:

- 34921A Armature Multiplexer (channels 41 through 44 only)

Parameters

Name	Type	Range of Values	Default Value
<mode>	Boolean	{OFF 0 ON 1}	Autorange ON
<ch_list>	Numeric	One or more channels in the form (@sccc) . Current measurements are allowed only on channels 41 through 44 on the 34921A.	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.
- Autorange thresholds:

Down range <10% of range
at:
Up range at: >120% of range

- With autoranging enabled, the instrument selects one of the following ranges based on the input signal detected:

10 mA, 100 mA, 1 A

- Selecting a discrete range (see **[SENSe:]CURRent:AC:RANGe** command) will disable autoranging on the specified channels.
- The CONFigure and MEASure? commands automatically enable autoranging.
- The instrument enables autoranging after a Factory Reset (***RST** command). An Instrument Preset (**SYSTem:PRESet** command) or Card Reset (**SYSTem:CPON** command) does not change the setting.

Return Format

The query command returns "0" (OFF) or "1" (ON) for each channel specified. Multiple responses are separated by commas.

Examples

The following command disables autoranging on channels 41 and 42 in slot 1.

```
CURR:AC:RANG:AUTO OFF, (@1041,1042)
```

The following query returns the autoranging settings on channels 41 and 42 in slot 1.

```
CURR:AC:RANG:AUTO? (@1041,1042)
```

Typical Response: 0,0

See Also

CONFigure:CURRent:AC

[SENSe:]CURRent:AC:RANGe

[SENSe:]CURRent[:DC]:APERture:ENABled?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

[SENSe:]CURRent[:DC]:APERture:ENABled? [(@<ch_list>)]

Description

This command queries whether the aperture mode is enabled or disabled for dc current measurements on the specified channels. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

Used With:

- 34921A Armature Multiplexer (channels 41 through 44 only)

Parameters

Name	Type	Range of Values	Default Value
<ch_list>	Numeric	One or more channels in the form (@sccc) . Current measurements are allowed only on channels 41 through 44 on the 34921A.	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- The CONFigure, MEASure?, [SENSe:]CURRent[:DC]:NPLC, and [SENSe:]CURRent[:DC]:RESolution commands automatically disable the aperture mode (these commands select an integration time in NPLCs).

Return Format

The query command returns "0" if the aperture mode is disabled or "1" if the aperture mode is enabled for each channel specified. Multiple responses are separated by commas.

Example

The following command returns the state of the aperture mode on channels 41 and 42 in slot 1.

```
CURR:DC:APER:ENAB? (@1041,1042)
```

Typical Response: 1,1

See Also

`CONFigure:CURRent[:DC]`

`[SENSe:]CURRent[:DC]:APERture`

`[SENSe:]CURRent[:DC]:NPLC`

[SENSe:]CURRent[:DC]:APERture

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

[SENSe:]CURRent[:DC]:APERture {<seconds>|MIN|MAX|DEF} [, (@<ch_list>)]

[SENSe:]CURRent[:DC]:APERture? [(@<ch_list>)|MIN|MAX]

Description

This command enables the aperture mode and sets the integration time in seconds (called *aperture time*) for dc current measurements on the specified channels. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

NOTE

You should use this command only when you want precise control of the integration time of the internal DMM. Otherwise, specifying integration time using NPLC (see [\[SENSe:\]CURRent\[:DC\]:NPLC](#) command) executes faster and offers better noise rejection characteristics for values of NPLC greater than 1.

Used With:

- 34921A Armature Multiplexer (channels 41 through 44 only)

Parameters

Name	Type	Range of Values	Default Value
<seconds>	Numeric	Desired aperture time in seconds between 300 μ s and 1 second, with 4 μ s resolution. MIN = 300 μ s, MAX = 1 second	Aperture disabled.
<ch_list>	Numeric	One or more channels in the form (@sccc) . Current measurements are allowed only on channels 41 through 44 on the 34921A.	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- For the <seconds> parameter, you can substitute MIN or MAX for a numeric value. MIN selects the smallest value accepted, which gives the lowest resolution; MAX selects the largest value accepted, which gives the highest resolution.
- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.

- Only the integral number of power line cycles (1, 2, 10, 20, 100, or 200 PLCs) provide normal mode (line frequency noise) rejection.
- The `CONFigure`, `MEASure?`, `[SENSe:]CURREnt[:DC]:NPLC`, and `[SENSe:]CURREnt[:DC]:RESolution` commands automatically disable the aperture mode (these commands select an integration time in NPLCs). You can use the `[SENSe:]CURREnt[:DC]:APERture:ENABLEd?` command to query whether the aperture mode is currently enabled or disabled.
- The aperture mode is disabled after a Factory Reset (`*RST` command). An Instrument Preset (`SYSTem:PRESet` command) or Card Reset (`SYSTem:CPON` command) does not change the setting.

Return Format

The query command returns the aperture time in the form `"+1.00000000E-01"` for each channel specified. Multiple responses are separated by commas. Note that if the aperture mode is currently disabled (see `[SENSe:]CURREnt[:DC]:APERture:ENABLEd?` command), the value returned will represent the previous value specified, *not* the actual integration time.

Examples

The following command enables the aperture mode and sets the aperture time to 300 ms on channels 41 and 42 in slot 1.

```
CURR:DC:APER 300E-03, (@1041,1042)
```

The following query returns the aperture time selected on channels 41 and 42 in slot 1.

```
CURR:DC:APER? (@1041,1042)
CURR:DC:APER:ENAB? !Verify that aperture mode is enabled ("1")
```

Typical	<code>+3.00000000E-</code>
Response:	<code>01,+3.00000000E-01</code>
	<code>1</code>

See Also

`CONFigure:CURREnt[:DC]`

`[SENSe:]CURREnt[:DC]:APERture:ENABLEd?`

`[SENSe:]CURREnt[:DC]:NPLC`

[SENSe:]CURRent[:DC]:NPLC

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

[SENSe:]CURRent[:DC]:NPLC {<PLCs>|MIN|MAX|DEF} [, (@<ch_list>)]

[SENSe:]CURRent[:DC]:NPLC? [(@<ch_list>)|MIN|MAX]

Description

This command sets the **integration time** in number of power line cycles (PLCs) on the specified channels. Integration time affects the measurement resolution (for better resolution, use a longer integration time) and measurement speed (for faster measurements, use a shorter integration time). If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

Used With:

- 34921A Armature Multiplexer (channels 41 through 44 only)

Parameters

Name	Type	Range of Values	Default Value
<PLCs>	Discrete	{0.02 0.2 1 2 10 20 100 200} MIN = 0.02 PLC, MAX = 200 PLC	1 PLC
<ch_list>	Numeric	One or more channels in the form (@sccc) . Current measurements are allowed only on channels 41 through 44 on the 34921A.	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.
- Only the integral number of power line cycles (1, 2, 10, 20, 100, or 200 PLCs) provide normal mode (line frequency noise) rejection.
- Setting the integration time also sets the resolution for the measurement. Click [here](#) to see the relationship between integration time, measurement resolution, number of digits, and number of bits.
- The specified integration time is used for all measurements on the selected channels. If you have applied Mx+B scaling or have assigned alarms to the selected channel, those measurements are also made using the specified integration time. Measurements taken during the Monitor function also use the specified integration time.

- You can also set the integration time by specifying an *aperture time* (see **[SENSe:]CURRent[:DC]:APERture** command). However, note that specifying integration time using NPLCs executes faster and offers better noise rejection characteristics for values of NPLC greater than 1.
- The CONFigure, MEASure?, [SENSe:]CURRent[:DC]:NPLC, and [SENSe:]CURRent[:DC]:RESolution commands automatically disable the aperture mode (these commands select an integration time in NPLCs). You can use the **[SENSe:]CURRent[:DC]:APERture:ENABLEd?** command to query whether the aperture mode is currently enabled or disabled.
- The instrument sets the integration time to 1 PLC after a Factory Reset (***RST** command). An Instrument Pre-set (**SYSTem:PRESet** command) or Card Reset (**SYSTem:CPON** command) does *not* change the setting.

Return Format

The query command returns the integration time in the form "+1.00000000E+00" for each channel specified. Multiple responses are separated by commas. Note that if the aperture mode is currently enabled (see **[SENSe:]CURRent[:DC]:APERture:ENABLEd?** command), the value returned will represent the previous value specified, *not* the actual integration time.

Examples

The following command set the integration time to 0.2 PLCs on channels 41 and 42 in slot 1.

```
CURR:DC:NPLC 0.2, (@1041,1042)
```

The following query returns the integration time settings on channels 3 and 13 in slot 1.

```
CURR:DC:NPLC? (@1041,1042)
CURR:DC:APER:ENAB? !Verify that aperture mode is disabled ("0")
```

Typical	+2.00000000E-
Response:	01,+2.00000000E-01
	0

See Also

CONFigure:CURRent[:DC]

[SENSe:]CURRent[:DC]:APERture

[SENSe:]CURRent[:DC]:APERture:ENABLEd?

[SENSe:]CURRent[:DC]:RESolution

[SENSe:]CURRent[:DC]:RANGe

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

[SENSe:]CURRent[:DC]:RANGe {<range>|MIN|MAX|DEF} [, (@<ch_list>)]

[SENSe:]CURRent[:DC]:RANGe? [{(@<ch_list>)|MIN|MAX}]

Description

This command selects the measurement range for dc current measurements on the specified channels. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

Used With:

- 34921A Armature Multiplexer (channels 41 through 44 only)

Parameters

Name	Type	Range of Values	Default Value
<range>	Discrete	Desired range in amps: 10 mA (MIN) 100 mA 1 A (MAX)	This is a required parameter
<ch_list>	Numeric	One or more channels in the form (@sccc) . Current measurements are allowed only on channels 41 through 44 on the 34921A.	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.
- Selecting a discrete range will disable autoranging on the specified channels (see [\[SENSe:\]CURRent\[:DC\]:RANGe:AUTO](#) command).
- The CONFigure and MEASure? commands automatically enable autoranging.
- If the input signal is greater than can be measured on the selected range (manual ranging), the instrument gives an *overload indication*: "±OVLd" from the front panel or "±9.9E+37" from the remote interface.

- The instrument enables autoranging after a Factory Reset (***RST** command). An Instrument Preset (**SYSTem:PRESet** command) or Card Reset (**SYSTem:CPON** command) does not change the setting.

Return Format

The query command returns the range in the form "+1.00000000E-01" for each channel specified. Multiple responses are separated by commas.

Examples

The following command selects the 100 mA range on channels 41 and 42 in slot 1.

```
CURR:DC:RANG 0.1, (@1041,1042)
```

The following query returns the range selected on channels 41 and 42 in slot 1.

```
CURR:DC:RANG? (@1041,1042)
```

Typical Response: +1.00000000E-01,+1.00000000E-01

See Also

CONFigure:CURRent[:DC]

[SENSe:]CURRent[:DC]:RANGe:AUTO

[SENSe:]CURRent[:DC]:RANGe:AUTO

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

[SENSe:]CURRent[:DC]:RANGe:AUTO <mode> [, (@<ch_list>)]

[SENSe:]CURRent[:DC]:RANGe:AUTO? [(@<ch_list>)]

Description

This command disables or enables autoranging for dc current measurements on the specified channels. Autoranging is convenient because the instrument automatically selects the range for each measurement based on the input signal detected. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

Used With:

- 34921A Armature Multiplexer (channels 41 through 44 only)

Parameters

Name	Type	Range of Values	Default Value
<mode>	Boolean	{OFF 0 ON 1}	Autorange ON
<ch_list>	Numeric	One or more channels in the form (@sccc) . Current measurements are allowed only on channels 41 through 44 on the 34921A.	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.
- Autorange thresholds:

Down range <10% of range
at:
Up range at: >120% of range

- With autoranging enabled, the instrument selects one of the following ranges based on the input signal detected:

10 mA, 100 mA, 1 A

- Selecting a discrete range (see **[SENSe:]CURRent[:DC]:RANGe** command) will disable autoranging on the specified channels.
- The CONFigure and MEASure? commands automatically enable autoranging.
- The instrument enables autoranging after a Factory Reset (***RST** command). An Instrument Preset (**SYSTem:PRESet** command) or Card Reset (**SYSTem:CPON** command) does not change the setting.

Return Format

The query command returns "0" (OFF) or "1" (ON) for each channel specified. Multiple responses are separated by commas.

Examples

The following command disables autoranging on channels 41 and 42 in slot 1.

```
CURR:DC:RANG:AUTO OFF, (@1041,1042)
```

The following query returns the autoranging settings on channels 41 and 42 in slot 1.

```
CURR:DC:RANG:AUTO? (@1041,1042)
```

Typical Response: 0,0

See Also

CONFigure:CURRent[:DC]

[SENSe:]CURRent[:DC]:RANGe

[SENSe:]CURRent[:DC]:RESolution

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

[SENSe:]CURRent[:DC]:RESolution {<resolution>|MIN|MAX|DEF} [, (@<ch_list>)]

[SENSe:]CURRent[:DC]:RESolution? [(@<ch_list>)|MIN|MAX]

Description

This command selects the measurement resolution for dc current measurements on the specified channels. Specify the resolution in the same units as the selected measurement function, *not in number of digits*. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

Used With:

- 34921A Armature Multiplexer (channels 41 through 44 only)

Parameters

Name	Type	Range of Values	Default Value
<resolution>	Numeric	Desired resolution in amps.	0.000003 x Range (1 PLC)
<ch_list>	Numeric	One or more channels in the form (@sccc) . Current measurements are allowed only on channels 41 through 44 on the 34921A.	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- For the <resolution> parameter, you can substitute MIN or MAX for a numeric value. MIN selects the smallest value accepted, which gives the highest resolution; MAX selects the largest value accepted, which gives the least resolution.
- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.
- Setting the resolution also sets the integration time for the measurement. The following table shows the relationship between integration time, measurement resolution, number of digits, and number of bits.

Integration Time	Resolution	Digits	Bits

0.02 PLC	< 0.0001 x Range	4½ Digits	15
0.2 PLC	< 0.00001 x Range	5½ Digits	18
1 PLC	< 0.000003 x Range	5½ Digits	20
2 PLC	< 0.0000022 x Range	6½ Digits	21
10 PLC	< 0.000001 x Range	6½ Digits	24
20 PLC	< 0.0000008 x Range	6½ Digits	25
100 PLC	< 0.0000003 x Range	6½ Digits	26
200 PLC	< 0.00000022 x Range	6½ Digits	26

- You can also set the integration time by specifying an *aperture time* (see **[SENSe:]CURRent[:DC]:APERture** command). However, note that specifying integration time using NPLCs executes faster and offers better noise rejection characteristics for values of NPLC greater than 1.
- The CONFigure, MEASure?, [SENSe:]CURRent[:DC]:NPLC, and [SENSe:]CURRent[:DC]:RESolution commands automatically disable the aperture mode (these commands select an integration time in NPLCs). You can use the **[SENSe:]CURRent[:DC]:APERture:ENABled?** command to query whether the aperture mode is currently enabled or disabled.
- The instrument sets the resolution to 1 PLC after a Factory Reset (***RST** command). An Instrument Preset (**SYSTem:PRESet** command) or Card Reset (**SYSTem:CPON** command) does *not* change the setting.

Return Format

The query command returns the resolution in the form "+1.00000000E-04" for each channel specified. Multiple responses are separated by commas. Note that if the aperture mode is currently enabled (see **[SENSe:]CURRent[:DC]:APERture:ENABled?** command), the value returned will represent the previous value specified, *not* the actual integration time.

Examples

The following command sets the measurement resolution to 100 mA on channels 41 and 42 in slot 1.

```
CURR:DC:RES 0.1, (@1041,1042)
```

The following query returns the resolution selected on channels 41 and 42 in slot 1.

```
CURR:DC:RES? (@1041,1042)
CURR:DC:APER:ENAB? !Verify that aperture mode is disabled ("0")
```

Typical
Response: +1.00000000E-
 04,+1.00000000E-04
 0

See Also

CONFigure:CURRent[:DC]

[SENSe:]CURRent[:DC]:APERture

[SENSe:]CURREnt[:DC]:APERture:ENABled?

[SENSe:]CURREnt[:DC]:NPLC

[SENSe:]CURRent[:DC]:ZERO:AUTO

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

[SENSe:]CURRent[:DC]:ZERO:AUTO <mode> [, (@<ch_list>)]

[SENSe:]CURRent[:DC]:ZERO:AUTO? [(@<ch_list>)]

Description

This command disables or enables the autozero mode on the specified channels. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

When autozero is enabled (default), the instrument internally disconnects the input signal following each measurement, and takes a *zero* reading. It then subtracts the zero reading from the preceding reading. This prevents offset voltages present on the instrument's input circuitry from affecting measurement accuracy.

When autozero is disabled, the instrument takes one zero reading and subtracts it from all subsequent measurements. It takes a new zero reading each time you change the function, range, or integration time.

Used With:

- 34921A Armature Multiplexer (channels 41 through 44 only)

Parameters

Name	Type	Range of Values	Default Value
<mode>	Discrete	{OFF ONCE 0 ON 1}	Autozero ON
<ch_list>	Numeric	One or more channels in the form <u>(@sccc)</u> . Current measurements are allowed only on channels 41 through 44 on the 34921A.	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- Applies to dc current measurements only.
- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.
- The OFF and ONCE parameters have a similar effect. Autozero OFF does *not* issue a new zero measurement. Autozero ONCE issues an immediate zero measurement.

- The autozero mode is set indirectly when you set the **resolution** and integration time. Autozero is automatically turned off when you select an integration time less than 1 PLC.
- The CONFigure and MEASure? commands automatically enable autozero.
- The autozero setting is stored in **volatile** memory and will be enabled (autozero ON) when power is turned off or after a Factory Reset (***RST** command).

Return Format

The query command returns "0" (OFF or ONCE) or "1" (ON) for each channel specified. Multiple responses are separated by commas.

Examples

The following command disables autozero on channels 41 and 42 in slot 1. With autozero disabled, a new zero measurement is not issued until the next time the instrument goes to the "wait-for-trigger" state.

```
CURR:ZERO:AUTO OFF, (@1041,1042)
```

The following query returns the autozero settings on channels 41 and 42 in slot 1.

```
CURR:ZERO:AUTO? (@1041,1042)
```

Typical Response: **0,0**

See Also

CONFigure:CURRent[:DC]

[SENSe:]RESistance:ZERO:AUTO

[SENSe:]TEMPerature:ZERO:AUTO

[SENSe:]VOLTage[:DC]:ZERO:AUTO

[SENSe:]COUNter:ABORt

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

[SENSe:]COUNter:ABORt (@<ch_list>)

Description

This command aborts an *initiated* counter measurement in progress (see [SENSe:]COUNter:INITiate command) on the specified counter channels on the 34950A Digital I/O Module. This command may be useful to abort a long internally- or externally-gated measurement.

Used With:

- 34950A Digital I/O Module

Parameters

Name	Type	Range of Values	Default Value
<ch_list>	Numeric	One or more counter channels in the form (@sccc). Select from s301 or s302.	This is a required parameter

Remarks

- This command does *not* clear or invalidate any measurement in memory.
- Once an initiated counter measurement has been terminated, use the [SENSe:]COUNter:INITiate command to resume the measurement.
- You can also use this command in the totalizer mode (see CONFigure:COUNter:TOTalize command) to stop the totalizer operation.

Examples

The following command configures counter channels 301 and 302 on the module in slot 3 to measure frequency and then initiates the measurement. The [SENSe:]COUNter:ABORt command aborts the measurement.

```
CONF:COUN:FREQ 1E-3, (@3301, 3302)
COUN:INIT (@3301, 3302)
COUN:FREQ? (@3301, 3302)
COUN:ABOR !Abort the measurement
```

The following command configures counter channels 301 and 302 on the module in slot 3 for a totalizer operation. The [SENSe:]COUNter:ABORt command stops the totalizer operation.

```
CONF:COUN:TOT READ, (@3301,3302)
COUN:ABOR !Abort the totalizer operation
```

See Also

[SENSe:]COUNter:INITiate

[SENSe:]COUNter:DATA?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

[SENSe:]COUNter:DATA? (@<ch_list>)

Description

This command returns the data from the last configured counter measurement on the 34950A Digital I/O Module. The results returned are based on the counter measurement function previously selected (frequency, period, duty cycle, pulse width, or totalize).

Used With:

- 34950A Digital I/O Module

Parameters

Name	Type	Range of Values	Default Value
<ch_list>	Numeric	One or more counter channels in the form (@sccc). Select from s301 or s302.	This is a required parameter

Remarks

- If the specified counter channels are currently initiated (see [SENSe:]COUNter:INITiate command) and are using an *internal* gate source (see [SENSe:]COUNter:GATE:SOURce command), then the [SENSe:]COUNter:DATA? command will pend until the measurement is finished.
- When the counter takes an initiated measurement, it gathers enough information about the signal to derive all five measurement attributes (frequency, period, duty cycle, pulse width, and totalize).
- For non-initiated totalizer measurements, the [SENSe:]COUNter:DATA? command will return the current result.

Return Format

For initiated measurements, the command returns the results in hertz (frequency), seconds (period or pulse width), percent (duty cycle), or count (totalize). Multiple responses are separated by commas.

For totalizer measurements, the command returns an unsigned decimal value representing the count on each totalizer channel specified (a full 32-bit count is returned). Multiple responses are separated by commas.

Examples

The following command configures counter channels 301 and 302 on the module in slot 3 for frequency measurements and reads the results.

```
CONF:COUN:FREQ 1E-3, (@3301, 3302)
COUN:INIT (@3301, 3302)
COUN:DATA? (@3301, 3302)
```

Typical Response: +3.45600000E+05,+1.23400000E+05

The following command configures counter channels 301 and 302 on the module in slot 3 for totalizer measurements and reads the results.

```
CONF:COUN:TOT READ, (@3301, 3302)
COUN:DATA? (@3301, 3302)
```

Typical Response: 1.321300000E+03,3.874300000E+03

See Also

[CONFigure:COUNter:DCYCLE](#)

[CONFigure:COUNter:FREQuency](#)

[CONFigure:COUNter:PERiod](#)

[CONFigure:COUNter:PWIDth](#)

[CONFigure:COUNter:TOTalize](#)

[\[SENSe:\]COUNter:GATE:SOURce](#)

[\[SENSe:\]COUNter:DCYCLE\[:DATA\]?](#)

[\[SENSe:\]COUNter:FREQuency\[:DATA\]?](#)

[\[SENSe:\]COUNter:PERiod\[:DATA\]?](#)

[\[SENSe:\]COUNter:PWIDth\[:DATA\]?](#)

[\[SENSe:\]COUNter:TOTalize\[:DATA\]?](#)

[SENSe:]COUNter:DCYClE[:DATA]?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

[SENSe:]COUNter:DCYClE[:DATA]? (@<ch_list>)

Description

This command returns the duty cycle measured on the specified counter channels on the 34950A Digital I/O Module.

Used With:

- 34950A Digital I/O Module

Parameters

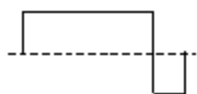
Name	Type	Range of Values	Default Value
<ch_list>	Numeric	One or more counter channels in the form (@sccc). Select from s301 or s302 .	This is a required parameter

Remarks

- The duty cycle represents the amount of time per cycle that the input signal is at a high level (assuming that the polarity is not reversed) and is expressed as a percentage. The specified counter channels must detect at least two edges for a valid duty cycle measurement.



20% Duty Cycle



80% Duty Cycle

- If the specified channels have been configured for a totalizer measurement (see [CONFig-ure:COUNter:TOTalize](#) command), the [SENSe:]COUNter:DCYClE[:DATA]? command will return "+9.91000000E+37".

Return Format

The command returns the duty cycle in percent for each counter channel specified. Multiple responses are separated by commas.

Example

The following command configures counter channels 301 and 302 on the module in slot 3 for duty cycle measurements and reads the results.

```
CONF:COUN:DCYC 1E-3, (@3301, 3302)
COUN:INIT (@3301, 3302)
COUN:DCYC? (@3301, 3302)
```

Typical Response: +5.00000000E+01,+5.00000000E+01

See Also

[CONFigure:COUNter:DCYClE](#)

[\[SENSe:\]COUNter:DATA?](#)

[SENSe:]COUNter:FREQuency[:DATA]?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

[SENSe:]COUNter:FREQuency[:DATA]? (@<ch_list>)

Description

This command returns the frequency measured on the specified counter channels on the 34950A Digital I/O Module.

Used With:

- 34950A Digital I/O Module

Parameters

Name	Type	Range of Values	Default Value
<ch_list>	Numeric	One or more counter channels in the form (@sccc). Select from s301 or s302.	This is a required parameter

Remarks

- The frequency is measured as: $(NumberRisingEdges - 1) / GateTime$. The specified counter channels must detect at least two edges for a valid frequency measurement. The maximum input frequency allowed is 10 MHz.
- If the specified channels have been configured for a totalizer measurement (see **CONFig-ure:COUNter:TOTalize** command), the [SENSe:]COUNter:FREQuency[:DATA]? command will return "+9.91000000E+37".

Return Format

The command returns the frequency in hertz for each counter channel specified. Multiple responses are separated by commas.

Example

The following command configures counter channels 301 and 302 on the module in slot 3 for frequency measurements and reads the results.

```
CONF:COUN:FREQ 1E-3, (@3301,3302)
COUN:INIT (@3301,3302)
COUN:FREQ? (@3301,3302)
```

Typical Response: +3.45600000E+05,+3.31300000E+05

See Also

[CONFigure:COUNter:FREQuency](#)

[\[SENSe:\]COUNter:DATA?](#)

[SENSe:]COUNter:FUNcTion

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

[SENSe:]COUNter:FUNcTion <function>, (@<ch_list>)

[SENSe:]COUNter:FUNcTion? (@<ch_list>)

Description

This command selects the present measurement function on the specified counter channels on the 34950A Digital I/O Module. You can select frequency, period, duty cycle, pulse width, or totalize.

Used With:

- 34950A Digital I/O Module

Parameters

Name	Type	Range of Values	Default Value
<function>	Discrete	{FREQuency PERiod DCYcLe PWIDth TOTalize}	This is a required parameter
<ch_list>	Numeric	One or more counter channels in the form (@sccc) . Select from s301 or s302.	This is a required parameter

Remarks

- When the counter takes an initiated measurement, it gathers enough information about the signal to derive all five measurement attributes (frequency, period, duty cycle, pulse width, and totalize).

Return Format

The query command returns "FREQ", "PER", "DCYC", "PWID", or "TOT" for the specified channels. Multiple responses are separated by commas.

Examples

The following command selects the period function on counter channels 301 and 302 on the module in slot 3.

```
COUN:FUNC PER, (@3301, 3302)
```

The following command queries the function on counter channels 301 and 302 on the module in slot 3.

```
COUN:FUNC? (@3301,3302)
```

Typical Response: **PER,PER**

See Also

[CONFigure:COUNter:DCYClE](#)

[CONFigure:COUNter:FREQuency](#)

[CONFigure:COUNter:PERiod](#)

[CONFigure:COUNter:PWIDth](#)

[CONFigure:COUNter:TOTalize](#)

[MEASure:COUNter:DCYClE?](#)

[MEASure:COUNter:FREQuency?](#)

[MEASure:COUNter:PERiod?](#)

[MEASure:COUNter:PWIDth?](#)

[MEASure:COUNter:TOTalize?](#)

[SENSe:]COUNter:GATE:POLarity

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

[SENSe:]COUNter:GATE:POLarity <polarity>, (@<ch_list>)

[SENSe:]COUNter:GATE:POLarity? (@<ch_list>)

Description

This command sets the logic polarity of the Gate input line for counter operations on the 34950A Digital I/O Module (each bank has its own Gate input line). You can specify the gate polarity as "normal" (active high, default) or "inverted" (active low). Changing the gate polarity while an initiated measurement is in progress (see [\[SENSe:\]COUNter:INITiate](#) command) is *not* allowed.

Used With:

- 34950A Digital I/O Module

Parameters

Name	Type	Range of Values	Default Value
<polarity>	Discrete	{NORMal INVerted}	NORMal (active high)
<ch_list>	Numeric	One or more counter channels in the form (@sccc) . Select from s301 or s302.	This is a required parameter

Remarks

- If you change the gate polarity while a counter operation is in progress, the count on the specified channels will be cleared.
- The selected gate polarity is stored in **volatile** memory and will be set to "NORM" when power is turned off or after a Factory Reset (***RST** command).

Return Format

The query command returns "NORM" or "INV" for the specified channels. Multiple responses are separated by commas.

Examples

The following command selects an inverted gate polarity (active low) on counter channels 301 and 302 on the module in slot 3.

```
COUN:GATE:POL INV, (@3301, 3302)
```

The following query returns the gate polarity on counter channels 301 and 302 on the module in slot 3.

```
COUN:GATE:POL? (@3301, 3302)
```

Typical Response: **INV,INV**

See Also

[SENSe:]COUNter:GATE:SOURce

[SENSe:]COUNter:GATE:SOURce

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

[SENSe:]COUNter:GATE:SOURce <source>, (@<ch_list>)

[SENSe:]COUNter:GATE:SOURce? (@<ch_list>)

Description

This command selects the gate source for counter measurements on the 34950A Digital I/O Module (each bank has it's own Gate input line). You can select either the internal (default) source or an external gate signal. Changing the gate source while an initiated measurement is in progress (see [SENSe:]COUNter:INITiate command) is *not* allowed.

Used With:

- 34950A Digital I/O Module

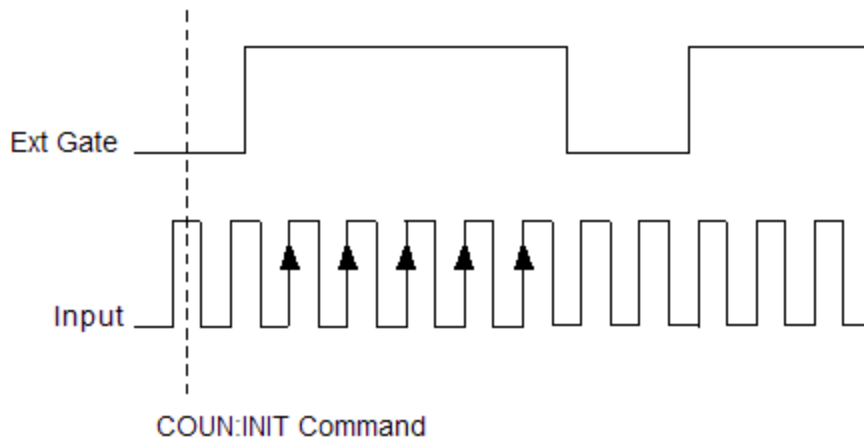
Parameters

Name	Type	Range of Values	Default Value
<source>	Discrete	{INTernal EXTernal}	INTernal
<ch_list>	Numeric	One or more counter channels in the form (@sccc). Select from s301 or s302.	This is a required parameter

Remarks

- If you change the gate polarity while a totalizing operation is in progress, the count on the specified channels will be cleared.
- For *initiated* measurements (see [SENSe:]COUNter:INITiate command), the counter can generate its own internally-timed gate signal. If you select the *internal* gate source, the counter will be triggered immediately after the [SENSe:]COUNter:INITiate command is received. If you select the *external* gate source, the [SENSe:]COUNter:INITiate command initiates (arms) the measurement and a valid edge on the external Gate line will trigger the internally-timed gate.

- For *totalizer* measurements with an *internal* gate source, the counter will continuously totalize (free-running mode). With an *external* gate source, the counter will totalize only during the time from the first assertion to the first de-assertion of the external gate signal (see diagram below).



- The selected gate source is stored in **volatile** memory and will be set to "INT" when power is turned off or after a Factory Reset (***RST** command).

Return Format

The query command returns "INT" or "EXT" for the specified channels. Multiple responses are separated by commas.

Examples

The following command selects an external gate source on counter channels 301 and 302 on the module in slot 3.

```
COUN:GATE:SOUR EXT, (@3301, 3302)
```

The following query returns the gate source on counter channels 301 and 302 on the module in slot 3.

```
COUN:GATE:SOUR? (@3301, 3302)
```

Typical Response: **EXT,EXT**

See Also

[\[SENSe:\]COUNter:GATE:POLarity](#)

[\[SENSe:\]COUNter:GATE:TIME\[:INTernal\]](#)

[\[SENSe:\]COUNter:INITiate](#)

[SENSe:]COUNter:GATE:TIME[:INTernal]

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

[SENSe:]COUNter:GATE:TIME[:INTernal] {<time>|MIN|MAX|DEF}, (@<ch_list>)

[SENSe:]COUNter:GATE:TIME[:INTernal]? [{MIN|MAX},] (@<ch_list>)

Description

This command sets the internal gate time for *initiated* measurements on the specified counter channels on the 34950A Digital I/O Module (each bank has it's own Gate input line). The specified gate time is the measurement aperture during which the signal data is gathered. For repetitive signals, longer gate times will lead to increased resolution for frequency, period, pulse width, and duty cycle measurements.

Used With:

- 34950A Digital I/O Module

Parameters

Name	Type	Range of Values	Default Value
<time>	Numeric	Desired gate time between 100 ns and 10 seconds, with 50 ns resolution. MIN = 100 ns, MAX = 100 seconds	1 ms
<ch_list>	Numeric	One or more counter channels in the form (@sccc). Select from s301 or s302.	This is a required parameter

Remarks

- Changing the gate time while an initiated measurement is in progress (see [SENSe:]COUNter:INITiate command) is *not* allowed.
- The selected gate time is stored in **volatile** memory and will be set to 1 ms when power is turned off or after a Factory Reset (*RST command).

Return Format

The query command returns the gate time in the form "+1.00000000E-03" for each channel specified. Multiple responses are separated by commas.

Examples

The following command sets the gate time to 200 ms on counter channels 301 and 302 on the module in slot 3.

```
COUN:GATE:TIME 200E-3, (@3301, 3302)
```

The following query returns the threshold voltage settings on counter channels 301 and 302 on the module in slot 3.

```
COUN:GATE:TIME? (@3301, 3302)
```

Typical Response: +2.00000000E-01,+2.00000000E-01

See Also

[SENSe:]COUNter:GATE:SOURce

[SENSe:]COUNter:INITiate

[SENSe:]COUNter:INITiate

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

[SENSe:]COUNter:INITiate (@<ch_list>)

Description

This command initiates a counter measurement on the 34950A Digital I/O Module. Once the counter measurement is initiated, gating can begin.

Used With:

- 34950A Digital I/O Module

Parameters

Name	Type	Range of Values	Default Value
<ch_list>	Numeric	One or more counter channels in the form (@sccc) . Select from s301 or s302.	This is a required parameter

Remarks

- If the gate source is *internal* (see [\[SENSe:\]COUNter:GATE:SOURce](#) command), the internally-timed gate and the measurement will begin immediately. Otherwise, the external gate is used.
- To abort an initiated counter measurement in progress, use the [\[SENSe:\]COUNter:ABORT](#) command.
- In the totalizer mode (see [CONFigure:COUNter:TOTalize](#) command), use the [SENSe:]COUNter:INITiate command to resume a measurement previously aborted by the [\[SENSe:\]COUNter:ABORT](#) command. If the totalizer is already running, the [SENSe:]COUNter:INITiate command does nothing (no error is generated).

Example

The following command configures counter channels 301 and 302 on the module in slot 3 to measure frequency and then initiates the measurement.

```
CONF:COUN:FREQ 1E-3, (@3301,3302)
COUN:INIT (@3301,3302) !Initiate the measurement
COUN:FREQ? (@3301,3302)
```

See Also

[\[SENSe:\]COUNter:ABORT](#)

[SENSe:]COUNter:PERiod[:DATA]?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

[SENSe:]COUNter:PERiod[:DATA]? (@<ch_list>)

Description

This command returns the period measured on the specified counter channels on the 34950A Digital I/O Module (this is the reciprocal of the frequency).

Used With:

- 34950A Digital I/O Module

Parameters

Name	Type	Range of Values	Default Value
<ch_list>	Numeric	One or more counter channels in the form (@sccc). Select from s301 or s302.	This is a required parameter

Remarks

- The specified counter channels must detect at least two edges for a valid period measurement.
- If the specified channels have been configured for a totalizer measurement (see [CONFig-ure:COUNter:TOTalize](#) command), the [SENSe:]COUNter:PERiod[:DATA]? command will return "+9.91000000E+37".

Return Format

The command returns the period in seconds for each counter channel specified. Multiple responses are separated by commas.

Example

The following command configures counter channels 301 and 302 on the module in slot 3 for period measurements and reads the results.

```
CONF:COUN:PER 1E-3, (@3301, 3302)
COUN:INIT (@3301, 3302)
COUN:PER? (@3301, 3302)
```

Typical Response: +2.89400000E-06,+4.83700000E-06

See Also

[CONFigure:COUNter:PERiod](#)

[\[SENSe:\]COUNter:DATA?](#)

[SENSe:]COUNter:PWIDth[:DATA]?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

[SENSe:]COUNter:PWIDth[:DATA]? (@<ch_list>)

Description

This command returns the pulse width measured on the specified counter channels on the 34950A Digital I/O Module.

Used With:

- 34950A Digital I/O Module

Parameters

Name	Type	Range of Values	Default Value
<ch_list>	Numeric	One or more counter channels in the form (@sccc). Select from s301 or s302.	This is a required parameter

Remarks

- The pulse width represents the amount of time per cycle that the input signal is at a high level (assuming that the polarity is not reversed) and is expressed in seconds. If multiple pulses occur during the specified gate time, the result will be the average width of all pulses.
- If the specified channels have been configured for a totalizer measurement (see [CONFig-ure:COUNter:TOTalize](#) command), the [SENSe:]COUNter:PWIDth[:DATA]? command will return "+9.91000000E+37".

Return Format

The command returns the pulse width in seconds for each counter channel specified. Multiple responses are separated by commas.

Example

The following command configures counter channels 301 and 302 on the module in slot 3 for pulse width measurements and reads the results.

```
CONF:COUN:PWID 1E-3, (@3301,3302)  
COUN:INIT (@3301,3302)  
COUN:PWID? (@3301,3302)
```

Typical Response: +1.44700000E-06,+3.98300000E-06

See Also

CONFigure:COUNter:PWIDth

[SENSe:]COUNter:DATA?

[SENSe:]COUNter:SLOPe

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

```
[SENSe:]COUNter:SLOPe <slope>, (@<ch_list>)
```

```
[SENSe:]COUNter:SLOPe? (@<ch_list>)
```

Description

This command configures the specified counter channels on the 34950A Digital I/O Module to count on the rising edge (positive) or falling edge (negative) of the input signal.

Used With:

- 34950A Digital I/O Module

Parameters

Name	Type	Range of Values	Default Value
<slope>	Discrete	{NEGative POSitive}	POSitive (rising edge)
<ch_list>	Numeric	One or more counter channels in the form (@sccc) . Select from s301 or s302.	This is a required parameter

Remarks

- If you change the slope while a counter operation is in progress, the count on the specified channels will be cleared.
- The selected slope is stored in **volatile** memory and will be set to "POS" when power is turned off or after a Factory Reset (***RST** command).

Return Format

The query command returns "NEG" or "POS" for the specified channels. Multiple responses are separated by commas.

Examples

The following command configures counter channels 301 and 302 on the module in slot 3 to count on the negative edge (falling) of the input signal.

```
COUN:SLOP NEG, (@3301, 3302)
```

The following query returns the edge setting on counter channels 301 and 302 on the module in slot 3.

```
COUN:SLOP? (@3301,3302)
```

Typical Response: **NEG,NEG**

See Also

[SENSe:]TOTalize:SLOPe

[SENSe:]COUNter:THReshold:VOLTage

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

[SENSe:]COUNter:THReshold:VOLTage {<voltage>|MIN|MAX|DEF}, (@<ch_list>)

[SENSe:]COUNter:THReshold:VOLTage? [{MIN|MAX},] (@<ch_list>)

Description

This command sets the input threshold voltage for the specified counter channels on the 34950A Digital I/O Module. Changing the threshold voltage while an initiated measurement is in progress (see [\[SENSe:\]COUNter:INITiate](#) command) is *not* allowed.

Used With:

- 34950A Digital I/O Module

Parameters

Name	Type	Range of Values	Default Value
<voltage>	Numeric	Desired threshold voltage between 0V and 3V, with 20 mV resolution. MIN = 0V, MAX = 3V	0.8V (TTL)
<ch_list>	Numeric	One or more counter channels in the form (@sccc). Select from s301 or s302 .	This is a required parameter

Remarks

- If you change the threshold voltage while a totalizer operation is in progress, the count on the specified channels will be cleared.
- The selected threshold voltage is stored in **volatile** memory and will be set to 0.8V when power is turned off or after a Factory Reset ([*RST](#) command).

Return Format

The query command returns the threshold voltage in the form "+1.00000000E+00" for each channel specified. Multiple responses are separated by commas.

Examples

The following command sets the threshold voltage to 1.8V on counter channels 301 and 302 on the module in slot 3.

```
COUN:THR:VOLT 1.8, (@3301, 3302)
```

The following query returns the threshold voltage settings on counter channels 301 and 302 on the module in slot 3.

```
COUN:THR:VOLT? (@3301, 3302)
```

Typical Response: +1.80000000E+00,+1.80000000E+00

See Also

[\[SENSe:\]COUNter:SLOPe](#)

[\[SENSe:\]TOTalize:THReshold:VOLTage](#)

[SENSe:]COUNter:TOTalize:CLEar:IMMediate

Syntax | Description | Parameters | Remarks | Return Format | Example

Syntax

[SENSe:]COUNter:TOTalize:CLEar:IMMediate (@<ch_list>)

Description

This command immediately clears the count on the specified totalizer channels on the 34950A Digital I/O Module. Clearing the count while an initiated measurement is in progress (see [SENSe:]COUNter:INITiate command) is *not* allowed.

Used With:

- 34950A Digital I/O Module

Parameters

Name	Type	Range of Values	Default Value
<ch_list>	Numeric	One or more totalizer channels in the form (@sccc). Select from s301 or s302.	This is a required parameter

Example

The following command clears the count on totalizer channel 301 on the module in slot 3.

```
COUN:TOT:CLEAR:IMM (@3301)
```

See Also

[SENSe:]COUNter:TOTalize[:DATA]?

[SENSe:]COUNter:TOTalize[:DATA]?

Syntax | Description | Parameters | Remarks | Return Format | Example

Syntax

[SENSe:]COUNter:TOTalize[:DATA]? (@<ch_list>)

Description

This command reads the count on the specified totalizer channels on the 34950A Digital I/O Module. If you have configured the count to be reset when it is read (see **CONFigure:TOTalize** and **[SENSe:]COUNter:TOTalize:TYPE** commands), then this command will reset the count to "0" after it is read. The count is reset regardless of whether the specified channels are in a scan list or even whether a scan is in progress.

Used With:

- 34950A Digital I/O Module

Parameters

Name	Type	Range of Values	Default Value
<ch_list>	Numeric	One or more totalizer channels in the form (@sccc). Select from s301 or s302 .	This is a required parameter

Remarks

- The maximum count is 4,294,967,295 ($2^{32} - 1$). The count rolls over to "0" after reaching the maximum allowed value.
- If you send this command while an initiated measurement is in progress (see **[SENSe:]COUNter:INITiate** command), the query will wait until the measurement is complete before returning the count.
- The output from this command is affected by the settings of the **FORMat:READing** commands. Depending on the formats selected, each reading may or may not be stored with measurement units, time stamp, channel number, and alarm status information.

Return Format

The command returns an unsigned decimal value representing the count on each totalizer channel specified (a full 32-bit count is returned). Multiple responses are separated by commas.

Example

The following command reads the count on totalizer channels 301 and 302 on the module in slot 3.

COUN:TOT:DATA? (@3301,3302)

Typical Response: 1.321300000E+03,3.874300000E+03

See Also

CONFigure:COUNter:TOTalize

[SENSe:]COUNter:DATA?

[SENSe:]COUNter:TOTalize:TYPE

[SENSe:]COUNter:TOTalize:TYPE

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

[SENSe:]COUNter:TOTalize:TYPE <mode>, (@<ch_list>)

[SENSe:]COUNter:TOTalize:TYPE? (@<ch_list>)

Description

This command enables or disables an automatic reset of the count on the specified totalizer channels on the 34950A Digital I/O Module. To read the totalizer during a scan without resetting the count, select the READ parameter. To read the totalizer during a scan and reset the count to "0" after it is read, select the RRESet parameter (this means "read and reset").

Used With:

- 34950A Digital I/O Module

Parameters

Name	Type	Range of Values	Default Value
<mode>	Discrete	{READ RRESet}	This is a required parameter
<ch_list>	Numeric	One or more totalizer channels in the form (@sccc) . Select from s301 or s302.	This is a required parameter

Remarks

- The maximum count is 4,294,967,295 ($2^{32} - 1$). The count rolls over to "0" after reaching the maximum allowed value.

Return Format

The query command returns "READ" or "RRES" for the specified channels. Multiple responses are separated by commas.

Examples

The following command configures totalizer channels 301 and 302 on the module in slot 3 to be read without resetting their count.

```
COUN:TOT:TYPE READ, (@3301, 3302)
```

The following query returns the totalizer setting on totalizer channels 301 and 302 on the module in slot 3.

```
COUN:TOT:TYPE? (@3301, 3302)
```

Typical Response: **READ,READ**

See Also

[SENSe:]COUNter:TOTalize[:DATA]?

[SENSe:]DIGital:DATA[:<width>]?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

[SENSe:]DIGital:DATA[:<width>]? [<format>,@] (@<ch_list>)

Description

This command reads the specified digital input channels and sends the results directly to the instrument's output buffer. Note that if the specified channels are presently configured as outputs, this command will return the last value output from the channels (the channels are *not* reconfigured as inputs).

Used With:

- 34950A Digital I/O Module (digital input channels only)
- 34952A Multifunction Module (digital input channels only)
- 34959A Breadboard Module (digital input channels only)

Parameters

Name	Type	Range of Values	Default Value
<width>	Discrete	{BYTE 1 WORD 2 LWORD 4} BYTE (or "1" byte): 8 bits WORD (or "2" bytes): 16 bits LWORD (or "4" bytes): 32 bits <i>34959A: Only valid configurations are BYTE/WORD.</i>	If no <width> is specified, the currently configured width is used (see CONFigure:DIGital:WIDTh command).
<format>	Discrete	{DECimal BINary HEXadecimal OCTal }	DECimal
<ch_list>	Numeric	One or more digital input channels in the form (@sccc). 34950A: s101 through s104, s201 through s204 34952A: s001 through s004 34959A: s001 or s002	This is a required parameter

Remarks

- Depending on the width specified, the channel numbering is modified as shown below. For example, if you specify the width as a 16-bit WORD on the 34950A, channels 101 and 102 are combined and addressed collectively as channel 101.

34950A	Bank 2				Bank 1			
BYTE (8 Bits):	Ch 204	Ch 203	Ch 202	Ch 201	Ch 104	Ch 103	Ch 102	Ch 101
WORD (16 Bits):	Ch 203		Ch 201		Ch 103		Ch 101	
LWORD (32 Bits):	Ch 201				Ch 101			

34952A	Bank 1			
BYTE (8 Bits):	Ch 4	Ch 3	Ch 2	Ch 1
WORD (16 Bits):	Ch 3		Ch 1	
LWORD (32 Bits):	Ch 1			

- If the specified channels are presently configured as outputs (see **CONFigure:DIGital:DIRection?** command), this command will return the last value output from the channels (the channels are *not* reconfigured as inputs). To reconfigure the channels as an input, use the **CONFigure:DIGital:DIRection** command.
- On the 34950A, it is not valid to read a channel while buffered (memory) I/O is enabled (see **[SENSe:]DIGital:MEMory:ENABle** command). Changing the channel width will disable buffered operations and clear memory on the specified digital channels.
- Use the **[SENSe:]DIGital:DATA:BIT?** command to query the state of individual bits on the specified digital input channels.
- The selected width is stored in **volatile** memory and will be set to BYTE when power is turned off or after a Factory Reset (***RST** command).

Return Format

This command returns a value representing the bit pattern on each digital channel specified. Multiple responses are separated by commas. The output from this command is not affected by the settings of the **FORMat:READIng** commands.

Examples

The following program segment configures channels 101 and 103 on the **34950A** in slot 3 as outputs and then reads the output values (the channels are *not* reconfigured as inputs). Then, the channels are reconfigured as inputs and the values are again read (this time, the actual inputs from the channels are returned).

```
SOUR:DIG:DATA:WORD 12364, (@3101,3103)  !Channels are outputs
DIG:DATA:WORD? (@3101,3103)  !Returns "12364,12364", channels remain as
outputs
CONF:DIG:DIR INP, (@3101,3103)  !Channels are inputs
DIG:DATA:WORD? (@3101,3103)  !Returns actual input from channels
```

Typical Response: **65487,64972**

The following program segment queries the byte values from digital input channels 201 and 203 on the **34950A** in slot 3 and returns the corresponding hexadecimal values to the instrument's output buffer.

```
CONF:DIG:DIR INP, (@3201,3203)  !Channels are inputs
DIG:DATA:BYTE? HEX, (@3201,3203)
```

Typical Response: **00F0,0060**

The following program segment queries the word values from digital input channels 1 and 3 on the **34952A** in slot 5 and returns the corresponding decimal values to the instrument's output buffer.

```
CONF:DIG:DIR INP, (@5001,5003)  !Channels are inputs
DIG:DATA:WORD? (@5001,5003)
```

Typical Response: **61440,65280**

See Also

CONF:figure:DIGital

CONF:figure:DIGital:DIRection

CONF:figure:DIGital:WIDTh

[SENSe:]DIGital:DATA:BIT?

[SENSe:]DIGital:MEMory:ENABle

[SENSe:]DIGital:DATA:BIT?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

[SENSe:]DIGital:DATA:BIT? <bit>, (@<ch_list>)

Description

This command queries the state of individual bits on the specified digital input channels and sends the results directly to the instrument's output buffer. Note that if the specified channels are presently configured as outputs, this command will return the last value output from the channels (the channels are *not* reconfigured as inputs).

Used With:

- 34950A Digital I/O Module (digital input channels only)
- 34952A Multifunction Module (digital input channels only)
- 34959A Breadboard Module (digital input channels only)

Parameters

Name	Type	Range of Values	Default Value
<bit>	Numeric	Bit number on the specified channel. The acceptable range is based on the channel width set by the CONFigure:DIGital:WIDTh command. BYTE (8 Bits): 0 (LSB) to 7 (MSB) WORD (16 Bits): 0 (LSB) to 15 (MSB) LWORD (32 Bits): 0 (LSB) to 31 (MSB) 34959A: <i>Only valid configurations are BYTE/WORD.</i>	This is a required parameter
<ch_list>	Numeric	One or more digital input channels in the form (@sccc) . 34950A: s101 through s104, s201 through s204 34952A: s001 through s004 34959A: s001 or s002	This is a required parameter

Remarks

- If the specified channels are presently configured as outputs (see **CONFigure:DIGital:DIRection?** command), this command will return the last value output from the channels (the channels are *not* reconfigured as inputs). To reconfigure the channels as an input, use the **CONFigure:DIGital:DIRection** command.
- On the 34950A, it is not valid to read a channel while buffered (memory) I/O is enabled (see **[SENSe:]DIGital:MEMory:ENABle** command).

Return Format

This command returns "0" or "1" indicating the value of the bit on each digital input channel specified. Multiple responses are separated by commas.

Examples

The following program segment configures channel 101 on the **34950A** in slot 3 as an output and then reads the output value (the channel is *not* reconfigured as an input). Then, the channel is reconfigured as an input and the value is again read (this time, the actual input from the channel is returned).

```
CONF:DIG:WIDTH BYTE, (@3101)  !Set channel width
SOUR:DIG:DATA:BYTE 64, (@3001) !Channel is an output
DIG:DATA:BIT? 0, (@3001)    !Returns "0" for bit 0, channel remains as output
CONF:DIG:DIR INP, (@3001)    !Channel is an input
DIG:DATA:BIT? 0, (@3001)    !Returns actual input from bit 0
```

The following program segment configures channel 3 on the **34952A** in slot 5 for a width of 16 bits and then reads the value of bit 12. The value is transferred to the instrument's output buffer.

```
CONF:DIG:WIDTH WORD, (@5003)  !Set channel width
DIG:DATA:BIT? 12, (@5003)    !Returns value of bit 12
```

Typical Response: 0

See Also

CONFigure:DIGital

CONFigure:DIGital:DIRection

CONFigure:DIGital:WIDTH

[SENSe:]DIGital:DATA[:<width>]?

[SENSe:]DIGital:MEMory:ENABle

[SENSe:]DIGital:HANDshake:THReshold

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

[SENSe:]DIGital:HANDshake:THReshold {<voltage>|MIN|MAX|DEF}, (@<ch_list>)

[SENSe:]DIGital:HANDshake:THReshold? [{MIN|MAX},] (@<ch_list>)

Description

This command sets the input threshold voltage for the H2 handshake line on the specified bank on the 34950A Digital I/O Module. Since handshaking is used for transfers involving the first channel on a bank only, this command must be directed to the first channel (i.e., channel 101 or 201 only), and extends to all channels involved in the channel width (see [CONFigure:DIGital:WIDTh](#) command).

This command also sets the input threshold voltage for the INTR (interrupt) line on the specified bank. The INTR line is an *input* when the specified channels are configured for buffered memory *output* operations (see [SOURce:DIGital:MEMory:ENABle](#) command).

Used With:

- 34950A Digital I/O Module

Parameters

Name	Type	Range of Values	Default Value
<voltage>	Numeric	Desired threshold voltage between 0V and 5V, with 20 mV resolution. MIN = 0V, MAX = 5V	0.8V (TTL)
<ch_list>	Numeric	The first channel on a bank in the form (@sccc). Select from s101 or s201.	This is a required parameter

Remarks

- The behavior of the three handshake lines depends on whether buffered memory output operations are enabled (see **SOURce:DIGital:MEMory:ENABle** command).

	H0 Line	H1 Line	H2 Line
Unbuffered Transfers	I/O Direction (output)	Strobe (output)	Not Used (Hi-Z)
Buffered Transfers	Start/Stop (output)	Strobe (output)	Input Strobe (input)

- If desired, you can use the **CONFigure:DIGital:HANDshake** command to select all of the handshake line parameters with one command. Use this command to select the input threshold voltage, output logic "1" voltage level, and logic polarity.
- The selected threshold voltage is stored in **volatile** memory and will be set to 0.8V when power is turned off or after a Factory Reset (***RST** command).

Return Format

The query command returns the threshold voltage in the form **"+1.00000000E+00"** for each channel specified. Multiple responses are separated by commas.

Examples

The following program segment downloads and outputs a "walking ones" pattern from channel 101 on the module in slot 3. The length of the trace is set to 32 samples. In addition, the cycle count is set to output the complete trace three times. Once memory is enabled, a software trigger is used to trigger the memory output. Once the trace pattern is configured and assigned to the channel, the handshake threshold voltage is set to 1.8V.

```
SOUR:DIG:DATA:WORD #HFFFF, (@3101) !Set initial output pattern
SOUR:DIG:MEM:NCYC 3, (@3101) !Output complete trace 3 times
TRAC:DIG:FUNC (@3101), WONES, PATTERN_1, 32 !Download "walking ones" pattern
SOUR:DIG:MEM:TRAC PATTERN_1, (@3101) !Assign trace to channel 101
SOUR:DIG:MEM:ENAB ON, (@3101) !Enable memory on channel 101
DIG:HAND:THR 1.8, (@3101) !Set handshake threshold voltage to 1.8V
SOUR:DIG:MEM:START (@3101) !Trigger memory output
```

The following query returns the threshold voltage settings on channel 101 on the module in slot 3.

```
DIG:HAND:THR? (@3101)
```

Typical Response: **+1.80000000E+00**

See Also

[CONFigure:DIGital:HANDshake](#)

[CONFigure:DIGital:HANDshake:POLarity](#)

[CONFigure:DIGital:WIDTH](#)

[SOURce:DIGital:MEMory:ENABLe](#)

[SENSe:]DIGital:INTerrupt[:ENABLE]

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

[SENSe:]DIGital:INTerrupt[:ENABLE] <mode>, (@<ch_list>)

[SENSe:]DIGital:INTerrupt[:ENABLE]? (@<ch_list>)

Description

This command disables or enables the hardware INTR (interrupt) lines as an output on the 34950A Digital I/O Module. The INTR line is an *output* when the specified channels are configured for buffered memory *input* operations (see [\[SENSe:\]DIGital:MEMory:ENABLE](#) command). Since interrupts are used for transfers involving the first channel on a bank only, this command must be directed to the first channel (i.e., channel 101 or 201 only), and extends to all channels involved in the channel width (see [CONFigure:DIGital:WIDTh](#) command). You can send this command at any time, but the setting applies only if buffered memory input operations are enabled.

Used With:

- 34950A Digital I/O Module

Parameters

Name	Type	Range of Values	Default Value
<mode>	Boolean	{OFF ON 1}	OFF (disabled)
<ch_list>	Numeric	The first channel on a bank in the form (@sccc). Select from s101 or s201.	This is a required parameter

Remarks

- During buffered memory *input* operations, the INTR line is an *output* and will be asserted when a pattern match is found or when memory is full (see [\[SENSe:\]DIGital:INTerrupt:MODE](#) command).
- The INTR lines and handshake lines (H0, H1, and H2) on each bank share their input threshold and output level setting. See the [\[SENSe:\]DIGital:HANDshake:THReshold](#) command to set the input threshold voltage (the INTR line is an *input* when the specified channels are configured for buffered memory *output* operations). See the [SOURce:DIGital:HANDshake:LEVel](#) command to set the output voltage level (the INTR line is an *output* when the specified channels are configured for buffered memory *input* operations).
- The instrument disables interrupts after a Factory Reset ([*RST](#) command) and sets the INTR line to a high-impedance state. An Instrument Preset ([SYSTem:PRESet](#) command) or Card Reset ([SYSTem:CPON](#) command) does not change the status of the interrupt lines.

Return Format

The query command returns "0" (OFF) or "1" (ON) for each channel specified. Multiple responses are separated by commas.

Examples

The following program segment enables outputs from the INTR line on channels 101 and 201 in slot 3.

```
CONF:DIG:WIDTH WORD, (@3101,3201) !Width = 16 bits
DIG:MEM:ENAB ON, (@3101,3201) !Enable buffered read
DIG:INT:ENAB ON, (@3101,3201) !Enable interrupt output
```

The following query returns the interrupt settings on channels 101 and 201 in slot 3.

```
DIG:INT:ENAB? (@3101,3201)
```

Typical Response: **1,1**

See Also

[CONFigure:DIGital:INTerrupt:POLarity](#)

[CONFigure:DIGital:WIDTh](#)

[\[SENSe:\]DIGital:HANDshake:THReshold](#)

[\[SENSe:\]DIGital:INTerrupt:MODE](#)

[\[SENSe:\]DIGital:INTerrupt:STATus?](#)

[\[SENSe:\]DIGital:MEMory:ENABle](#)

[SOURce:DIGital:HANDshake:LEVel](#)

[SENSe:]DIGital:INTerrupt:MODE

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

[SENSe:]DIGital:INTerrupt:MODE <mode>, (@<ch_list>)

[SENSe:]DIGital:INTerrupt:MODE? (@<ch_list>)

Description

This command selects the condition to be reported by the hardware INTR (interrupt) line on the 34950A Digital I/O Module (one INTR line per bank). When buffered memory *input* operations are enabled on the specified bank (see [\[SENSe:\]DIGital:MEMory:ENABle](#) command), you can use the INTR line to provide a hardware indication that either memory is full (default) or a valid pattern match has been detected. The INTR line will be asserted when the selected condition is true, and will be de-asserted as soon as the condition goes false.

Since interrupts are used for transfers involving the first channel on a bank only, this command must be directed to the first channel (i.e., channel 101 or 201 only), and extends to all channels involved in the channel width (see [CONFigure:DIGital:WIDTh](#) command). You can send this command at any time, but the setting applies only if buffered memory input operations are enabled and interrupts are enabled (see [\[SENSe:\]DIGital:INTerrupt\[:ENABle\]](#) command).

Used With:

- 34950A Digital I/O Module

Parameters

Name	Type	Range of Values	Default Value
<mode>	Discrete	{MFUL COMPare}	MFUL (memory full)
<ch_list>	Numeric	The first channel on a bank in the form (@sccc). Select from s101 or s201.	This is a required parameter

Remarks

- If the INTR line is enabled and the mode is set to COMPare (pattern match), an interrupt will be generated when a pattern match is detected on the specified channels (see [CALCulate:COMPare:DATA\[:<width>\]](#) command). Note that the pattern comparison mode will generate hardware interrupts even if the pattern compare mode is disabled (see [CALCulate:COMPare:STATe](#) command).
- The instrument disables interrupts after a Factory Reset ([*RST](#) command) and sets the INTR line to a high-impedance state. An Instrument Preset ([SYSTem:PRESet](#) command) or Card Reset ([SYSTem:CPON](#) command) does not change the setting.

Return Format

The query command returns "MFUL" or "COMP" for each channel specified. Multiple responses are separated by commas.

Examples

The following program segment configures the module in slot 3 for one 16-bit word and enables the buffered memory input mode with a sample count of 250 read operations. When memory becomes full, a hardware interrupt will be generated on the INTR line (Bank 1).

```
CONF:DIG:WIDTH WORD, (@3101)  !Width = 16 bits
DIG:MEM:SAMP:COUNT 250, (@3101)  !Sample count is 250 read operations
DIG:MEM:ENAB ON, (@3101)  !Enable buffered memory mode
DIG:MEM:START (@3101)  !Start buffered read operation
DIG:INT:MODE MFUL, (@3101)  !Select "memory full" interrupt
DIG:INT:ENAB ON, (@3101)  !Enable interrupts (Bank 1)
```

The following program segment sets the digital pattern for the module in slot 3 and then enables the pattern comparison mode. When the data read from the bank is equal to the comparison pattern, a hardware interrupt will be generated on the INTR line (Bank 2).

```
CONF:DIG:WIDTH WORD, (@3201)  !Width = 16 bits
DIG:MEM:ENAB ON, (@3201)  !Enable buffered memory mode
CALC:COMP:DATA:BYTE 140, (@3201)  !Set comparison pattern (1000 1100)
DIG:INT:MODE COMP, (@3201)  !Interrupt on pattern match
DIG:INT:ENAB ON, (@3201)  !Enables interrupts on channel 101
DIG:INT:MODE COMP, (@3201)  !Select "compare" interrupt
DIG:INT:ENAB ON, (@3201)  !Enable interrupts (Bank 2)
```

The following query returns the interrupt mode settings on channels 101 and 201 in slot 3.

```
DIG:INT:MODE? (@3101, 3201)
```

Typical Response: **MFUL,COMP**

See Also

CALCulate:COMPare:DATA[:<width>]

CALCulate:COMPare:TYPE

CONFigure:DIGital:WIDTH

[SENSe:]DIGital:INTerrupt[:ENABLE]

[SENSe:]DIGital:INTerrupt:STATus?

[SENSe:]DIGital:MEMory:ENABLE

[SENSe:]DIGital:INTerrupt:STATus?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

[SENSe:]DIGital:INTerrupt:STATus? (@<ch_list>)

Description

This command queries the hardware INTR (interrupt) line on the 34950A Digital I/O Module and returns the current status. Since interrupts are used for transfers involving the first channel on a bank only, this command must be directed to the first channel (i.e., channel 101 or 201 only), and extends to all channels involved in the channel width (see [CONFigure:DIGital:WIDTh](#) command).

Used With:

- 34950A Digital I/O Module

Parameters

Name	Type	Range of Values	Default Value
<ch_list>	Numeric	The first channel on a bank in the form (@sccc). Select from s101 or s201.	This is a required parameter

Remarks

- The instrument disables interrupts after a Factory Reset (*RST command) and sets the INTR line to a high-impedance state. An Instrument Preset (SYSTem:PRESet command) or Card Reset (SYSTem:CPON command) does not change the status of the interrupt lines.

Return Format

The command returns "1" if the INTR line is enabled and asserted. Returns "0" if the INTR line disabled or de-asserted. Multiple responses are separated by commas.

Example

The following query returns the status of the INTR lines on channel 101 (Bank 1) and channel 201 (Bank 2) in slot 3.

```
DIG:INT:STAT? (@3101,3201)
```

Typical Response: 1,1

See Also

[SENSe:]DIGital:INTerrupt[:ENABle]

[SENSe:]DIGital:MEMory:CLEar

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

[SENSe:]DIGital:MEMory:CLEar (@<ch_list>)

Description

This command clears the memory for buffered input operations on the 34950A Digital I/O Module. You can execute this command while a buffered input operation is in progress. The width of the first channel in each bank (i.e., channels 101 and 201) controls the width of the memory operations (64K x 8 Bits, 64K x 16 Bits, or 32K x 32 Bits). The first channel on the specified bank must be configured as an input prior to starting a buffered read (see [CONFigure:DIGital](#) command).

Used With:

- 34950A Digital I/O Module

Parameters

Name	Type	Range of Values	Default Value
<ch_list>	Numeric	The first channel on a bank in the form (@sccc). Select from s101 or s201.	This is a required parameter

Remarks

- Depending on the width specified (see [CONFigure:DIGital:WIDTh](#) command), the channel numbering is modified as shown below. For example, if you specify the width as a 16-bit WORD, channels 101 and 102 are combined and addressed collectively as channel 101.

	Bank 2				Bank 1			
BYTE (8 Bits):	Ch 204	Ch 203	Ch 202	Ch 201	Ch 104	Ch 103	Ch 102	Ch 101
WORD (16 Bits):	Ch 203		Ch 201		Ch 103		Ch 101	
LWORD (32 Bits):	Ch 201				Ch 101			

- To perform a non-destructive read of data in memory, use the [\[SENSe:\]DIGital:MEMory\[:DATA\]?](#) command.

Example

The following command clears memory on channels 101 and 201 on the module in slot 3.

```
DIG:MEM:CLE (@3101,3201)
```

See Also

[CONFigure:DIGital](#)

[CONFigure:DIGital:WIDTh](#)

[\[SENSe:\]DIGital:MEMory\[:DATA\]?](#)

[SENSe:]DIGital:MEMory:COMPare:ACTion

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

[SENSe:]DIGital:MEMory:COMPare:ACTion <mode>, (@<ch_list>)

[SENSe:]DIGital:MEMory:COMPare:ACTion? (@<ch_list>)

Description

This command starts or stops a buffered (memory) input operation when a pattern comparison is found on the 34950A Digital I/O Module. This command is used in conjunction with the CALCulate:COMPare commands to configure the pattern comparison parameters. The width of the first channel in each bank (i.e., channels 101 and 201) controls the width of the memory operations (64K x 8 Bits, 64K x 16 Bits, or 32K x 32 Bits). The first channel on the specified bank must be configured as an input prior to starting a buffered read (see **CONFigure:DIGital** command).

Used With:

- 34950A Digital I/O Module

Parameters

Name	Type	Range of Values	Default Value
<mode>	Discrete	{CONTinue START STOP}	CONTinue (state of buffered read is not affected upon pattern match)
<ch_list>	Numeric	The first channel on a bank in the form (@sccc). Select from s101 or s201.	This is a required parameter

Remarks

- Depending on the width specified (see **CONFigure:DIGital:WIDTh** command), the channel numbering is modified as shown below. For example, if you specify the width as a 16-bit WORD, channels 101 and 102 are combined and addressed collectively as channel 101.

	Bank 2				Bank 1			
BYTE (8 Bits):	Ch 204	Ch 203	Ch 202	Ch 201	Ch 104	Ch 103	Ch 102	Ch 101
WORD (16 Bits):	Ch 203		Ch 201		Ch 103		Ch 101	

LWORD (32 Bits):	Ch 201	Ch 101

- Pattern comparisons are performed on a per-bank basis (i.e., the entire bank is reserved for the pattern comparison). For example, if you are using channels 101 and 102 for pattern comparison and then perform a static read of channel 103, the module will perform a pattern comparison on channels 101 and 102.
- If a buffered input operation is already running, any extraneous "start" requests upon pattern match will be ignored. If a buffered input operation is already stopped, any extraneous "stop" requests upon pattern match will be ignored.
- Pattern comparisons can be performed with or without handshaking (see **CONFigure:DIGital:HANDshake** command). If you are using handshaking, the specified digital pattern is evaluated with each handshaking operation. If you are not using handshaking, the specified digital pattern is evaluated continuously as soon as you enable the pattern comparison mode.
- The selected setting is stored in **volatile** memory and will be set to CONTinue when power is turned off or after a Factory Reset (***RST** command).

Return Format

The query command returns "CONT", "STAR", or "STOP" for each channel specified. Multiple responses are separated by commas.

Examples

The following program segment sets the digital pattern for the module in slot 3 and then enables the pattern comparison mode. When the data read from the bank is equal to the comparison pattern, a buffered read is initiated. In this example, handshaking is not used.

```
CONF:DIG:WIDTH BYTE, (@3101,3201) !Width = 8 bits
CALC:COMP:DATA:BYTE 140, (@3101,3201) !Set comparison pattern (1000 1100)
CALC:COMP:STAT ON, (@3101,3201) !Enable pattern comparison mode
DIG:MEM:SAMP:COUN 200, (@3101,3201) !Sample count = 200
DIG:MEM:ENAB ON, (@3101,3201) !Enable buffered reads
DIG:MEM:COMP:ACT STAR, (@3101,3201) !Start buffered read upon match
```

The following query returns the pattern comparison setting on channels 101 and 201 on the module in slot 3.

```
DIG:MEM:COMP:ACT? (@3101,3201)
```

Typical Response: **STAR,STAR**

See Also

CALCulate:COMPare:DATA

CALCulate:COMPare:MASK

CALCulate:COMPare:STATe

CALCulate:COMPare:TYPE
CONFigure:DIGital
CONFigure:DIGital:HANDshake
CONFigure:DIGital:WIDTh
[SENSe:]DIGital:MEMory[:DATA]?
[SENSe:]DIGital:MEMory[:DATA]:ALL?
[SENSe:]DIGital:MEMory:ENABle
[SENSe:]DIGital:MEMory:MATCH[:DATA]?
[SENSe:]DIGital:MEMory:START
[SENSe:]DIGital:MEMory:STOP

[SENSe:]DIGital:MEMory[:DATA]?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

[SENSe:]DIGital:MEMory[:DATA]? <index>, <count>, (@<channel>)

Description

This command performs a *non-destructive* read of data stored in memory from a buffered input operation on the 34950A Digital I/O Module. The specified number of samples are read, starting at the specified index (the oldest data is stored at index "0"). This command is *not* valid while buffered operations are enabled (see [\[SENSe:\]DIGital:MEMory:ENABLE](#) command).

The width of the first channel in each bank (i.e., channels 101 and 201) controls the width of the memory operations (64K x 8 Bits, 64K x 16 Bits, or 32K x 32 Bits). The first channel on the specified bank must be configured as an input prior to starting a buffered read (see [CONFigure:DIGital](#) command).

Used With:

- 34950A Digital I/O Module

Parameters

Name	Type	Range of Values	Default Value
<index>	Numeric	Desired starting index. Specify any value between 0 (oldest data) and the most-recently acquired data in memory. Note that since memory is zero-based, the valid range for <index> is as follows: BYTE: 0 through 65534 WORD: 0 through 65534 LWORD: 0 through 32766	This is a required parameter
<count>	Numeric	Desired number of samples to be read.	This is a required parameter
<channel>	Numeric	One channel in the form (@sccc). Select from s101 or s201.	This is a required parameter

Remarks

- Depending on the width specified (see **CONFigure:DIGital:WIDTh** command), the channel numbering is modified as shown below. For example, if you specify the width as a 16-bit WORD, channels 101 and 102 are combined and addressed collectively as channel 101.

	Bank 2				Bank 1			
BYTE (8 Bits):	Ch 204	Ch 203	Ch 202	Ch 201	Ch 104	Ch 103	Ch 102	Ch 101
WORD (16 Bits):	Ch 203		Ch 201		Ch 103		Ch 101	
LWORD (32 Bits):	Ch 201				Ch 101			

- The sum of the count and the index must be less than the number of captured sample points (see **[SENSe:]DIGital:MEMory[:DATA]:POINts?** command).
- To read all data stored in memory from a buffered input operation, use the **[SENSe:]DIGital:MEMory[:DATA]:ALL?** command.
- To clear the memory, use the **[SENSe:]DIGital:MEMory:CLEar** command.
- When reading data from memory, you can specify the byte order (NORMal or SWAPped) using the **FORMat:BORDer** command.

Return Format

This command returns the specified number of samples. Use the **[SENSe:]DIGital:MEMory[:DATA]:FORMat** command to select a comma-separated ASCII ("LIST") format or a floating-point **IEEE-488.2 Binary Block** ("BLOCK") format.

Example

The following program segment enables a buffered read on channel 101 on the module in slot 3 and then reads the data from memory.

```
CONF:DIG:WIDTH WORD, (@3101) !Width = 16 bits
DIG:MEM:SAMP:COUN 20, (@3101) !Sample count = 20
DIG:MEM:FORM LIST !Format = ASCII list
DIG:MEM:ENAB ON, (@3101) !Enable buffered read
DIG:MEM:STAR (@3101) !Start buffered read
<Wait for sample count to be satisfied>
DIG:MEM:ENAB OFF, (@3101) !Disable buffered read
DIG:MEM? 0,2, (@3101) !Read 2 samples from memory
```

Typical Response: **61440,65280**

See Also

CONFigure:DIGital

CONFigure:DIGital:WIDTh

FORMat:BORDER

[SENSe:]DIGital:MEMory:CLEar

[SENSe:]DIGital:MEMory[:DATA]:ALL?

[SENSe:]DIGital:MEMory[:DATA]:FORMat

[SENSe:]DIGital:MEMory[:DATA]:POINTs?

[SENSe:]DIGital:MEMory:ENABle

[SENSe:]DIGital:MEMory:MATCH[:DATA]?

[SENSe:]DIGital:MEMory:SAMPle:COUNT

[SENSe:]DIGital:MEMory[:DATA]:ALL?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

[SENSe:]DIGital:MEMory[:DATA]:ALL? (@<channel>)

Description

This command performs a *non-destructive* read of all data stored in memory from a buffered input operation on the 34950A Digital I/O Module. The width of the first channel in each bank (i.e., channels 101 and 201) controls the width of the memory operations (64K x 8 Bits, 64K x 16 Bits, or 32K x 32 Bits). The first channel on the specified bank must be configured as an input prior to starting a buffered read (see [CONFigure:DIGital](#) command).

This command is *not* valid while buffered operations are enabled (see [\[SENSe:\]DIGital:MEMory:ENABLE](#) command).

Used With:

- 34950A Digital I/O Module

Parameters

Name	Type	Range of Values	Default Value
<channel>	Numeric	One channel in the form (@sccc). Select from s101 or s201.	This is a required parameter

Remarks

- Depending on the width specified (see [CONFigure:DIGital:WIDTH](#) command), the channel numbering is modified as shown below. For example, if you specify the width as a 16-bit WORD, channels 101 and 102 are combined and addressed collectively as channel 101.

	Bank 2				Bank 1			
BYTE (8 Bits):	Ch 204	Ch 203	Ch 202	Ch 201	Ch 104	Ch 103	Ch 102	Ch 101
WORD (16 Bits):	Ch 203		Ch 201		Ch 103		Ch 101	
LWORD (32 Bits):	Ch 201				Ch 101			

- To read a specific number of samples from memory, use the [\[SENSe:\]DIGital:MEMory\[:DATA\]?](#) command.
- To clear the memory, use the [\[SENSe:\]DIGital:MEMory:CLEar](#) command.

- When reading data from memory, you can specify the byte order (NORMAL or SWAPPed) using the **FORMat:BORDer** command.

Return Format

This command returns all data stored in memory on the specified channel. Use **[SENSe:]DIGital:MEMory[:DATA]:FORMat** command to select a comma-separated ASCII ("LIST") format or a floating-point **IEEE-488.2 Binary Block** ("BLOCK") format.

Example

The following program segment enables a buffered read on channel 101 on the module in slot 3 and then reads the data from memory.

```
CONF:DIG:WIDTH WORD, (@3101)  !Width = 16 bits
DIG:MEM:SAMP:COUN 20, (@3101)  !Sample count = 20
DIG:MEM:FORM LIST  !Format = ASCII list
DIG:MEM:ENAB ON, (@3101)  !Enable buffered read
DIG:MEM:STAR (@3101)  !Start buffered read
  <Wait for sample count to be satisfied>
DIG:MEM:ENAB OFF, (@3101)  !Disable buffered read
DIG:MEM:ALL? (@3101)  !Read all samples from memory
```

Typical Response: **61440,65280, ...**

See Also

CONFigure:DIGital

CONFigure:DIGital:WIDTH

FORMat:BORDer

[SENSe:]DIGital:MEMory:CLEar

[SENSe:]DIGital:MEMory[:DATA]?

[SENSe:]DIGital:MEMory[:DATA]:FORMat

[SENSe:]DIGital:MEMory[:DATA]:POINTs?

[SENSe:]DIGital:MEMory:ENABLE

[SENSe:]DIGital:MEMory:MATCH[:DATA]?

[SENSe:]DIGital:MEMory:SAMPLE:COUNT

[SENSe:]DIGital:MEMory[:DATA]:FORMat

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

[SENSe:]DIGital:MEMory[:DATA]:FORMat <mode>

[SENSe:]DIGital:MEMory[:DATA]:FORMat?

Description

This command selects the format for data returned by buffered input operations on the 34950A Digital I/O Module. This command applies to the data returned by the [SENSe:]DIGital:MEMory[:DATA]? and [SENSe:]DIGital:MEMory[:DATA]:ALL? commands. Select the "LIST" parameter (default) to return data in comma-separated ASCII format. Select the "BLOCK" format to return data in floating-point IEEE-488.2 Binary Block ("BLOCK") format.

NOTE

This command applies to the entire mainframe and cannot be selectively used on individual channels or modules.

Used With:

- 34950A Digital I/O Module

Parameters

Name	Type	Range of Values	Default Value
<mode>	Discrete	{LIST BLOCK}	LIST

Remarks

- The format setting is stored in non-volatile memory, and does not change when power has been off, after a Factory Reset (*RST command), or after an Instrument Preset (SYSTem:PRESet command).

Return Format

The query command returns "LIST" or "BLOC".

Examples

The following program segment enables a buffered read on channel 101 on the module in slot 3 and selects the IEEE-488.2 binary block format.

```
CONF:DIG:WIDTH WORD, (@3101)  !Width = 16 bits
DIG:MEM:SAMP:COUN 20, (@3101)  !Sample count = 20
DIG:MEM:FORM BLOC  !Format = Binary block
DIG:MEM:ENAB ON, (@3101)  !Enable buffered read
DIG:MEM:STAR (@3101)  !Start buffered read
<Wait for entire buffered read to complete>
DIG:MEM? 0,2, (@3101)  !Read the first two samples in memory
```

The following query returns the format currently selected.

```
DIG:MEM:FORM?
```

Typical Response: **BLOC**

See Also

[\[SENSe:\]DIGital:MEMory\[:DATA\]?](#)

[\[SENSe:\]DIGital:MEMory\[:DATA\]:ALL?](#)

[\[SENSe:\]DIGital:MEMory:MATCH\[:DATA\]?](#)

[SENSe:]DIGital:MEMory[:DATA]:POINts?

Syntax | Description | Parameters | Remarks | Return Format | Example

Syntax

[SENSe:]DIGital:MEMory[:DATA]:POINts? [MAX,] (@<ch_list>)

Description

This command returns the number of samples currently stored in memory from a buffered input operation on the specified channels on the 34950A Digital I/O Module. You can use the optional MAX parameter to query the maximum number of samples that can be stored in memory for the configured width. You can execute this query at any time.

The width of the first channel in each bank (i.e., channels 101 and 201) controls the width of the memory operations (64K x 8 Bits, 64K x 16 Bits, or 32K x 32 Bits). The first channel on the specified bank must be configured as an input prior to starting a buffered read (see **CONFigure:DIGital** command).

Used With:

- 34950A Digital I/O Module

Parameters

Name	Type	Range of Values	Default Value
<ch_list>	Numeric	The first channel on a bank in the form (@sccc). Select from s101 or s201.	This is a required parameter

Remarks

- Depending on the width specified (see **CONFigure:DIGital:WIDTH** command), the channel numbering is modified as shown below. For example, if you specify the width as a 16-bit WORD, channels 101 and 102 are combined and addressed collectively as channel 101.

	Bank 2				Bank 1			
BYTE (8 Bits):	Ch 204	Ch 203	Ch 202	Ch 201	Ch 104	Ch 103	Ch 102	Ch 101
WORD (16 Bits):	Ch 203		Ch 201		Ch 103		Ch 101	
LWORD (32 Bits):	Ch 201				Ch 101			

- For 8- and 16-bit widths, the maximum sample count allowed is 65535. For 32-bit widths, the maximum is 32767 samples.

Return Format

The query command returns the number of samples in the form "+1.00000000E+00" for each channel specified. Multiple responses are separated by commas.

Example

The following command returns the number of samples currently stored in memory on channels 101 and 201 on the module in slot 3.

```
DIG:MEM:POIN? (@3101,3201)
```

Typical Response: +2.00000000E+02,+2.00000000E+02

See Also

CONFigure:DIGital

CONFigure:DIGital:WIDTh

[SENSe:]DIGital:MEMory:CLEar

[SENSe:]DIGital:MEMory:SAMPle:COUNT

[SENSe:]DIGital:MEMory:ENABle

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

[SENSe:]DIGital:MEMory:ENABle <mode>, (@<ch_list>)

[SENSe:]DIGital:MEMory:ENABle? (@<ch_list>)

Description

This command enables buffered (memory) input operations on the 34950A Digital I/O Module. This command clears memory, applies the specified sample count (see [SENSe:]DIGital:MEMory:SAMPle:COUNT command), and places the specified channels in the wait-for-trigger state. The first channel on the specified bank must be configured as an input prior to starting a buffered read (see CONFigure:DIGital command).

Used With:

- 34950A Digital I/O Module

Parameters

Name	Type	Range of Values	Default Value
<mode>	Boolean	{OFF 0 ON 1}	OFF (disabled)
<ch_list>	Numeric	The first channel on a bank in the form (@sccc). Select from s101 or s201.	This is a required parameter

Remarks

- Depending on the width specified (see CONFigure:DIGital:WIDTh command), the channel numbering is modified as shown below. For example, if you specify the width as a 16-bit WORD, channels 101 and 102 are combined and addressed collectively as channel 101.

	Bank 2				Bank 1			
BYTE (8 Bits):	Ch 204	Ch 203	Ch 202	Ch 201	Ch 104	Ch 103	Ch 102	Ch 101
WORD (16 Bits):	Ch 203		Ch 201		Ch 103		Ch 101	
LWORD (32 Bits):	Ch 201				Ch 101			

- Once memory is enabled, send the **[SENSe:]DIGital:MEMory:START** or **[SENSe:]DIGital:MEMory:STEP** command to start the buffered read.
- If memory is currently disabled, sending the **[SENSe:]DIGital:MEMory:START** command will enable memory and start the buffered read.
- Changing the direction will disable buffered operations on the specified digital channels. In addition, changing the channel width will disable buffered operations and clear memory on the specified digital channels.
- The instrument disables buffered memory after a Factory Reset (***RST** command). An Instrument Preset (**SYSTem:PRESet** command) or Card Reset (**SYSTem:CPON** command) does *not* change the setting.

Return Format

The query command returns "0" (OFF) or "1" (ON) for each channel specified. Multiple responses are separated by commas.

Examples

The following program segment enables buffered reads on channels 101 and 201 on the module in slot 3.

```
CONF:DIG:WIDTH WORD, (@3101,3201)  !Width = 16 bits
DIG:MEM:SAMP:COUN 200, (@3101,3201)  !Sample count = 200
DIG:MEM:ENAB ON, (@3101,3201)  !Enable buffered reads
DIG:MEM:STAR (@3101,3201)  !Start buffered reads
```

The following query returns the memory setting.

```
DIG:MEM:ENAB? (@3101,3201)
```

Typical Response: **1,1**

See Also

CONFigure:DIGital

CONFigure:DIGital:WIDTh

[SENSe:]DIGital:MEMory:START

[SENSe:]DIGital:MEMory:STEP

[SENSe:]DIGital:MEMory:MATCh[:DATA]?

Syntax | Description | Parameters | Remarks | Return Format | Example

Syntax

[SENSe:]DIGital:MEMory:MATCh[:DATA]? (@<ch_list>)

Description

This command performs a *non-destructive* read of the triggering pattern that started a buffered input operation on the 34950A Digital I/O Module. The response from this command is valid only if a start-on-pattern-match trigger has occurred (see [SENSe:]DIGital:MEMory:COMParE:ACTion command).

Used With:

- 34950A Digital I/O Module

Parameters

Name	Type	Range of Values	Default Value
<ch_list>	Numeric	The first channel on a bank in the form (@sccc). Select from s101 or s201.	This is a required parameter

Remarks

- Depending on the width specified (see CONFigure:DIGital:WIDTh command), the channel numbering is modified as shown below. For example, if you specify the width as a 16-bit WORD, channels 101 and 102 are combined and addressed collectively as channel 101.

	Bank 2				Bank 1			
BYTE (8 Bits):	Ch 204	Ch 203	Ch 202	Ch 201	Ch 104	Ch 103	Ch 102	Ch 101
WORD (16 Bits):	Ch 203		Ch 201		Ch 103		Ch 101	
LWORD (32 Bits):	Ch 201				Ch 101			

- To read a specific number of samples in memory from a buffered input operation, use the [SENSe:]DIGital:MEMory[:DATA]? command. Note that the response from this command does *not* return the triggering pattern.
- To read *all* data stored in memory from a buffered input operation, use the [SENSe:]DIGital:MEMory

[[:DATA]:ALL? command. Note that the response from this command does *not* return the triggering pattern.

- To clear the memory, use the **[SENSe:]DIGital:MEMory:CLEar** command.

Return Format

This command returns the triggering pattern that started a buffered input operation.

Example

The following program segment sets the digital pattern for the module in slot 3 and then enables the pattern comparison mode. When the data read from the bank is equal to the comparison pattern, a buffered read is initiated. In this example, handshaking is not used.

```
CONF:DIG:WIDTH BYTE, (@3101,3201)  !Width = 8 bits
CALC:COMP:DATA:BYTE 140, (@3101,3201)  !Set comparison pattern (1000 1100)
CALC:COMP:STAT ON, (@3101,3201)  !Enable pattern comparison mode
DIG:MEM:SAMP:COUN 200, (@3101,3201)  !Sample count = 200
DIG:MEM:ENAB ON, (@3101,3201)  !Enable buffered reads
DIG:MEM:COMP:ACT STAR, (@3101,3201)  !Start buffered read upon match
<Wait for pattern match>
DIG:MEM:MATC? (@3101,3201)  !Read triggering pattern
```

Typical Response: **140,140**

See Also

CONFigure:DIGital:WIDTh

[SENSe:]DIGital:MEMory:COMPare:ACTion

[SENSe:]DIGital:MEMory[:DATA]?

[SENSe:]DIGital:MEMory[:DATA]:ALL?

[SENSe:]DIGital:MEMory:SAMPlE:COUNT

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

[SENSe:]DIGital:MEMory:SAMPlE:COUNT {<count>|MIN|MAX|DEF|INFinity}, (@<ch_list>)

[SENSe:]DIGital:MEMory:SAMPlE:COUNT? [{MIN|MAX},] (@<ch_list>)

Description

This command sets the number of samples to capture for buffered (memory) input operations on the 34950A Digital I/O Module. The specified sample count can be set at any time, but it will not take effect until the *next* time you enable memory (see [SENSe:]DIGital:MEMory:ENABle command). The width of the first channel in each bank (i.e., channels 101 and 201) controls the width of the memory operations (64K x 8 Bits, 64K x 16 Bits, or 32K x 32 Bits). The first channel on the specified bank must be configured as an input prior to starting a buffered read (see CONFigure:DIGital command).

Used With:

- 34950A Digital I/O Module

Parameters

Name	Type	Range of Values	Default Value
<count>	Numeric	Desired sample count between 1 and 65535 (for 8- and 16-bit widths) or 32767 (for 32-bit widths). MIN = 1, MAX = 65535 (32767 for 32-bit widths), INF = continuous	0 (continuous)
<ch_list>	Numeric	The first channel on a bank in the form (@sccc). Select from s101 or s201.	This is a required parameter

Remarks

- Depending on the width specified (see CONFigure:DIGital:WIDTh command), the channel numbering is modified as shown below. For example, if you specify the width as a 16-bit WORD, channels 101 and 102 are combined and addressed collectively as channel 101.

	Bank 2				Bank 1			
BYTE (8 Bits):	Ch 204	Ch 203	Ch 202	Ch 201	Ch 104	Ch 103	Ch 102	Ch 101

WORD (16 Bits):	Ch 203	Ch 201	Ch 103	Ch 101
LWORD (32 Bits):	Ch 201		Ch 101	

- If you specify an infinite sample count (default, INFINITY or "0"), the bank will continue to capture data until you perform a stop operation using the **[SENSe:]DIGital:MEMory:STOP** command. If memory overflows, the newest data will overwrite the first (oldest) data stored. The most recent data is always preserved.
- After specifying the desired sample count, you can use the **[SENSe:]DIGital:MEMory:STARt** command to start the buffered input operation.
- For buffered input transfers, the oldest data is stored at index zero (0). You can use the **[SENSe:]DIGital:MEMory[:DATA]?** command to perform a non-destructive read of the data stored in memory. Or, use the **[SENSe:]DIGital:MEMory:CLEar** command to clear the memory.
- You can use the **[SENSe:]DIGital:MEMory[:DATA]:POINts?** command to read the number of samples currently stored in memory.
- The selected sample count is stored in **volatile** memory and will be set to 0 (continuous) when power is turned off or after a Factory Reset (***RST** command).

Return Format

The query command returns the sample count for each channel specified. Multiple responses are separated by commas. For a continuous count ("0" or INFINITY), the query command returns "0".

Examples

The following program segment sets the sample count on channels 101 and 201 on the module in slot 3.

```
CONF:DIG:WIDTH WORD, (@3101,3201) !Width = 16 bits
DIG:MEM:SAMP:COUN 200, (@3101,3201) !Sample count = 200
DIG:MEM:ENAB ON, (@3101,3201) !Enable buffered reads
DIG:MEM:STAR (@3101,3201) !Start buffered reads
```

The following query returns the sample count on channels 101 and 201 on the module in slot 3.

```
DIG:MEM:SAMP:COUN? (@3101,3201)
```

Typical Response: **200,200**

See Also

CONFigure:DIGital

CONFigure:DIGital:WIDTH

[SENSe:]DIGital:MEMory:CLEar

[SENSe:]DIGital:MEMory[:DATA]?

[SENSe:]DIGital:MEMory[:DATA]:ALL?

[SENSe:]DIGital:MEMory[:DATA]:POINTs?

[SENSe:]DIGital:MEMory:ENABle

[SENSe:]DIGital:MEMory:MATCH[:DATA]?

[SENSe:]DIGital:MEMory:STARt

[SENSe:]DIGital:MEMory:STOP

[SENSe:]DIGital:MEMory:START

Syntax | Description | Parameters | Remarks | Return Format | Example

Syntax

[SENSe:]DIGital:MEMory:START (@<ch_list>)

Description

This command starts buffered (memory) input operations on the 34950A Digital I/O Module. If memory is currently disabled (see [SENSe:]DIGital:MEMory:ENABLE command), this command will enable memory and start the buffered read. The width of the first channel in each bank (i.e., channels 101 and 201) controls the width of the memory operations (64K x 8 Bits, 64K x 16 Bits, or 32K x 32 Bits). The first channel on the specified bank must be configured as an input prior to starting a buffered read (see CONFigure:DIGital command).

Used With:

- 34950A Digital I/O Module

Parameters

Name	Type	Range of Values	Default Value
<ch_list>	Numeric	The first channel on a bank in the form (@sccc). Select from s101 or s201.	This is a required parameter

Remarks

- Depending on the width specified (see CONFigure:DIGital:WIDTh command), the channel numbering is modified as shown below. For example, if you specify the width as a 16-bit WORD, channels 101 and 102 are combined and addressed collectively as channel 101.

	Bank 2				Bank 1			
BYTE (8 Bits):	Ch 204	Ch 203	Ch 202	Ch 201	Ch 104	Ch 103	Ch 102	Ch 101
WORD (16 Bits):	Ch 203		Ch 201		Ch 103		Ch 101	
LWORD (32 Bits):	Ch 201				Ch 101			

- You can also use this command to resume a stopped buffered read (see [SENSe:]DIGital:MEMory:STOP command).

- If you are using handshaking (see **CONFigure:DIGital:HANDshake** command), the buffered read will start when the handshake occurs following the [SENSe:]DIGital:MEMory:STARt command.
- This command overrides the pattern comparison mode (see **[SENSe:]DIGital:MEMory:COMPare:ACTion** command); therefore, you can use the [SENSe:]DIGital:MEMory:STARt command to start the buffered read even if the bank is configured to start on a pattern compare.
- You can use the **[SENSe:]DIGital:MEMory:CLEar** command prior to sending the [SENSe:]DIGital:MEMory:STARt command to clear the memory and start the buffered read from the beginning.
- If you send this command while a buffered read is already running, additional [SENSe:]DIGital:MEMory:STARt commands are ignored (no error is generated).

Example

The following program segment configures a buffered read on channels 101 and 201 on the module in slot 3 and then starts the read.

```
CONF:DIG:WIDTH WORD, (@3101,3201)  !Width = 16 bits
DIG:MEM:SAMP:COUN 200, (@3101,3201)  !Sample count = 200
DIG:MEM:ENAB ON, (@3101,3201)  !Enable buffered reads
DIG:MEM:STAR (@3101,3201)  !Start buffered reads
```

See Also

CONFigure:DIGital

CONFigure:DIGital:HANDshake

CONFigure:DIGital:WIDTH

[SENSe:]DIGital:MEMory:CLEar

[SENSe:]DIGital:MEMory:COMPare:ACTion

[SENSe:]DIGital:MEMory[:DATA]?

[SENSe:]DIGital:MEMory[:DATA]:ALL?

[SENSe:]DIGital:MEMory:ENABLE

[SENSe:]DIGital:MEMory:MATCH[:DATA]?

[SENSe:]DIGital:MEMory:STEP

[SENSe:]DIGital:MEMory:STOP

[SENSe:]DIGital:MEMory:STEP

Syntax | Description | Parameters | Remarks | Return Format | Example

Syntax

[SENSe:]DIGital:MEMory:STEP (@<ch_list>)

Description

This command reads one sample into buffered memory on the 34950A Digital I/O Module. If memory is currently disabled (see [SENSe:]DIGital:MEMory:ENABLE command), this command will enable memory and step once (one sample is stored in memory). The width of the first channel in each bank (i.e., channels 101 and 201) controls the width of the memory operations (64K x 8 Bits, 64K x 16 Bits, or 32K x 32 Bits). The first channel on the specified bank must be configured as an input prior to starting a buffered read (see CONFigure:DIGital command).

Used With:

- 34950A Digital I/O Module

Parameters

Name	Type	Range of Values	Default Value
<ch_list>	Numeric	The first channel on a bank in the form (@sccc). Select from s101 or s201.	This is a required parameter

Remarks

- Depending on the width specified (see CONFigure:DIGital:WIDTH command), the channel numbering is modified as shown below. For example, if you specify the width as a 16-bit WORD, channels 101 and 102 are combined and addressed collectively as channel 101.

	Bank 2				Bank 1			
BYTE (8 Bits):	Ch 204	Ch 203	Ch 202	Ch 201	Ch 104	Ch 103	Ch 102	Ch 101
WORD (16 Bits):	Ch 203		Ch 201		Ch 103		Ch 101	
LWORD (32 Bits):	Ch 201				Ch 101			

- If you are using handshaking (see CONFigure:DIGital:HANDshake command), the buffered read will start when the handshake occurs following the [SENSe:]DIGital:MEMory:STEP command.

- This command overrides the pattern comparison mode (see [\[SENSe:\]DIGital:MEMory:COMPare:ACTion](#) command); therefore, you can use the [\[SENSe:\]DIGital:MEMory:STEP](#) command to step once if the bank is configured to start on a pattern compare.
- If you send this command while a buffered read is already running, it will stop memory and step once. To resume a stopped buffered read, send the [\[SENSe:\]DIGital:MEMory:START](#) command.

Example

The following program segment configures a buffered read on channels 101 and 201 on the module in slot 3 and then reads one sample into memory.

```
CONF:DIG:WIDTH WORD, (@3101,3201) !Width = 16 bits
DIG:MEM:SAMP:COUN 200, (@3101,3201) !Sample count = 200
DIG:MEM:ENAB ON, (@3101,3201) !Enable buffered reads
DIG:MEM:STEP (@3101,3201) !Read one sample into memory per channel
```

See Also

[CONFigure:DIGital](#)

[CONFigure:DIGital:HANDshake](#)

[CONFigure:DIGital:WIDTH](#)

[\[SENSe:\]DIGital:MEMory:COMPare:ACTion](#)

[\[SENSe:\]DIGital:MEMory\[:DATA\]?](#)

[\[SENSe:\]DIGital:MEMory\[:DATA\]:ALL?](#)

[\[SENSe:\]DIGital:MEMory:ENABle](#)

[\[SENSe:\]DIGital:MEMory:MATCH\[:DATA\]?](#)

[\[SENSe:\]DIGital:MEMory:START](#)

[\[SENSe:\]DIGital:MEMory:STOP](#)

[SENSe:]DIGital:MEMory:STOP

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

[SENSe:]DIGital:MEMory:STOP (@<ch_list>)

Description

This command stops a buffered (memory) input operation in progress on the 34950A Digital I/O Module. To resume a stopped buffered read, send the **[SENSe:]DIGital:MEMory:START** command. The width of the first channel in each bank (i.e., channels 101 and 201) controls the width of the memory operations (64K x 8 Bits, 64K x 16 Bits, or 32K x 32 Bits). The first channel on the specified bank must be configured as an input prior to starting a buffered read (see **CONFigure:DIGital** command).

Used With:

- 34950A Digital I/O Module

Parameters

Name	Type	Range of Values	Default Value
<ch_list>	Numeric	The first channel on a bank in the form (@sccc). Select from s101 or s201.	This is a required parameter

Remarks

- Depending on the width specified (see **CONFigure:DIGital:WIDTh** command), the channel numbering is modified as shown below. For example, if you specify the width as a 16-bit WORD, channels 101 and 102 are combined and addressed collectively as channel 101.

	Bank 2				Bank 1			
BYTE (8 Bits):	Ch 204	Ch 203	Ch 202	Ch 201	Ch 104	Ch 103	Ch 102	Ch 101
WORD (16 Bits):	Ch 203		Ch 201		Ch 103		Ch 101	
LWORD (32 Bits):	Ch 201				Ch 101			

- This command overrides the pattern comparison mode (see **[SENSe:]DIGital:MEMory:COMPare:ACTion** command); therefore, you can use the [SENSe:]DIGital:MEMory:STOP command to stop the buffered read if the bank is configured to stop on a pattern compare.

Example

The following program segment starts a buffered read on channels 101 and 201 on the module in slot 3 and then stops the read.

```
CONF:DIG:WIDTH WORD, (@3101,3201)  !Width = 16 bits
DIG:MEM:SAMP:COUN 200, (@3101,3201)  !Sample count = 200
DIG:MEM:ENAB ON, (@3101,3201)  !Enable buffered reads
DIG:MEM:STAR (@3101,3201)  !Start buffered reads
DIG:MEM:STOP (@3101,3201)  !Stop buffered reads
```

See Also

[CONFigure:DIGital](#)

[CONFigure:DIGital:HANDshake](#)

[CONFigure:DIGital:WIDTh](#)

[\[SENSe:\]DIGital:MEMory:COMParE:ACTion](#)

[\[SENSe:\]DIGital:MEMory:STARt](#)

[\[SENSe:\]DIGital:MEMory:STEP](#)

[SENSe:]DIGital:THReshold

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

[SENSe:]DIGital:THReshold {<voltage>|MIN|MAX|DEF}, (@<ch_list>)

[SENSe:]DIGital:THReshold? [{MIN|MAX},] (@<ch_list>)

Description

This command sets the input threshold voltage for digital input operations on the 34950A Digital I/O Module. You can send this command at any time, but the setting applies only to input channels.

Used With:

- 34950A Digital I/O Module

Parameters

Name	Type	Range of Values	Default Value
<voltage>	Numeric	Desired threshold voltage between 0V and 5V, with 20 mV resolution. MIN = 0V, MAX = 5V	0.8V (TTL)
<ch_list>	Numeric	One or more digital input channels in the form (@sccc). Select from s101 through s104, s201 through s204.	This is a required parameter

Remarks

- The selected threshold voltage applies to the specified channel, independent of the current channel width (see [CONFigure:DIGital:WIDTh](#) command).
- The selected threshold voltage is stored in **volatile** memory and will be set to 0.8V when power is turned off or after a Factory Reset (***RST** command).

Return Format

The query command returns the threshold voltage in the form "+1.00000000E+00" for each channel specified. Multiple responses are separated by commas.

Examples

The following command sets the threshold voltage to 1.8V on channels 101 and 103 on the module in slot 3.

```
DIG:DATA:THR 1.8, (@3101, 3103)
```

The following query returns the threshold voltage settings on channels 101 and 103 on the module in slot 3.

```
DIG:DATA:THR? (@3101, 3103)
```

Typical Response: **+1.80000000E+00,+1.80000000E+00**

See Also

CONFigure:DIGital

CONFigure:DIGital:WIDTh

[SENSe:]MODUle:COUNter:GATE:THReshold[:VOLTage]

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

[SENSe:]MODUle:COUNter:GATE:THReshold[:VOLTage] {<voltage>|MIN|MAX|DEF}, <slot>

[SENSe:]MODUle:COUNter:GATE:THReshold[:VOLTage]? [{MIN|MAX},] <slot>

Description

This command sets the external gate threshold voltage for both counters on the 34950A Digital I/O Module (both banks share the same threshold).

Used With:

- 34950A Digital I/O Module

Parameters

Name	Type	Range of Values	Default Value
<voltage>	Numeric	Desired threshold voltage between 0V and 3V, with 20 mV resolution. MIN = 0V, MAX = 3V	0.8V (TTL)
<slot>	Discrete	{1 2 3 4 5 6 7 8}	This is a required parameter

Remarks

- To select the external gate source, use the [SENSe:]COUNter:GATE:SOURce command.
- To select the logic polarity for an external gate signal, use the [SENSe:]COUNter:GATE:POLarity command.
- The selected threshold voltage is stored in **volatile** memory and will be set to 0.8V when power is turned off or after a Factory Reset (*RST command).

Return Format

The query command returns the gate threshold voltage in the form "+1.00000000E+00" for the specified slot.

Examples

The following command sets the gate threshold voltage to 1.8V on the module in slot 3.

```
MOD:COUN:GATE:THR 1.8,3
```

The following query returns the gate threshold voltage setting on the module in slot 3.

```
MOD:COUN:GATE:THR? 3
```

Typical Response: **+1.80000000E+00**

See Also

[\[SENSe:\]COUNter:GATE:POLarity](#)

[\[SENSe:\]COUNter:GATE:SOURce](#)

[SENSe:]TOTalize:CLEar:IMMediate

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

[SENSe:]TOTalize:CLEar:IMMediate (@<ch_list>)

Description

This command immediately clears the count on the specified counter/totalizer channels.

Used With:

- 34950A Digital I/O Module (counter channels only)
- 34952A Multifunction Module (totalizer channels only)

Parameters

Name	Type	Range of Values	Default Value
<ch_list>	Numeric	One or more counter/totalizer channels in the form (@sccc) . 34950A: s301, s302 34952A: s005	This is a required parameter

Example

The following command clears the count on totalizer channel 5 on the 34952A in slot 5.

```
TOT:CLEAR:IMM (@5005)
```

See Also

[\[SENSe:\]TOTalize:DATA?](#)

[SENSe:]TOTalize:DATA?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

[SENSe:]TOTalize:DATA? (@<ch_list>)

Description

This command reads the count on the specified totalizer channels. If you have configured the count to be reset when it is read (see **CONFigure:TOTalize** and **[SENSe:]TOTalize:TYPE** commands), then this command will reset the count to "0" after it is read. The count is reset regardless of whether the specified channels are in a scan list or even whether a scan is in progress.

Used With:

- 34950A Digital I/O Module (counter channels only)
- 34952A Multifunction Module (totalizer channels only)

Parameters

Name	Type	Range of Values	Default Value
<ch_list>	Numeric	One or more counter/totalizer channels in the form (@sccc) . 34950A: s301, s302 34952A: s005	This is a required parameter

Remarks

- The maximum count is 4,294,967,295 ($2^{32} - 1$). The count rolls over to "0" after reaching the maximum allowed value.
- The output from this command is affected by the settings of the **FORMat:READing** commands. Depending on the formats selected, each reading may or may not be stored with measurement units, time stamp, channel number, and alarm status information.

Return Format

The command returns an unsigned decimal value representing the count on each totalizer channel specified (a full 32-bit count is returned). Multiple responses are separated by commas.

Examples

The following command reads the count on totalizer channels 301 and 302 on the 34950A in slot 3.

```
TOT:DATA? (@3301,3302)
```

Typical Response: **1.321300000E+03,3.874300000E+03**

The following command reads the count on totalizer channel 5 on the 34952A in slot 5.

```
TOT:DATA? (@5005)
```

Typical Response: **5.764300000E+03**

See Also

CONFigure:TOTalize

[SENSe:]TOTalize:TYPE

[SENSe:]TOTalize:SLOPe

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

[SENSe:]TOTalize:SLOPe <slope>, (@<ch_list>)

[SENSe:]TOTalize:SLOPe? (@<ch_list>)

Description

This command configures the specified totalizer channels to count on the rising edge (positive) or falling edge (negative) of the input signal.

Used With:

- 34950A Digital I/O Module (counter channels only)
- 34952A Multifunction Module (totalizer channels only)

Parameters

Name	Type	Range of Values	Default Value
<slope>	Discrete	{NEGative POSitive}	POSitive (rising edge)
<ch_list>	Numeric	One or more counter/totalizer channels in the form (@sccc) . 34950A: s301, s302 34952A: s005	This is a required parameter

Remarks

- The selected slope is stored in **volatile** memory and will be set to "POS" when power is turned off or after a Factory Reset (***RST** command).

Return Format

The query command returns "NEG" or "POS" for the specified channels. Multiple responses are separated by commas.

Examples

The following command configures totalizer channels 301 and 302 on the 34950A in slot 3 to count on the negative edge (falling) of the input signal.

```
TOT:SLOP NEG, (@3301, 3302)
```

The following query returns the edge setting on totalizer channels 301 and 302 on the 34950A in slot 3.

```
TOT:SLOP? (@3301, 3302)
```

Typical Response: **NEG,NEG**

See Also

[\[SENSe:\]COUNter:SLOPe](#)

[SENSe:]TOTAlize:THReshold[:MODE]

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

[SENSe:]TOTAlize:THReshold[:MODE] <threshold>, (@<ch_list>)

[SENSe:]TOTAlize:THReshold[:MODE]? (@<ch_list>)

Description

This command configures the threshold at which an edge is detected on the specified totalizer channels. Select "AC" to detect changes through 0 volts or "TTL" (default) to detect changes through TTL threshold levels.



Used With:

- 34950A Digital I/O Module (counter channels only)
- 34952A Multifunction Module (totalizer channels only)

Parameters

Name	Type	Range of Values	Default Value
<threshold>	Discrete	{AC TTL}	TTL
<ch_list>	Numeric	One or more counter/totalizer channels in the form (@sccc) . 34950A: s301, s302 34952A: s005	This is a required parameter

Remarks

- The selected threshold is stored in **volatile** memory and will be set to "TTL" when power is turned off or after a Factory Reset (***RST** command).

Return Format

The query command returns "AC" or "TTL" for the specified channels. Multiple responses are separated by commas.

Examples

The following command configures totalizer channels 301 and 302 on the 34950A in slot 3 to use an AC threshold.

```
TOT:THR AC, (@3301,3302)
```

The following query returns the threshold setting on totalizer channels 301 and 302 on the 34950A in slot 3.

```
TOT:THR? (@3301,3302)
```

Typical Response: **AC,AC**

[SENSe:]TOTAlize:THReshold:VOLTage

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

[SENSe:]TOTAlize:THReshold:VOLTage {<voltage>|MIN|MAX|DEF}, (@<ch_list>)

[SENSe:]TOTAlize:THReshold:VOLTage? [{MIN|MAX},] (@<ch_list>)

Description

This command sets the input threshold voltage for the specified totalizer channels on the 34950A Digital I/O Module.

Used With:

- 34950A Digital I/O Module

Parameters

Name	Type	Range of Values	Default Value
<voltage>	Numeric	Desired threshold voltage between 0V and 3V, with 20 mV resolution. MIN = 0V, MAX = 3V	2.5V (TTL)
<ch_list>	Numeric	One or more totalizer channels in the form (@sccc). Select from s301 or s302.	This is a required parameter

Remarks

- If you change the threshold voltage while a totalizer operation is in progress, the count on the specified channels will be cleared.
- The selected threshold voltage is stored in **volatile** memory and will be set to 2.5V when power is turned off or after a Factory Reset (***RST** command).

Return Format

The query command returns the threshold voltage in the form "+1.00000000E+00" for each channel specified. Multiple responses are separated by commas.

Examples

The following command sets the threshold voltage to 1.8V on totalizer channels 301 and 302 on the module in slot 3.

```
TOT:THR:VOLT 1.8, (@3301, 3302)
```

The following query returns the threshold voltage settings on totalizer channels 301 and 302 on the module in slot 3.

```
TOT:THR:VOLT? (@3301, 3302)
```

Typical Response: +1.80000000E+00,+1.80000000E+00

See Also

[\[SENSe:\]TOTalize:SLOPe](#)

[\[SENSe:\]COUNter:THReshold:VOLTage](#)

[SENSe:]TOTalize:TYPE

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

[SENSe:]TOTalize:TYPE <mode>, (@<ch_list>)

[SENSe:]TOTalize:TYPE? (@<ch_list>)

Description

This command enables or disables an automatic reset of the count on the specified totalizer channels. To read the totalizer during a scan without resetting the count, select the READ parameter. To read the totalizer during a scan and reset the count to "0" after it is read, select the RRESet parameter (this means "read and reset").

Used With:

- 34950A Digital I/O Module (counter channels only)
- 34952A Multifunction Module (totalizer channels only)

Parameters

Name	Type	Range of Values	Default Value
<mode>	Discrete	{READ RRESet}	This is a required parameter
<ch_list>	Numeric	One or more counter/totalizer channels in the form (@sccc) . 34950A: s301, s302 34952A: s005	This is a required parameter

Remarks

- The maximum count is 4,294,967,295 ($2^{32} - 1$). The count rolls over to "0" after reaching the maximum allowed value.

Return Format

The query command returns "READ" or "RRES" for the specified channels. Multiple responses are separated by commas.

Examples

The following command configures totalizer channels 301 and 302 on the 34950A in slot 3 to be read without resetting their count.

```
TOT:TYPE READ, (@3009, 3010)
```

The following query returns the totalizer setting on totalizer channels 301 and 302 on the 34950A in slot 3.

```
TOT:TYPE? (@3009, 3010)
```

Typical Response: **READ,READ**

See Also

[SENSe:]TOTalize:DATA?

[SENSe:]FREQuency:APERture

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

[SENSe:]FREQuency:APERture {<seconds>|MIN|MAX|DEF} [, (@<ch_list>)]

[SENSe:]FREQuency:APERture? [(@<ch_list>)|MIN|MAX]

Description

This command selects the aperture time (also called *gate time*) for frequency measurements on the specified channels. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

Used With:

- 34921A through 34925A Multiplexer Modules

Parameters

Name	Type	Range of Values	Default Value
<seconds>	Discrete	Desired gate time in seconds: 10 ms (4½ digits, MIN) 100 ms (5½ digits) 1 second (6½ digits, MAX)	100 ms
<ch_list>	Numeric	One or more channels in the form (@sccc) .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- For the <seconds> parameter, you can substitute MIN or MAX for a numeric value. MIN selects the smallest value accepted, which gives the lowest accuracy; MAX selects the largest value accepted, which gives the highest accuracy.
- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.
- Since frequency and period are related functions, changing a measurement parameter for one function will also change the corresponding parameter for the other function (see [\[SENSe:\]PERiod:APERture](#) command).
- The instrument sets the aperture time to 100 ms after a Factory Reset (***RST** command). An Instrument Pre-set (**SYSTem:PRESet** command) or Card Reset (**SYSTem:CPON** command) does *not* change the setting.

Return Format

The query command returns the aperture time in the form "+1.00000000E-01" for each channel specified. Multiple responses are separated by commas.

Examples

The following command sets the gate time to 10 ms on channels 3 and 13 in slot 1.

```
FREQ:APER 10E-03, (@1003,1013)
```

The following query returns the gate time selected on channels 3 and 13 in slot 1.

```
FREQ:APER? (@1003,1013)
```

Typical Response: +1.00000000E-02,+1.00000000E-02

See Also

[CONFigure:FREQuency](#)

[SENSe:]FREQuency:RANGe:LOWer

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

[SENSe:]FREQuency:RANGe:LOWer {<timeout>|MIN|MAX|DEF} [, (@<ch_list>)]

[SENSe:]FREQuency:RANGe:LOWer? [(@<ch_list>)|MIN|MAX]

Description

The instrument uses three different timeout ranges for frequency measurements. The instrument selects the slow (3 Hz), medium (20 Hz), or fast (200 Hz) measurement timeout based on the input frequency that you specify with this command for the selected channels. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

Used With:

- 34921A through 34925A Multiplexer Modules

Parameters

Name	Type	Range of Values	Default Value
<timeout>	Discrete	{3 20 200} MIN = 3 Hz (slow), MAX = 200 Hz (fast)	20 Hz (medium)
<ch_list>	Numeric	One or more channels in the form (@sccc) .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- Applies to frequency measurements only.
- For the <timeout> parameter, specify the lowest frequency expected in the input signal on the specified channels. The instrument selects the appropriate measurement timeout based on the frequency you specify.

Input Frequency	Timeout
3 Hz to 300 kHz (Slow)	1 second
20 Hz to 300 kHz (Medium)	100 ms
200 Hz to 300 kHz (Fast)	10 ms

- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.
- The CONFigure and MEASure? commands automatically select the 20 Hz (medium) timeout.
- The instrument selects the medium timeout (20 Hz) after a Factory Reset (***RST** command). An Instrument Preset (**SYSTem:PRESet** command) or Card Reset (**SYSTem:CPON** command) does *not* change the setting.

Return Format

The query command returns "3" (slow), "20" (medium), or "200" (fast) for each channel specified. Multiple responses are separated by commas.

Examples

The following command selects the slow filter (3 Hz) on channel 3 in slot 1.

```
FREQ:RANG:LOW 3, (@1003,1013)
```

The following query returns the timeout settings on channels 3 and 13 in slot 1.

```
FREQ:RANG:LOW? (@1003,1013)
```

Typical Response: **3,3**

See Also

CONFigure:FREQuency

[SENSe:]FREQuency:VOLTage:RANGe

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

[SENSe:]FREQuency:VOLTage:RANGe {<voltage_range>|AUTO|MIN|MAX|DEF} [, (@<ch_list>)]

[SENSe:]FREQuency:VOLTage:RANGe? [{(@<ch_list>)|MIN|MAX}]

Description

This command selects the voltage range for frequency measurements on the specified channels. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

Used With:

- 34921A through 34925A Multiplexer Modules

Parameters

Name	Type	Range of Values	Default Value
<voltage_range>	Discrete	Desired range in volts: 100 mV (MIN) 1 V 10 V 100 V 300 V (MAX)	This is a required parameter
<ch_list>	Numeric	One or more channels in the form <u>(@sccc)</u> .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.
- Selecting a discrete range will disable autoranging on the specified channels.
- If the input signal is greater than can be measured on the selected range (manual ranging), the instrument gives an *overload indication*: "±OVLD" from the front panel or "±9.9E+37" from the remote interface.
- Since frequency and period are related functions, changing a measurement parameter for one function will also change the corresponding parameter for the other function (see [SENSe:]PERiod:VOLTage:RANGe command).

- The instrument enables autoranging after a Factory Reset (***RST** command). An Instrument Preset (**SYSTem:PRESet** command) or Card Reset (**SYSTem:CPON** command) does not change the setting.

Return Format

The query command returns the voltage range in the form "+1.00000000E+01" for each channel specified. Multiple responses are separated by commas.

Examples

The following command selects the 10 volt range for frequency measurements on channels 3 and 13 in slot 1.

```
FREQ:VOLT:RANG 10, (@1003,1013)
```

The following query returns the voltage range selected on channels 3 and 13 in slot 1.

```
FREQ:VOLT:RANG? (@1003,1013)
```

Typical Response: +1.00000000E+01,+1.00000000E+01

See Also

CONFigure:FREQuency

[SENSe:]FREQuency:VOLTage:RANGe:AUTO

[SENSe:]FREQuency:VOLTage:RANGe:AUTO

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

[SENSe:]FREQuency:VOLTage:RANGe:AUTO <mode> [, (@<ch_list>)]

[SENSe:]FREQuency:VOLTage:RANGe:AUTO? [(@<ch_list>)]

Description

This command disables or enables voltage autoranging for frequency measurements on the specified channels. Autoranging is convenient because the instrument automatically selects the range for each measurement based on the input signal detected. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

Used With:

- 34921A through 34925A Multiplexer Modules

Parameters

Name	Type	Range of Values	Default Value
<mode>	Boolean	{OFF 0 ON 1}	Autorange ON
<ch_list>	Numeric	One or more channels in the form (@sccc) .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.
- Autorange thresholds:

Down range <10% of range
at:
Up range at: >120% of range

- With autoranging enabled, the instrument selects one of the following ranges based on the input signal detected:

100 mV, 1 V, 10 V, 100 V, 300 V

- Selecting a discrete range (see `[SENSe:]FREQuency:VOLTage:RANGe` command) will disable autoranging on the specified channels.
- Since frequency and period are related functions, changing a measurement parameter for one function will also change the corresponding parameter for the other function (see `[SENSe:]PERiod:VOLTage:RANGe:AUTO` command).
- The instrument enables autoranging after a Factory Reset (`*RST` command). An Instrument Preset (`SYSTem:PRESet` command) or Card Reset (`SYSTem:CPON` command) does not change the setting.

Return Format

The query command returns "0" (OFF) or "1" (ON) for each channel specified. Multiple responses are separated by commas.

Examples

The following command disables autoranging on channels 3 and 13 in slot 1.

```
FREQ:VOLT:RANG:AUTO OFF, (@1003,1013)
```

The following query returns the autoranging settings on channels 3 and 13 in slot 1.

```
FREQ:VOLT:RANG:AUTO? (@1003,1013)
```

Typical Response: 0,0

See Also

`CONFigure:FREQuency`

`[SENSe:]FREQuency:RANGe:LOWer`

`[SENSe:]FREQuency:VOLTage:RANGe`

[SENSe:]PERiod:APERture

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

[SENSe:]PERiod:APERture {<seconds>|MIN|MAX|DEF} [, (@<ch_list>)]

[SENSe:]PERiod:APERture? [(@<ch_list>)|MIN|MAX]

Description

This command selects the aperture time (also called *gate time*) for period measurements on the specified channels. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

Used With:

- 34921A through 34925A Multiplexer Modules

Parameters

Name	Type	Range of Values	Default Value
<seconds>	Discrete	Desired gate time in seconds: 10 ms (4½ digits, MIN) 100 ms (5½ digits) 1 second (6½ digits, MAX)	100 ms
<ch_list>	Numeric	One or more channels in the form (@sccc) .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- For the <seconds> parameter, you can substitute MIN or MAX for a numeric value. MIN selects the smallest value accepted, which gives the lowest accuracy; MAX selects the largest value accepted, which gives the highest accuracy.
- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.
- Since frequency and period are related functions, changing a measurement parameter for one function will also change the corresponding parameter for the other function (see [\[SENSe:\]FREQuency:APERture](#) command).
- The instrument sets the aperture time to 100 ms after a Factory Reset (***RST** command). An Instrument Pre-set (**SYSTem:PRESet** command) or Card Reset (**SYSTem:CPON** command) does *not* change the setting.

Return Format

The query command returns the aperture time in the form "+1.00000000E-01" for each channel specified. Multiple responses are separated by commas.

Examples

The following command sets the gate time to 10 ms on channels 3 and 13 in slot 1.

```
PER:APER 10E-03, (@1003,1013)
```

The following query returns the gate time selected on channels 3 and 13 in slot 1.

```
PER:APER? (@1003,1013)
```

Typical Response: +1.00000000E-02,+1.00000000E-02

See Also

[CONFigure:PERiod](#)

[SENSe:]PERiod:VOLTage:RANGe

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

```
[SENSe:]PERiod:VOLTage:RANGe {<voltage_range>|MIN|MAX|DEF} [, (@<ch_list>)]
```

```
[SENSe:]PERiod:VOLTage:RANGe? [{(@<ch_list>)|MIN|MAX}]
```

Description

This command selects the voltage range for period measurements on the specified channels. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

Used With:

- 34921A through 34925A Multiplexer Modules

Parameters

Name	Type	Range of Values	Default Value
<voltage_range>	Discrete	Desired range in volts: 100 mV (MIN) 1 V 10 V 100 V 300 V (MAX)	This is a required parameter
<ch_list>	Numeric	One or more channels in the form (@sccc) .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.
- Selecting a discrete range will disable autoranging on the specified channels.
- If the input signal is greater than can be measured on the selected range (manual ranging), the instrument gives an *overload indication*: "±OVLD" from the front panel or "±9.9E+37" from the remote interface.
- Since frequency and period are related functions, changing a measurement parameter for one function will also change the corresponding parameter for the other function (see [\[SENSe:\]FREQuency:VOLTage:RANGe](#) command).

- The instrument enables autoranging after a Factory Reset (***RST** command). An Instrument Preset (**SYSTem:PRESet** command) or Card Reset (**SYSTem:CPON** command) does not change the setting.

Return Format

The query command returns the voltage range in the form "+1.00000000E+01" for each channel specified. Multiple responses are separated by commas.

Examples

The following command selects the 10 volt range for period measurements on channels 3 and 13 in slot 1.

```
PER:VOLT:RANG 10, (@1003,1013)
```

The following query returns the voltage range selected on channels 3 and 13 in slot 1.

```
PER:VOLT:RANG? (@1003,1013)
```

Typical Response: +1.00000000E+01,+1.00000000E+01

See Also

CONFigure:PERiod

[SENSe:]PERiod:VOLTage:RANGe:AUTO

[SENSe:]PERiod:VOLTage:RANGe:AUTO

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

[SENSe:]PERiod:VOLTage:RANGe:AUTO <mode> [, (@<ch_list>)]

[SENSe:]PERiod:VOLTage:RANGe:AUTO? [(@<ch_list>)]

Description

This command disables or enables voltage autoranging for period measurements on the specified channels. Autoranging is convenient because the instrument automatically selects the range for each measurement based on the input signal detected. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

Used With:

- 34921A through 34925A Multiplexer Modules

Parameters

Name	Type	Range of Values	Default Value
<mode>	Boolean	{OFF 0 ON 1}	Autorange ON
<ch_list>	Numeric	One or more channels in the form <u>(@sccc)</u> .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.
- Autorange thresholds:

Down range <10% of range
at:
Up range at: >120% of range

- With autoranging enabled, the instrument selects one of the following ranges based on the input signal detected:

100 mV, 1 V, 10 V, 100 V, 300 V

- Selecting a discrete range (see `[SENSe:]PERiod:VOLTage:RANGe` command) will disable autoranging on the specified channels.
- Since frequency and period are related functions, changing a measurement parameter for one function will also change the corresponding parameter for the other function (see `[SENSe:]FREQuency:VOLTage:RANGe:AUTO` command).
- The instrument enables autoranging after a Factory Reset (`*RST` command). An Instrument Preset (`SYSTem:PRESet` command) or Card Reset (`SYSTem:CPON` command) does not change the setting.

Return Format

The query command returns "0" (OFF) or "1" (ON) for each channel specified. Multiple responses are separated by commas.

Examples

The following command disables autoranging on channels 3 and 13 in slot 1.

```
PER:VOLT:RANG:AUTO OFF, (@1003, 1013)
```

The following query returns the autoranging settings on channels 3 and 13 in slot 1.

```
PER:VOLT:RANG:AUTO? (@1003, 1013)
```

Typical Response: 0,0

See Also

`CONFigure:PERiod`

`[SENSe:]FREQuency:RANGe:LOWer`

`[SENSe:]PERiod:VOLTage:RANGe`

[SENSe:]FRESistance:APERture

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

[SENSe:]FRESistance:APERture {<seconds>|MIN|MAX|DEF} [, (@<ch_list>)]

[SENSe:]FRESistance:APERture? [(@<ch_list>)|MIN|MAX]

Description

This command enables the aperture mode and sets the integration time in seconds (called *aperture time*) for 4-wire resistance measurements on the specified channels. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

NOTE

You should use this command only when you want precise control of the integration time of the internal DMM. Otherwise, specifying integration time using NPLC (see [\[SENSe:\]FRESistance:NPLC](#) command) executes faster and offers better noise rejection characteristics for values of NPLC greater than 1.

Used With:

- 34921A Armature Multiplexer
- 34922A Armature Multiplexer
- 34923A Reed Multiplexer (differential mode only)
- 34924A Reed Multiplexer
- 34925A FET Multiplexer (differential mode only)

Parameters

Name	Type	Range of Values	Default Value
<seconds>	Numeric	Desired aperture time in seconds between 300 μ s and 1 second, with 4 μ s resolution. MIN = 300 μ s, MAX = 1 second	Aperture disabled.
<ch_list>	Numeric	One or more channels in the form (@sccc) .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- For the <seconds> parameter, you can substitute MIN or MAX for a numeric value. MIN selects the smallest value accepted, which gives the lowest resolution; MAX selects the largest value accepted, which gives the highest resolution.
- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.
- Since 2-wire and 4-wire resistance are related functions, changing a measurement parameter for one function will also change the corresponding parameter for the other function (see **[SENSe:]RESistance:APERture** command).
- For 4-wire resistance measurements, the instrument automatically pairs channel *n* in Bank 1 with channel *n+20* in Bank 2 (34921A, 34923A, 34925A) or *n+35* (34922A, 34924A) to provide the source and sense connections. For example, make the source connections to the HI and LO terminals on channel 2 in Bank 1 and the sense connections to the HI and LO terminals on channel 22 (or 37) in Bank 2. Specify the paired channel in Bank 1 (source) as the <ch_list> channel (channels in Bank 2 are not allowed in the <ch_list>).
- Four-wire measurements are not allowed on the multiplexer modules configured for the single-ended mode (see **SYSTem:MODule:WIRE:MODE** command).
- Only the integral number of power line cycles (1, 2, 10, 20, 100, or 200 PLCs) provide normal mode (line frequency noise) rejection.
- The CONFigure, MEASure?, [SENSe:]FRESistance:NPLC, and [SENSe:]FRESistance:RESolution commands disable the aperture time mode (these commands select an integration time in number of power line cycles). You can use the **[SENSe:]FRESistance:APERture:ENABLEd?** command to query whether the aperture mode is currently enabled or disabled.
- The aperture mode is disabled after a Factory Reset (***RST** command). An Instrument Preset (**SYSTem:PRESet** command) or Card Reset (**SYSTem:CPON** command) does not change the setting.

Return Format

The query command returns the aperture time in the form "+1.00000000E-01" for each channel specified. Multiple responses are separated by commas. Note that if the aperture mode is currently disabled (see **[SENSe:]FRESistance:APERture:ENABLEd?** command), the value returned will represent the previous value specified, *not* the actual integration time.

Examples

The following command enables the aperture mode and sets the aperture time to 300 ms on channels 3 and 13 in slot 1. For this 4-wire measurement, the instrument automatically pairs these channels in Bank 1 with the corresponding channels in Bank 2.

```
FRES:APER 300E-03, (@1003,1013)
```

The following query returns the aperture time selected on channels 3 and 13 in slot 1.

FRES:APER? (@1003,1013)

FRES:APER:ENAB? !Verify that aperture mode is enabled ("1")

Typical	+3.00000000E-
Response:	01,+3.00000000E-01
	1

See Also

[CONFigure:FRESistance](#)

[\[SENSe:\]FRESistance:APERture:ENABLEd?](#)

[\[SENSe:\]FRESistance:NPLC](#)

[SENSe:]FRESistance:APERture:ENABLEd?

Syntax | Description | Parameters | Remarks | Return Format | Example

Syntax

[SENSe:]FRESistance:APERture:ENABLEd? [(@<ch_list>)]

Description

This command queries whether the aperture mode is enabled or disabled for 4-wire resistance measurements on the specified channels. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

Used With:

- 34921A Armature Multiplexer
- 34922A Armature Multiplexer
- 34923A Reed Multiplexer (differential mode only)
- 34924A Reed Multiplexer
- 34925A FET Multiplexer (differential mode only)

Parameters

Name	Type	Range of Values	Default Value
<ch_list>	Numeric	One or more channels in the form (@sccc) .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- Since 2-wire and 4-wire resistance are related functions, changing a measurement parameter for one function will also change the corresponding parameter for the other function (see [\[SENSe:\]RESistance:APERture:ENABLEd?](#) command).
- For 4-wire resistance measurements, the instrument automatically pairs channel *n* in Bank 1 with channel *n+20* in Bank 2 (34921A, 34923A, 34925A) or *n+35* (34922A, 34924A) to provide the source and sense connections. For example, make the source connections to the HI and LO terminals on channel 2 in Bank 1 and the sense connections to the HI and LO terminals on channel 22 (or 37) in Bank 2. Specify the paired channel in Bank 1 (source) as the <ch_list> channel (channels in Bank 2 are not allowed in the <ch_list>).
- Four-wire measurements are not allowed on the multiplexer modules configured for the single-ended mode (see [SYSTem:MODule:WIRE:MODE](#) command).

- The CONFigure, MEASure?, [SENSe:]FRESistance:NPLC, and [SENSe:]FRESistance:RESolution commands disable the aperture time mode (these commands select an integration time in number of power line cycles).

Return Format

The query command returns "0" if the aperture mode is disabled or "1" if the aperture mode is enabled for each channel specified. Multiple responses are separated by commas.

Example

The following command returns the state of the aperture mode on channels 3 and 13 in slot 1.

```
FRES:APER:ENAB? (@1003,1013)
```

Typical Response: 1,1

See Also

[CONFigure:FRESistance](#)

[\[SENSe:\]FRESistance:APERture](#)

[\[SENSe:\]FRESistance:NPLC](#)

[SENSe:]FRESistance:NPLC

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

```
[SENSe:]FRESistance:NPLC {<PLCs>|MIN|MAX|DEF} [, (@<ch_list>)]
```

```
[SENSe:]FRESistance:NPLC? [(@<ch_list>)|MIN|MAX]
```

Description

This command sets the **integration time** in number of power line cycles (PLCs) on the specified channels. Integration time affects the measurement resolution (for better resolution, use a longer integration time) and measurement speed (for faster measurements, use a shorter integration time). If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

Used With:

- 34921A Armature Multiplexer
- 34922A Armature Multiplexer
- 34923A Reed Multiplexer (differential mode only)
- 34924A Reed Multiplexer
- 34925A FET Multiplexer (differential mode only)

Parameters

Name	Type	Range of Values	Default Value
<PLCs>	Discrete	{0.02 0.2 1 2 10 20 100 200} MIN = 0.02 PLC, MAX = 200 PLC	1 PLC
<ch_list>	Numeric	One or more channels in the form (@sccc) .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.
- Since 2-wire and 4-wire resistance are related functions, changing a measurement parameter for one function will also change the corresponding parameter for the other function (see [\[SENSe:\]RESistance:NPLC](#) command).

- For 4-wire resistance measurements, the instrument automatically pairs channel *n* in Bank 1 with channel *n+20* in Bank 2 (34921A, 34923A, 34925A) or *n+35* (34922A, 34924A) to provide the source and sense connections. For example, make the source connections to the HI and LO terminals on channel 2 in Bank 1 and the sense connections to the HI and LO terminals on channel 22 (or 37) in Bank 2. Specify the paired channel in Bank 1 (source) as the <ch_list> channel (channels in Bank 2 are not allowed in the <ch_list>).
- Four-wire measurements are not allowed on the multiplexer modules configured for the single-ended mode (see **SYSTem:MODule:WIRE:MODE** command).
- Only the integral number of power line cycles (1, 2, 10, 20, 100, or 200 PLCs) provide normal mode (line frequency noise) rejection.
- Setting the integration time also sets the resolution for the measurement. Click [here](#) to see the relationship between integration time, measurement resolution, number of digits, and number of bits.
- The specified integration time is used for all measurements on the selected channels. If you have applied Mx+B scaling or have assigned alarms to the selected channel, those measurements are also made using the specified integration time. Measurements taken during the Monitor function also use the specified integration time.
- You can also set the integration time by specifying an *aperture time* (see **[SENSe:]FRESistance:APERture** command). However, note that specifying integration time using NPLCs executes faster and offers better noise rejection characteristics for values of NPLC greater than 1.
- The CONFigure, MEASure?, [SENSe:]FRESistance:NPLC, and [SENSe:]FRESistance:RESolution commands disable the aperture time mode (these commands select an integration time in number of power line cycles). You can use the **[SENSe:]FRESistance:APERture:ENABLEd?** command to query whether the aperture mode is currently enabled or disabled.
- The instrument sets the integration time to 1 PLC after a Factory Reset (***RST** command). An Instrument Pre-set (**SYSTem:PRESet** command) or Card Reset (**SYSTem:CPON** command) does *not* change the setting.

Return Format

The query command returns the integration time in the form "+1.00000000E+00" for each channel specified. Multiple responses are separated by commas. Note that if the aperture mode is currently enabled (see **[SENSe:]FRESistance:APERture:ENABLEd?** command), the value returned will represent the previous value specified, *not* the actual integration time.

Examples

The following command set the integration time to 0.2 PLCs on channels 3 and 13 in slot 1. For this 4-wire measurement, the instrument automatically pairs these channels in Bank 1 with the corresponding channels in Bank 2.

```
FRES:NPLC 0.2, (@1003,1013)
```

The following query returns the integration time settings on channels 3 and 13 in slot 1.


```
FRES:NPLC? (@1003,1013)
```

```
FRES:APER:ENAB? !Verify that aperture mode is disabled ("0")
```

Typical	+2.00000000E-
Response:	01,+2.00000000E-01
	0

See Also

[CONFigure:FRESistance](#)

[\[SENSe:\]FRESistance:APERture](#)

[\[SENSe:\]FRESistance:APERture:ENABLEd?](#)

[\[SENSe:\]FRESistance:RESolution](#)

[SENSe:]FRESistance:OCOMpensated

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

[SENSe:]FRESistance:OCOMpensated <mode> [, (@<ch_list>)]

[SENSe:]FRESistance:OCOMpensated? [(@<ch_list>)]

Description

Offset compensation removes the effects of any dc voltages in the circuit being measured. The technique involves taking the difference between two resistance measurements on the specified channels, one with the current source turned on and one with the current source turned off. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

Used With:

- 34921A Armature Multiplexer
- 34922A Armature Multiplexer
- 34923A Reed Multiplexer (differential mode only)
- 34924A Reed Multiplexer
- 34925A FET Multiplexer (differential mode only)

Parameters

Name	Type	Range of Values	Default Value
<mode>	Boolean	{OFF 0 ON 1}	OFF 0
<ch_list>	Numeric	One or more channels in the form (@sccc) .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- Once enabled, offset compensation is applied to both 2-wire and 4-wire resistance measurements on the specified channels.
- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.

- Since 2-wire and 4-wire resistance are related functions, changing a measurement parameter for one function will also change the corresponding parameter for the other function (see **[SENSe:]RESistance:OCOMpensated** command).
- For 4-wire resistance measurements, the instrument automatically pairs channel *n* in Bank 1 with channel *n+20* in Bank 2 (34921A, 34923A, 34925A) or *n+35* (34922A, 34924A) to provide the source and sense connections. For example, make the source connections to the HI and LO terminals on channel 2 in Bank 1 and the sense connections to the HI and LO terminals on channel 22 (or 37) in Bank 2. Specify the paired channel in Bank 1 (source) as the <ch_list> channel (channels in Bank 2 are not allowed in the <ch_list>).
- Four-wire measurements are not allowed on the multiplexer modules configured for the single-ended mode (see **SYSTem:MODule:WIRE:MODE** command).
- The CONFigure and MEASure? commands automatically disable offset compensation.
- The instrument disables offset compensation after a Factory Reset (***RST** command). An Instrument Preset (**SYSTem:PRESet** command) or Card Reset (**SYSTem:CPON** command) does *not* change the setting.

Return Format

The query command returns "0" (OFF) or "1" (ON) for each channel specified. Multiple responses are separated by commas.

Examples

The following command enables offset compensation on channels 3 and 13 in slot 1. For this 4-wire measurement, the instrument automatically pairs these channels in Bank 1 with the corresponding channels in Bank 2.

```
FRES:OCOM ON, (@1003,1013)
```

The following query returns the offset compensation settings on channels 3 and 13 in slot 1.

```
FRES:OCOM? (@1003,1013)
```

Typical Response: 1,1

See Also

CONFigure:FRESistance

[SENSe:]FRESistance:RANGe

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

[SENSe:]FRESistance:RANGe {<range>|MIN|MAX|DEF} [, (@<ch_list>)]

[SENSe:]FRESistance:RANGe? [(@<ch_list>)|MIN|MAX]

Description

This command selects the measurement range for 4-wire resistance measurements on the specified channels. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

Used With:

- 34921A Armature Multiplexer
- 34922A Armature Multiplexer
- 34923A Reed Multiplexer (differential mode only)
- 34924A Reed Multiplexer
- 34925A FET Multiplexer (differential mode only)

Parameters

Name	Type	Range of Values	Default Value
<range>	Discrete	Desired range in ohms: 100Ω (MIN) 1 kΩ 10 kΩ 100 kΩ 1 MΩ 10 MΩ 100 MΩ (MAX)	This is a required parameter
<ch_list>	Numeric	One or more channels in the form (@sccc) .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.
- Selecting a discrete range will disable autoranging on the specified channels (see **[SENSe:]FREStance:RANGe:AUTO** command).
- Since 2-wire and 4-wire resistance are related functions, changing a measurement parameter for one function will also change the corresponding parameter for the other function (see **[SENSe:]RESistance:RANGe** command).
- The CONFigure and MEASure? commands automatically enable autoranging.
- If the input signal is greater than can be measured on the selected range (manual ranging), the instrument gives an *overload indication*: "±OVL" from the front panel or "±9.9E+37" from the remote interface.
- For 4-wire resistance measurements, the instrument automatically pairs channel *n* in Bank 1 with channel *n+20* in Bank 2 (34921A, 34923A, 34925A) or *n+35* (34922A, 34924A) to provide the source and sense connections. For example, make the source connections to the HI and LO terminals on channel 2 in Bank 1 and the sense connections to the HI and LO terminals on channel 22 (or 37) in Bank 2. Specify the paired channel in Bank 1 (source) as the <ch_list> channel (channels in Bank 2 are not allowed in the <ch_list>).
- Four-wire measurements are not allowed on the multiplexer modules configured for the single-ended mode (see **SYSTem:MODUle:WIRE:MODE** command).
- The instrument enables autoranging after a Factory Reset (***RST** command). An Instrument Preset (**SYSTem:PRESet** command) or Card Reset (**SYSTem:CPON** command) does not change the setting.

Return Format

The query command returns the range in the form "+1.00000000E+03" for each channel specified. Multiple responses are separated by commas.

Examples

The following command selects the 10 kΩ range on channels 3 and 13 in slot 1. For this 4-wire measurement, the instrument automatically pairs these channels in Bank 1 with the corresponding channels in Bank 2.

```
FRES:RANG 10E+3, (@1003,1013)
```

The following query returns the range selected on channels 3 and 13 in slot 1.

```
FRES:RANG? (@1003,1013)
```

Typical Response: +1.00000000E+04,+1.00000000E+04

See Also

CONFigure:FRESistance

[SENSe:]FREStance:RANGe:AUTO

[SENSe:]FRESistance:RANGe:AUTO

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

[SENSe:]FRESistance:RANGe:AUTO <mode> [, (@<ch_list>)]

[SENSe:]FRESistance:RANGe:AUTO? [(@<ch_list>)]

Description

This command disables or enables autoranging for 4-wire resistance measurements on the specified channels. Autoranging is convenient because the instrument automatically selects the range for each measurement based on the input signal detected. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

Used With:

- 34921A Armature Multiplexer
- 34922A Armature Multiplexer
- 34923A Reed Multiplexer (differential mode only)
- 34924A Reed Multiplexer
- 34925A FET Multiplexer (differential mode only)

Parameters

Name	Type	Range of Values	Default Value
<mode>	Boolean	{OFF 0 ON 1}	Autorange ON
<ch_list>	Numeric	One or more channels in the form (@sccc) .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- For 4-wire resistance measurements, the instrument automatically pairs channel *n* in Bank 1 with channel *n+20* in Bank 2 (34921A, 34923A, 34925A) or *n+35* (34922A, 34924A) to provide the source and sense connections. For example, make the source connections to the HI and LO terminals on channel 2 in Bank 1 and the sense connections to the HI and LO terminals on channel 22 (or 37) in Bank 2. Specify the paired channel in Bank 1 (source) as the <ch_list> channel (channels in Bank 2 are not allowed in the <ch_list>).
- Four-wire measurements are not allowed on the multiplexer modules configured for the single-ended mode (see **SYSTem:MODule:WIRE:MODE** command).

- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.
- Since 2-wire and 4-wire resistance are related functions, changing a measurement parameter for one function will also change the corresponding parameter for the other function (see **[SENSe:]RESistance:RANGe:AUTO** command).
- Autorange thresholds:

Down range <10% of range
at:
Up range at: >120% of range

- With autoranging enabled, the instrument selects one of the following ranges based on the input signal detected:

100 Ω , 1 k Ω , 10 k Ω , 100 k Ω , 1 M Ω , 10 M Ω , 100 M Ω

- Selecting a discrete range (see **[SENSe:]RESistance:RANGe** command) will disable autoranging on the specified channels.
- The CONFigure and MEASure? commands automatically enable autoranging.
- The instrument enables autoranging after a Factory Reset (***RST** command). An Instrument Preset (**SYSTem:PRESet** command) or Card Reset (**SYSTem:CPON** command) does not change the setting.

Return Format

The query command returns "0" (OFF) or "1" (ON) for each channel specified. Multiple responses are separated by commas.

Examples

The following command disables autoranging on channels 3 and 13 in slot 1. For this 4-wire measurement, the instrument automatically pairs these channels in Bank 1 with the corresponding channels in Bank 2.

```
FRES:RANG:AUTO OFF, (@1003,1013)
```

The following query returns the autoranging settings on channels 3 and 13 in slot 1.

```
FRES:RANG:AUTO? (@1003,1013)
```

Typical Response: 0,0

See Also

CONFigure:FRESistance

[SENSe:]RESistance:RANGe

[SENSe:]FRESistance:RESolution

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

[SENSe:]FRESistance:RESolution {<resolution>|MIN|MAX|DEF} [, (@<ch_list>)]

[SENSe:]FRESistance:RESolution? [{(@<ch_list>)|MIN|MAX}]

Description

This command selects the measurement resolution for 4-wire resistance measurements on the specified channels. Specify the resolution in the same units as the selected measurement function, *not in number of digits*. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

Used With:

- 34921A Armature Multiplexer
- 34922A Armature Multiplexer
- 34923A Reed Multiplexer (differential mode only)
- 34924A Reed Multiplexer
- 34925A FET Multiplexer (differential mode only)

Parameters

Name	Type	Range of Values	Default Value
<resolution>	Numeric	Desired resolution in ohms.	0.000003 x Range (1 PLC)
<ch_list>	Numeric	One or more channels in the form (@sccc) .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- For 4-wire resistance measurements, the instrument automatically pairs channel *n* in Bank 1 with channel *n+20* in Bank 2 (34921A, 34923A, 34925A) or *n+35* (34922A, 34924A) to provide the source and sense connections. For example, make the source connections to the HI and LO terminals on channel 2 in Bank 1 and the sense connections to the HI and LO terminals on channel 22 (or 37) in Bank 2. Specify the paired channel in Bank 1 (source) as the <ch_list> channel (channels in Bank 2 are not allowed in the <ch_list>).

- Four-wire measurements are not allowed on the multiplexer modules configured for the single-ended mode (see **SYSTem:MODule:WIRE:MODE** command).
- For the <resolution> parameter, you can substitute MIN or MAX for a numeric value. MIN selects the smallest value accepted, which gives the highest resolution; MAX selects the largest value accepted, which gives the least resolution.
- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.
- Since 2-wire and 4-wire resistance are related functions, changing a measurement parameter for one function will also change the corresponding parameter for the other function (see **[SENSe:]RESistance:RESolution** command).
- Setting the resolution also sets the integration time for the measurement. The following table shows the relationship between integration time, measurement resolution, number of digits, and number of bits.

Integration Time	Resolution	Digits	Bits
0.02 PLC	< 0.0001 x Range	4½ Digits	15
0.2 PLC	< 0.00001 x Range	5½ Digits	18
1 PLC	< 0.000003 x Range	5½ Digits	20
2 PLC	< 0.0000022 x Range	6½ Digits	21
10 PLC	< 0.000001 x Range	6½ Digits	24
20 PLC	< 0.0000008 x Range	6½ Digits	25
100 PLC	< 0.0000003 x Range	6½ Digits	26
200 PLC	< 0.00000022 x Range	6½ Digits	26

- You can also set the integration time by specifying an *aperture time* (see **[SENSe:]FRESistance:APERture** command). However, note that specifying integration time using NPLCs executes faster and offers better noise rejection characteristics for values of NPLC greater than 1.
- The CONFigure, MEASure?, **[SENSe:]FRESistance:NPLC**, and **[SENSe:]FRESistance:RESolution** commands disable the aperture time mode (these commands select an integration time in number of power line cycles). You can use the **[SENSe:]FRESistance:APERture:ENABLEd?** command to query whether the aperture mode is currently enabled or disabled.
- The instrument sets the resolution to 1 PLC after a Factory Reset (***RST** command). An Instrument Preset (**SYSTem:PRESet** command) or Card Reset (**SYSTem:CPON** command) does *not* change the setting.

Return Format

The query command returns the resolution in the form "+1.00000000E+02" for each channel specified. Multiple responses are separated by commas. Note that if the aperture mode is currently enabled (see **[SENSe:]FRESistance:APERture:ENABLEd?** command), the value returned will represent the previous value specified, *not* the actual integration time.

Examples

The following command sets the measurement resolution to 100 Ω on channels 3 and 13 in slot 1. For this 4-wire measurement, the instrument automatically pairs these channels in Bank 1 with the corresponding channels in Bank 2.

```
FRES:RES 100, (@1003,1013)
```

The following query returns the resolution selected on channels 3 and 13 in slot 1.

```
FRES:RES? (@1003,1013)  
FRES:APER:ENAB? !Verify that aperture mode is disabled ("0")
```

Typical	+1.00000000E+02,+1.00000000E
Response:	+02
	0

See Also

[CONFigure:FRESistance](#)

[\[SENSe:\]FRESistance:APERture](#)

[\[SENSe:\]FRESistance:APERture:ENABLEd?](#)

[\[SENSe:\]FRESistance:NPLC](#)

[SENSe:]RESistance:APERture

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Syntax

[SENSe:]RESistance:APERture {<seconds>|MIN|MAX|DEF} [, (@<ch_list>)]

[SENSe:]RESistance:APERture? [(@<ch_list>)|MIN|MAX]

Description

This command enables the aperture mode and sets the integration time in seconds (called *aperture time*) for 2-wire resistance measurements on the specified channels. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

NOTE

You should use this command only when you want precise control of the integration time of the internal DMM. Otherwise, specifying integration time using NPLC (see [\[SENSe:\]RESistance:NPLC](#) command) executes faster and offers better noise rejection characteristics for values of NPLC greater than 1.

Used With:

- 34921A through 34925A Multiplexer Modules

Parameters

Name	Type	Range of Values	Default Value
<seconds>	Numeric	Desired aperture time in seconds between 300 μ s and 1 second, with 4 μ s resolution. MIN = 300 μ s, MAX = 1 second	Aperture disabled.
<ch_list>	Numeric	One or more channels in the form (@sccc) .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- For the <seconds> parameter, you can substitute MIN or MAX for a numeric value. MIN selects the smallest value accepted, which gives the lowest resolution; MAX selects the largest value accepted, which gives the highest resolution.
- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.

- Since 2-wire and 4-wire resistance are related functions, changing a measurement parameter for one function will also change the corresponding parameter for the other function (see **[SENSe:]FRESistance:APERture** command).
- Only the integral number of power line cycles (1, 2, 10, 20, 100, or 200 PLCs) provide normal mode (line frequency noise) rejection.
- The CONFigure, MEASure?, [SENSe:]RESistance:NPLC, and [SENSe:]RESistance:RESolution commands disable the aperture mode (these commands select an integration time in number of power line cycles). You can use the **[SENSe:]RESistance:APERture:ENABLEd?** command to query whether the aperture mode is currently enabled or disabled.
- The aperture mode is disabled after a Factory Reset (***RST** command). An Instrument Preset (**SYSTem:PRESet** command) or Card Reset (**SYSTem:CPON** command) does not change the setting.

Return Format

The query command returns the aperture time in the form **"+1.00000000E-01"** for each channel specified. Multiple responses are separated by commas. Note that if the aperture mode is currently disabled (see **[SENSe:]FRESistance:APERture:ENABLEd?** command), the value returned will represent the previous value specified, *not* the actual integration time.

Examples

The following command enables the aperture mode and sets the aperture time to 300 ms on channels 3 and 13 in slot 1.

```
RES:APER 300E-03, (@1003,1013)
```

The following query returns the aperture time selected on channels 3 and 13 in slot 1.

```
RES:APER? (@1003,1013)
RES:APER:ENAB? !Verify that aperture mode is enabled ("1")
```

Typical	+3.00000000E-
Response:	01,+3.00000000E-01
	1

See Also

CONFigure:RESistance

[SENSe:]RESistance:APERture:ENABLEd?

[SENSe:]RESistance:NPLC

[SENSe:]RESistance:APERture:ENABled?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

[SENSe:]RESistance:APERture:ENABled? [(@<ch_list>)]

Description

This command queries whether the aperture mode is enabled or disabled for 2-wire resistance measurements on the specified channels. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

Used With:

- 34921A through 34925A Multiplexer Modules

Parameters

Name	Type	Range of Values	Default Value
<ch_list>	Numeric	One or more channels in the form (@sccc) .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- Since 2-wire and 4-wire resistance are related functions, changing a measurement parameter for one function will also change the corresponding parameter for the other function (see [\[SENSe:\]FRESistance:APERture:ENABled?](#) command).
- The CONFIGure, MEASure?, [SENSe:]RESistance:NPLC, and [SENSe:]RESistance:RESolution commands disable the aperture mode (these commands select an integration time in number of power line cycles).

Return Format

The query command returns "0" if the aperture mode is disabled or "1" if the aperture mode is enabled for each channel specified. Multiple responses are separated by commas.

Example

The following command returns the state of the aperture mode on channels 3 and 13 in slot 1.

```
RES:APER:ENAB? (@1003,1013)
```

Typical Response: 1,1

See Also

`CONFigure:RESistance`

`[SENSe:]RESistance:APERture`

`[SENSe:]RESistance:NPLC`

[SENSe:]RESistance:NPLC

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

[SENSe:]RESistance:NPLC {<PLCs>|MIN|MAX|DEF} [, (@<ch_list>)]

[SENSe:]RESistance:NPLC? [(@<ch_list>)|MIN|MAX]

Description

This command sets the **integration time** in number of power line cycles (PLCs) on the specified channels. Integration time affects the measurement resolution (for better resolution, use a longer integration time) and measurement speed (for faster measurements, use a shorter integration time). If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

Used With:

- 34921A through 34925A Multiplexer Modules

Parameters

Name	Type	Range of Values	Default Value
<PLCs>	Discrete	{0.02 0.2 1 2 10 20 100 200} MIN = 0.02 PLC, MAX = 200 PLC	1 PLC
<ch_list>	Numeric	One or more channels in the form (@sccc) .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- Only the integral number of power line cycles (1, 2, 10, 20, 100, or 200 PLCs) provide normal mode (line frequency noise) rejection.
- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.
- Since 2-wire and 4-wire resistance are related functions, changing a measurement parameter for one function will also change the corresponding parameter for the other function (see [\[SENSe:\]FRESistance:NPLC](#) command).
- Setting the integration time also sets the resolution for the measurement. Click [here](#) to see the relationship between integration time, measurement resolution, number of digits, and number of bits.

- The specified integration time is used for all measurements on the selected channels. If you have applied Mx+B scaling or have assigned alarms to the selected channel, those measurements are also made using the specified integration time. Measurements taken during the Monitor function also use the specified integration time.
- You can also set the integration time by specifying an *aperture time* (see **[SENSe:]RESistance:APERture** command). However, note that specifying integration time using NPLCs executes faster and offers better noise rejection characteristics for values of NPLC greater than 1.
- The CONFigure, MEASure?, [SENSe:]RESistance:NPLC, and [SENSe:]RESistance:RESolution commands disable the aperture mode (these commands select an integration time in number of power line cycles). You can use the **[SENSe:]RESistance:APERture:ENABLEd?** command to query whether the aperture mode is currently enabled or disabled.
- The instrument sets the integration time to 1 PLC after a Factory Reset (***RST** command). An Instrument Preset (**SYSTem:PRESet** command) or Card Reset (**SYSTem:CPON** command) does *not* change the setting.

Return Format

The query command returns the integration time in the form "+1.00000000E+00" for each channel specified. Multiple responses are separated by commas. Note that if the aperture mode is currently enabled (see **[SENSe:]RESistance:APERture:ENABLEd?** command), the value returned will represent the previous value specified, *not* the actual integration time.

Examples

The following command set the integration time to 0.2 PLCs on channels 3 and 13 in slot 1.

```
RES:NPLC 0.2, (@1003,1013)
```

The following query returns the integration time settings on channels 3 and 13 in slot 1.

```
RES:NPLC? (@1003,1013)
RES:APER:ENAB? !Verify that aperture mode is disabled ("0")
```

Typical	+2.00000000E-
Response:	01,+2.00000000E-01
	0

See Also

CONFigure:RESistance

[SENSe:]RESistance:APERture

[SENSe:]RESistance:APERture:ENABLEd?

[SENSe:]RESistance:RESolution

[SENSe:]RESistance:OCOMpensated

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

[SENSe:]RESistance:OCOMpensated <mode> [, (@<ch_list>)]

[SENSe:]RESistance:OCOMpensated? [(@<ch_list>)]

Description

Offset compensation removes the effects of any dc voltages in the circuit being measured. The technique involves taking the difference between two resistance measurements on the specified channels, one with the current source turned on and one with the current source turned off. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

Used With:

- 34921A through 34925A Multiplexer Modules

Parameters

Name	Type	Range of Values	Default Value
<mode>	Boolean	{OFF 0 ON 1}	OFF 0
<ch_list>	Numeric	One or more channels in the form (@sccc) .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- Once enabled, offset compensation is applied to both 2-wire and 4-wire resistance measurements on the specified channels.
- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.
- Since 2-wire and 4-wire resistance are related functions, changing a measurement parameter for one function will also change the corresponding parameter for the other function (see [\[SENSe:\]FRESistance:OCOMpensated](#) command).
- The CONFigure and MEASure? commands automatically disable offset compensation.

- The instrument disables offset compensation after a Factory Reset (***RST** command). An Instrument Preset (**SYSTem:PRESet** command) or Card Reset (**SYSTem:CPON** command) does *not* change the setting.

Return Format

The query command returns "0" (OFF) or "1" (ON) for each channel specified. Multiple responses are separated by commas.

Examples

The following command enables offset compensation on channels 3 and 13 in slot 1.

```
RES:OCOM ON, (@1003,1013)
```

The following query returns the offset compensation settings on channels 3 and 13 in slot 1.

```
RES:OCOM? (@1003,1013)
```

Typical Response: 1,1

See Also

CONFigure:RESistance

[SENSe:]RESistance:RANGe

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

```
[SENSe:]RESistance:RANGe {<range>|MIN|MAX|DEF} [, (@<ch_list>)]
```

```
[SENSe:]RESistance:RANGe? [(@<ch_list>)|MIN|MAX]
```

Description

This command selects the measurement range for 2-wire resistance measurements on the specified channels. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

Used With:

- 34921A through 34925A Multiplexer Modules

Parameters

Name	Type	Range of Values	Default Value
<range>	Discrete	Desired range in ohms: 100Ω (MIN) 1 kΩ 10 kΩ 100 kΩ 1 MΩ 10 MΩ 100 MΩ (MAX)	This is a required parameter
<ch_list>	Numeric	One or more channels in the form (@sccc) .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.
- Selecting a discrete range will disable autoranging on the specified channels (see [\[SENSe:\]RESistance:RANGe:AUTO](#) command).

- Since 2-wire and 4-wire resistance are related functions, changing a measurement parameter for one function will also change the corresponding parameter for the other function (see **[SENSe:]FRESistance:RANGe** command).
- The CONFigure and MEASure? commands automatically enable autoranging.
- If the input signal is greater than can be measured on the selected range (manual ranging), the instrument gives an *overload indication*: "±OVLD" from the front panel or "±9.9E+37" from the remote interface.
- The instrument enables autoranging after a Factory Reset (***RST** command). An Instrument Preset (**SYSTem:PRESet** command) or Card Reset (**SYSTem:CPON** command) does not change the setting.

Return Format

The query command returns the range in the form "+1.00000000E+03" for each channel specified. Multiple responses are separated by commas.

Examples

The following command selects the 10 k Ω range on channels 3 and 13 in slot 1.

```
RES:RANG 10E+3, (@1003,1013)
```

The following query returns the range selected on channels 3 and 13 in slot 1.

```
RES:RANG? (@1003,1013)
```

Typical Response: +1.00000000E+04,+1.00000000E+04

See Also

CONFigure:RESistance

[SENSe:]RESistance:RANGe:AUTO

[SENSe:]RESistance:RANGe:AUTO

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

[SENSe:]RESistance:RANGe:AUTO <mode> [, (@<ch_list>)]

[SENSe:]RESistance:RANGe:AUTO? [(@<ch_list>)]

Description

This command disables or enables autoranging for 2-wire resistance measurements on the specified channels. Autoranging is convenient because the instrument automatically selects the range for each measurement based on the input signal detected. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

Used With:

- 34921A through 34925A Multiplexer Modules

Parameters

Name	Type	Range of Values	Default Value
<mode>	Boolean	{OFF 0 ON 1}	Autorange ON
<ch_list>	Numeric	One or more channels in the form (@sccc) .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.
- Since 2-wire and 4-wire resistance are related functions, changing a measurement parameter for one function will also change the corresponding parameter for the other function (see [\[SENSe:\]FREStance:RANGe:AUTO](#) command).
- Autorange thresholds:

Down range <10% of range
at:
Up range at: >120% of range

- With autoranging enabled, the instrument selects one of the following ranges based on the input signal detected:

100Ω, 1 kΩ, 10 kΩ, 100 kΩ, 1 MΩ, 10 MΩ, 100 MΩ

- Selecting a discrete range (see **[SENSe:]RESistance:RANGe** command) will disable autoranging on the specified channels.
- The CONFigure and MEASure? commands automatically enable autoranging.
- The instrument enables autoranging after a Factory Reset (***RST** command). An Instrument Preset (**SYSTem:PRESet** command) or Card Reset (**SYSTem:CPON** command) does not change the setting.

Return Format

The query command returns "0" (OFF) or "1" (ON) for each channel specified. Multiple responses are separated by commas.

Examples

The following command disables autoranging on channels 3 and 13 in slot 1.

```
RES:RANG:AUTO OFF, (@1003,1013)
```

The following query returns the autoranging settings on channels 3 and 13 in slot 1.

```
RES:RANG:AUTO? (@1003,1013)
```

Typical Response: 0,0

See Also

CONFigure:RESistance

[SENSe:]RESistance:RANGe

[SENSe:]RESistance:RESolution

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

[SENSe:]RESistance:RESolution {<resolution>|MIN|MAX|DEF} [, (@<ch_list>)]

[SENSe:]RESistance:RESolution? [(@<ch_list>)|MIN|MAX]

Description

This command selects the measurement resolution for 2-wire resistance measurements on the specified channels. Specify the resolution in the same units as the selected measurement function, *not in number of digits*. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

Used With:

- 34921A through 34925A Multiplexer Modules

Parameters

Name	Type	Range of Values	Default Value
<resolution>	Numeric	Desired resolution in ohms.	0.000003 x Range (1 PLC)
<ch_list>	Numeric	One or more channels in the form (@sccc) .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- For the <resolution> parameter, you can substitute MIN or MAX for a numeric value. MIN selects the smallest value accepted, which gives the highest resolution; MAX selects the largest value accepted, which gives the least resolution.
- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.
- Since 2-wire and 4-wire resistance are related functions, changing a measurement parameter for one function will also change the corresponding parameter for the other function (see **[SENSe:]FREStance:RESolution** command).
- Setting the resolution also sets the integration time for the measurement. The following table shows the relationship between integration time, measurement resolution, number of digits, and number of bits.

Integration Time	Resolution	Digits	Bits
0.02 PLC	< 0.0001 x Range	4½ Digits	15
0.2 PLC	< 0.00001 x Range	5½ Digits	18
1 PLC	< 0.000003 x Range	5½ Digits	20
2 PLC	< 0.0000022 x Range	6½ Digits	21
10 PLC	< 0.000001 x Range	6½ Digits	24
20 PLC	< 0.0000008 x Range	6½ Digits	25
100 PLC	< 0.0000003 x Range	6½ Digits	26
200 PLC	< 0.00000022 x Range	6½ Digits	26

- You can also set the integration time by specifying an *aperture time* (see **[SENSe:]RESistance:APERture** command). However, note that specifying integration time using NPLCs executes faster and offers better noise rejection characteristics for values of NPLC greater than 1.
- The CONFigure, MEASure?, [SENSe:]RESistance:NPLC, and [SENSe:]RESistance:RESolution commands disable the aperture mode (these commands select an integration time in number of power line cycles). You can use the **[SENSe:]RESistance:APERture:ENABLEd?** command to query whether the aperture mode is currently enabled or disabled.
- The instrument sets the resolution to 1 PLC after a Factory Reset (***RST** command). An Instrument Preset (**SYSTem:PRESet** command) or Card Reset (**SYSTem:CPON** command) does *not* change the setting.

Return Format

The query command returns the resolution in the form "+1.00000000E+02" for each channel specified. Multiple responses are separated by commas. Note that if the aperture mode is currently enabled (see **[SENSe:]RESistance:APERture:ENABLEd?** command), the value returned will represent the previous value specified, *not* the actual integration time.

Examples

The following command sets the measurement resolution to 100Ω on channels 3 and 13 in slot 1.

```
RES:RES 100, (@1003,1013)
```

The following query returns the resolution selected on channels 3 and 13 in slot 1.

```
RES:RES? (@1003,1013)
RES:APER:ENAB? !Verify that aperture mode is disabled ("0")
```

Typical Response: +1.00000000E+02,+1.00000000E+02
0

See Also

CONFigure:RESistance

[SENSe:]RESistance:APERture

[SENSe:]RESistance:APERture:ENABLEd?

[SENSe:]RESistance:NPLC

[SENSe:]RESistance:ZERO:AUTO

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

[SENSe:]RESistance:ZERO:AUTO <mode> [, (@<ch_list>)]

[SENSe:]RESistance:ZERO:AUTO? [(@<ch_list>)]

Description

This command disables or enables the autozero mode on the specified channels. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

When autozero is enabled (default), the instrument internally disconnects the input signal following each measurement, and takes a *zero* reading. It then subtracts the zero reading from the preceding reading. This prevents offset voltages present on the instrument's input circuitry from affecting measurement accuracy.

When autozero is disabled, the instrument takes one zero reading and subtracts it from all subsequent measurements. It takes a new zero reading each time you change the function, range, or integration time.

Used With:

- 34921A through 34925A Multiplexer Modules

Parameters

Name	Type	Range of Values	Default Value
<mode>	Discrete	{OFF ONCE 0 ON 1}	Autozero ON
<ch_list>	Numeric	One or more channels in the form (@sccc) .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- Applies to 2-wire ohms measurements only. Autozero is automatically enabled when you select 4-wire ohms measurements.
- The OFF and ONCE parameters have a similar effect. Autozero OFF does *not* issue a new zero measurement. Autozero ONCE issues an immediate zero measurement.

- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.
- The autozero mode is set indirectly when you set the [resolution](#) and integration time. Autozero is automatically turned off when you select an integration time less than 1 PLC.
- The CONFigure and MEASure? commands automatically enable autozero.
- The autozero setting is stored in **volatile** memory and will be enabled (autozero ON) when power is turned off or after a Factory Reset (***RST** command).

Return Format

The query command returns "0" (OFF or ONCE) or "1" (ON) for each channel specified. Multiple responses are separated by commas.

Examples

The following command disables autozero on channels 3 and 13 in slot 1. With autozero disabled, a new zero measurement is not issued until the next time the instrument goes to the "wait-for-trigger" state.

```
RES:ZERO:AUTO OFF, (@1003, 1013)
```

The following query returns the autozero settings on channels 3 and 13 in slot 1.

```
RES:ZERO:AUTO? (@1003, 1013)
```

Typical Response: 0,0

See Also

CONFigure:RESistance

[SENSe:]CURRent[:DC]:ZERO:AUTO

[SENSe:]TEMPerature:ZERO:AUTO

[SENSe:]VOLTage[:DC]:ZERO:AUTO

[SENSe:]TEMPerature:APERture

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

[SENSe:]TEMPerature:APERture {<seconds>|MIN|MAX|DEF} [, (@<ch_list>)]

[SENSe:]TEMPerature:APERture? [(@<ch_list>)|MIN|MAX]

Description

This command enables the aperture mode and sets the integration time in seconds (called *aperture time*) for temperature measurements on the specified channels. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

NOTE

You should use this command only when you want precise control of the integration time of the internal DMM. Otherwise, specifying integration time using NPLC (see [\[SENSe:\]TEMPerature:NPLC](#) command) executes faster and offers better noise rejection characteristics for values of NPLC greater than 1.

The following table shows which temperature transducers are supported by each of the multiplexer modules.

	Thermocouple	RTD 2-Wire	RTD 4-Wire	Thermistor
34921A Armature Multiplexer	Yes ¹	Yes	Yes	Yes
34922A Armature Multiplexer	Yes ²	Yes	Yes	Yes
34923A Reed Multiplexer (2-Wire)	Yes ^{2,3}	Yes ⁴	Yes ⁴	Yes ⁵
34923A Reed Multiplexer (1-Wire)	Yes ^{2,3}	Yes ⁴	No	Yes ⁵
34924A Reed Multiplexer	Yes ^{2,3}	Yes ⁴	Yes ⁴	Yes ⁵
34925A FET Multiplexer (2-Wire)	Yes ²	No	Yes ⁵	No
34925A FET Multiplexer (1-Wire)	Yes ²	No	No	No

¹Optional 34921T Terminal Block is required for thermocouple measurements with built-in internal reference junction.

²A fixed or external reference junction temperature is required for thermocouple measurements with this module.

³Impact of higher offset voltage specification ($< 50 \mu\text{V}$) must be taken into consideration.

⁴1 k Ω or higher range used unless 100 Ω series resistors are bypassed on module.

⁵10 k Ω or higher range used for loads over approximately 300 Ω due to series resistance of FET channels.

Parameters

Name	Type	Range of Values	Default Value
<seconds>	Numeric	Desired aperture time in seconds between 300 μs and 1 second, with 4 μs resolution. MIN = 300 μs , MAX = 1 second	Aperture disabled.
<ch_list>	Numeric	One or more channels in the form <u>(@sccc)</u> .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- For the <seconds> parameter, you can substitute MIN or MAX for a numeric value. MIN selects the smallest value accepted, which gives the lowest resolution; MAX selects the largest value accepted, which gives the highest resolution.
- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.
- Only the integral number of power line cycles (1, 2, 10, 20, 100, or 200 PLCs) provide normal mode (line frequency noise) rejection.
- The CONFigure, MEASure?, and [SENSe:]TEMPerature:NPLC commands disable the aperture mode (these commands select an integration time in number of power line cycles). You can use the **[SENSe:]TEMPerature:APERture:ENABLEd?** command to query whether the aperture mode is currently enabled or disabled.
- The aperture mode is disabled after a Factory Reset (***RST** command). An Instrument Preset (**SYSTem:PRESet** command) or Card Reset (**SYSTem:CPON** command) does not change the setting.

Return Format

The query command returns the aperture time in the form "+1.00000000E-01" for each channel specified. Multiple responses are separated by commas. Note that if the aperture mode is currently disabled (see **[SENSe:]TEMPerature:APERture:ENABLEd?** command), the value returned will represent the previous value specified, *not* the actual integration time.

Examples

The following command enables the aperture mode and sets the aperture time to 300 ms on channels 3 and 13 in slot 1.

```
TEMP:APER 300E-03, (@1003,1013)
```

The following query returns the aperture time selected on channels 3 and 13 in slot 1.

```
TEMP:APER? (@1003,1013)  
TEMP:APER:ENAB? !Verify that aperture mode is enabled ("1")
```

Typical	+3.00000000E-
Response:	01,+3.00000000E-01
	1

See Also

[CONFigure:TEMPerature](#)

[\[SENSe:\]TEMPerature:APERture:ENABLEd?](#)

[\[SENSe:\]TEMPerature:NPLC](#)

[SENSe:]TEMPerature:APERture:ENABLEd?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

[SENSe:]TEMPerature:APERture:ENABLEd? [(@<ch_list>)]

Description

This command queries whether the aperture mode is enabled or disabled for temperature measurements on the specified channels. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

The following table shows which temperature transducers are supported by each of the multiplexer modules.

	Thermocouple	RTD 2-Wire	RTD 4-Wire	Thermistor
34921A Armature Multiplexer	Yes ¹	Yes	Yes	Yes
34922A Armature Multiplexer	Yes ²	Yes	Yes	Yes
34923A Reed Multiplexer (2-Wire)	Yes ^{2,3}	Yes ⁴	Yes ⁴	Yes ⁵
34923A Reed Multiplexer (1-Wire)	Yes ^{2,3}	Yes ⁴	No	Yes ⁵
34924A Reed Multiplexer	Yes ^{2,3}	Yes ⁴	Yes ⁴	Yes ⁵
34925A FET Multiplexer (2-Wire)	Yes ²	No	Yes ⁵	No
34925A FET Multiplexer (1-Wire)	Yes ²	No	No	No

¹ Optional 34921T Terminal Block is required for thermocouple measurements with built-in internal reference junction.

² A fixed or external reference junction temperature is required for thermocouple measurements with this module.

³ Impact of higher offset voltage specification (< 50 μ V) must be taken into consideration.

⁴ 1 k Ω or higher range used unless 100 Ω series resistors are bypassed on module.

⁵ 10 k Ω or higher range used for loads over approximately 300 Ω due to series resistance of FET channels.

Parameters

Name	Type	Range of Values	Default Value
<ch_list>	Numeric	One or more channels in the form <u>(@sccc)</u> .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- The CONFigure, MEASure?, and [SENSe:]TEMPerature:NPLC commands disable the aperture mode (these commands select an integration time in number of power line cycles).

Return Format

The query command returns "0" if the aperture mode is disabled or "1" if the aperture mode is enabled for each channel specified. Multiple responses are separated by commas.

Example

The following command returns the state of the aperture mode on channels 3 and 13 in slot 1.

```
TEMP:APER:ENAB? (@1003,1013)
```

Typical Response: 1,1

See Also

CONFigure:TEMPerature

[SENSe:]TEMPerature:APERture

[SENSe:]TEMPerature:NPLC

[SENSe:]TEMPerature:NPLC

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Syntax

[SENSe:]TEMPerature:NPLC {<PLCs>|MIN|MAX|DEF} [, (@<ch_list>)]

[SENSe:]TEMPerature:NPLC? [(@<ch_list>)|MIN|MAX]

Description

This command sets the **integration time** in number of power line cycles (PLCs) on the specified channels. Integration time affects the measurement resolution (for better resolution, use a longer integration time) and measurement speed (for faster measurements, use a shorter integration time). If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

The following table shows which temperature transducers are supported by each of the multiplexer modules.

	Thermocouple	RTD 2-Wire	RTD 4-Wire	Thermistor
34921A Armature Multiplexer	Yes ¹	Yes	Yes	Yes
34922A Armature Multiplexer	Yes ²	Yes	Yes	Yes
34923A Reed Multiplexer (2-Wire)	Yes ^{2,3}	Yes ⁴	Yes ⁴	Yes ⁵
34923A Reed Multiplexer (1-Wire)	Yes ^{2,3}	Yes ⁴	No	Yes ⁵
34924A Reed Multiplexer	Yes ^{2,3}	Yes ⁴	Yes ⁴	Yes ⁵
34925A FET Multiplexer (2-Wire)	Yes ²	No	Yes ⁵	No
34925A FET Multiplexer (1-Wire)	Yes ²	No	No	No

¹Optional 34921T Terminal Block is required for thermocouple measurements with built-in internal reference junction.

²A fixed or external reference junction temperature is required for thermocouple measurements with this module.

³Impact of higher offset voltage specification (< 50 μ V) must be taken into consideration.

⁴1 k Ω or higher range used unless 100 Ω series resistors are bypassed on module.

⁵10 k Ω or higher range used for loads over approximately 300 Ω due to series resistance of FET channels.

Parameters

Name	Type	Range of Values	Default Value
<PLCs>	Discrete	{0.02 0.2 1 2 10 20 100 200} MIN = 0.02 PLC, MAX = 200 PLC	1 PLC
<ch_list>	Numeric	One or more channels in the form (@sccc) .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- Only the integral number of power line cycles (1, 2, 10, 20, 100, or 200 PLCs) provide normal mode (line frequency noise) rejection.
- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.
- Setting the integration time also sets the resolution for the measurement. Click [here](#) to see the relationship between integration time, measurement resolution, number of digits, and number of bits.
- The specified integration time is used for all measurements on the selected channels. If you have applied Mx+B scaling or have assigned alarms to the selected channel, those measurements are also made using the specified integration time. Measurements taken during the Monitor function also use the specified integration time.
- You can also set the integration time by specifying an *aperture time* (see [\[SENSe:\]TEMPerature:APERTure](#) command). However, note that specifying integration time using NPLCs executes faster and offers better noise rejection characteristics for values of NPLC greater than 1.
- The CONFIGure, MEASure?, and [\[SENSe:\]TEMPerature:NPLC](#) commands disable the aperture mode (these commands select an integration time in number of power line cycles). You can use the [\[SENSe:\]TEMPerature:APERTure:ENABLEd?](#) command to query whether the aperture mode is currently enabled or disabled.
- The instrument sets the integration time to 1 PLC after a Factory Reset ([*RST](#) command). An Instrument Pre-set ([SYSTem:PRESet](#) command) or Card Reset ([SYSTem:CPON](#) command) does *not* change the setting.

Return Format

The query command returns the integration time in the form "+1.00000000E+00" for each channel specified. Multiple responses are separated by commas. Note that if the aperture mode is currently enabled (see [\[SENSe:\]TEMPerature:APERTure:ENABLEd?](#) command), the value returned will represent the previous value specified, *not* the actual integration time.

Examples

The following command set the integration time to 0.2 PLCs on channels 3 and 13 in slot 1.

```
TEMP:NPLC 0.2, (@1003,1013)
```

The following query returns the integration time settings on channels 3 and 13 in slot 1.

```
TEMP:NPLC? (@1003,1013)
TEMP:APER:ENAB? !Verify that aperture mode is disabled ("0")
```

Typical	+2.00000000E-
Response:	01,+2.00000000E-01
	0

See Also

[CONFigure:TEMPerature](#)

[\[SENSe:\]TEMPerature:APERture](#)

[\[SENSe:\]TEMPerature:APERture:ENABLEd?](#)

[SENSe:]TEMPerature:TRANsducer:TYPE

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

[SENSe:]TEMPerature:TRANsducer:TYPE <probe_type> [, (@<ch_list>)]

[SENSe:]TEMPerature:TRANsducer:TYPE? [(@<ch_list>)]

Description

This command selects the temperature transducer probe type to use for measurements on the specified channels. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

The following table shows which temperature transducers are supported by each of the multiplexer modules.

	Thermocouple	RTD 2-Wire	RTD 4-Wire	Thermistor
34921A Armature Multiplexer	Yes ¹	Yes	Yes	Yes
34922A Armature Multiplexer	Yes ²	Yes	Yes	Yes
34923A Reed Multiplexer (2-Wire)	Yes ^{2,3}	Yes ⁴	Yes ⁴	Yes ⁵
34923A Reed Multiplexer (1-Wire)	Yes ^{2,3}	Yes ⁴	No	Yes ⁵
34924A Reed Multiplexer	Yes ^{2,3}	Yes ⁴	Yes ⁴	Yes ⁵
34925A FET Multiplexer (2-Wire)	Yes ²	No	Yes ⁵	No
34925A FET Multiplexer (1-Wire)	Yes ²	No	No	No

¹ Optional 34921T Terminal Block is required for thermocouple measurements with built-in internal reference junction.

² A fixed or external reference junction temperature is required for thermocouple measurements with this module.

³ Impact of higher offset voltage specification (< 50 μ V) must be taken into consideration.

⁴ 1 k Ω or higher range used unless 100 Ω series resistors are bypassed on module.

⁵ 10 k Ω or higher range used for loads over approximately 300 Ω due to series resistance of FET channels.

Parameters

Name	Type	Range of Values	Default Value
<probe_type>	Discrete	{TCouple RTD FRTD THERmistor}	TCouple
<ch_list>	Numeric	One or more channels in the form (@sccc).	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.
- Thermocouple measurements directed at the internal DMM (i.e., no <ch_list> specified) require that a *fixed* reference junction temperature be used (see [SENSe:]TEMPerature:TRANsducer:TCouple:RJUNction:TYPE command).
- For 4-wire RTD measurements (FRTD), the instrument automatically pairs channel *n* in Bank 1 with channel *n+20* in Bank 2 (34921A, 34923A) or *n+35* (34922A, 34924A) to provide the source and sense connections. For example, make the source connections to the HI and LO terminals on channel 2 in Bank 1 and the sense connections to the HI and LO terminals on channel 22 (or 37) in Bank 2. Specify the paired channel in Bank 1 (source) as the <ch_list> channel (channels in Bank 2 are not allowed in the <ch_list>).
- The instrument selects thermocouple as the probe type after a Factory Reset (*RST command). An Instrument Preset (SYSTem:PRESet command) or Card Reset (SYSTem:CPON command) does *not* change the setting.

Return Format

The query command returns "TC", "RTD", "FRTD", or "THER" for each channel specified. Multiple responses are separated by commas.

Examples

The following command selects the RTD probe type on channels 3 and 13 in slot 1.

```
TEMP:TRAN:TYPE RTD, (@1003,1013)
```

The following query returns the probe selections on channels 3 and 13 in slot 1.

```
TEMP:TRAN:TYPE? (@1003,1013)
```

Typical Response: RTD,RTD

See Also

[CONFigure:TEMPerature](#)

[SENSe:]TEMPerature:ZERO:AUTO

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

[SENSe:]TEMPerature:ZERO:AUTO <mode> [, (@<ch_list>)]

[SENSe:]TEMPerature:ZERO:AUTO? [(@<ch_list>)]

Description

This command disables or enables the autozero mode on the specified channels. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

When autozero is enabled (default), the instrument internally disconnects the input signal following each measurement, and takes a *zero* reading. It then subtracts the zero reading from the preceding reading. This prevents offset voltages present on the instrument's input circuitry from affecting measurement accuracy.

When autozero is disabled, the instrument takes one zero reading and subtracts it from all subsequent measurements. It takes a new zero reading each time you change the function, range, or integration time.

The following table shows which temperature transducers are supported by each of the multiplexer modules.

	Thermocouple	RTD 2-Wire	RTD 4-Wire	Thermistor
34921A Armature Multiplexer	Yes ¹	Yes	Yes	Yes
34922A Armature Multiplexer	Yes ²	Yes	Yes	Yes
34923A Reed Multiplexer (2-Wire)	Yes ^{2,3}	Yes ⁴	Yes ⁴	Yes ⁵
34923A Reed Multiplexer (1-Wire)	Yes ^{2,3}	Yes ⁴	No	Yes ⁵
34924A Reed Multiplexer	Yes ^{2,3}	Yes ⁴	Yes ⁴	Yes ⁵
34925A FET Multiplexer (2-Wire)	Yes ²	No	Yes ⁵	No
34925A FET Multiplexer (1-Wire)	Yes ²	No	No	No

¹Optional 34921T Terminal Block is required for thermocouple measurements with built-in internal reference junction.

²A fixed or external reference junction temperature is required for thermocouple measurements with this module.

³Impact of higher offset voltage specification ($< 50 \mu\text{V}$) must be taken into consideration.

⁴1 k Ω or higher range used unless 100 Ω series resistors are bypassed on module.

⁵10 k Ω or higher range used for loads over approximately 300 Ω due to series resistance of FET channels.

Parameters

Name	Type	Range of Values	Default Value
<mode>	Discrete	{OFF ONCE 0 ON 1}	Autozero ON
<ch_list>	Numeric	One or more channels in the form <u>(@sccc)</u> .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- Applies to temperature measurements only. Autozero is automatically enabled for 4-wire RTD measurements.
- The OFF and ONCE parameters have a similar effect. Autozero OFF does *not* issue a new zero measurement. Autozero ONCE issues an immediate zero measurement.
- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.
- The autozero mode is set indirectly when you set the resolution and integration time. Autozero is automatically turned off when you select an integration time less than 1 PLC.
- You can set autozero from the remote interface only; you cannot directly set autozero from the front panel.
- The CONFigure and MEASure? commands automatically enable autozero.
- The autozero setting is stored in volatile memory and will be enabled (autozero ON) when power is turned off or after a Factory Reset (*RST command).

Return Format

The query command returns "0" (OFF or ONCE) or "1" (ON) for each channel specified. Multiple responses are separated by commas.

Examples

The following command disables autozero on channels 3 and 13 in slot 1. With autozero disabled, a new zero measurement is not issued until the next time the instrument goes to the "wait-for-trigger" state.

```
TEMP:ZERO:AUTO OFF, (@1003,1013)
```

The following query returns the autozero settings on channels 3 and 13 in slot 1.

```
TEMP:ZERO:AUTO? (@1003,1013)
```

Typical Response: 0,0

See Also

[CONFigure:TEMPerature](#)

[\[SENSe:\]CURREnt\[:DC\]:ZERO:AUTO](#)

[\[SENSe:\]RESistance:ZERO:AUTO](#)

[\[SENSe:\]VOLTage\[:DC\]:ZERO:AUTO](#)

[SENSe:]TEMPerature:TRANsducer:FRTD:OCOMpensated

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

[SENSe:]TEMPerature:TRANsducer:FRTD:OCOMpensated <mode> [, (@<ch_list>)]

[SENSe:]TEMPerature:TRANsducer:FRTD:OCOMpensated? [(@<ch_list>)]

Description

Offset compensation removes the effects of any dc voltages in the circuit being measured. The technique involves taking the difference between two resistance measurements on the specified channels, one with the current source turned on and one with the current source turned off. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

Used With:

- 34921A Armature Multiplexer
- 34922A Armature Multiplexer
- 34923A Reed Multiplexer (differential mode only)
- 34924A Reed Multiplexer

Parameters

Name	Type	Range of Values	Default Value
<mode>	Boolean	{OFF 0 ON 1}	OFF 0
<ch_list>	Numeric	One or more channels in the form (@sccc) .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- Applies only to 2-wire and 4-wire RTD measurements on the 100 Ω , 1 k Ω , and 10 k Ω ranges. Once enabled, offset compensation is applied to both 2-wire and 4-wire RTD measurements on the specified channels.
- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.
- Since 2-wire and 4-wire resistance are related functions, changing a measurement parameter for one function will also change the corresponding parameter for the other function (see [\[SENSe:\]TEMPerature:TRANsducer:RTD:OCOMpensated](#) command).

- For 4-wire resistance measurements, the instrument automatically pairs channel *n* in Bank 1 with channel *n+20* in Bank 2 (34921A, 34923A) or *n+35* (34922A, 34924A) to provide the source and sense connections. For example, make the source connections to the HI and LO terminals on channel 2 in Bank 1 and the sense connections to the HI and LO terminals on channel 22 (or 37) in Bank 2. Specify the paired channel in Bank 1 (source) as the <ch_list> channel (channels in Bank 2 are not allowed in the <ch_list>).
- Four-wire measurements are not allowed on the multiplexer modules configured for the single-ended mode (see **SYSTem:MODule:WIRE:MODE** command).
- The CONFigure and MEASure? commands automatically disable offset compensation.
- The instrument disables offset compensation after a Factory Reset (***RST** command). An Instrument Preset (**SYSTem:PRESet** command) or Card Reset (**SYSTem:CPON** command) does *not* change the setting.

Return Format

The query command returns "0" (OFF) or "1" (ON) for each channel specified. Multiple responses are separated by commas.

Examples

The following command enables offset compensation on channels 3 and 13 in slot 1. For this 4-wire measurement, the instrument automatically pairs these channels in Bank 1 with the corresponding channels in Bank 2.

```
TEMP:TRAN:FRTD:OCOM ON, (@1003, 1013)
```

The following query returns the offset compensation settings on channels 3 and 13 in slot 1.

```
TEMP:TRAN:FRTD:OCOM? (@1003, 1013)
```

Typical Response: 1,1

See Also

CONFigure:TEMPerature

[SENSe:]TEMPerature:TRANsducer:FRTD:REFerence

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

[SENSe:]TEMPerature:TRANsducer:FRTD:REFerence <mode> [, (@<ch_list>)]

[SENSe:]TEMPerature:TRANsducer:FRTD:REFerence? [(@<ch_list>)]

Description

This command disables or enables the specified 4-wire RTD channels to be used as the reference channel for subsequent thermocouple measurements that specify an external reference source (see [SENSe:]TEMPerature:TRANsducer:TCouple:RJUNction:TYPE command). If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

Used With:

- 34921A Armature Multiplexer (with optional 34921T Terminal Block)
- 34922A Armature Multiplexer
- 34923A Reed Multiplexer (differential mode only)
- 34924A Reed Multiplexer

Parameters

Name	Type	Range of Values	Default Value
<mode>	Boolean	{OFF 0 ON 1}	OFF
<ch_list>	Numeric	One or more channels in the form (@sccc).	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.
- Since 2-wire and 4-wire resistance are related functions, changing a measurement parameter for one function will also change the corresponding parameter for the other function (see [SENSe:]TEMPerature:TRANsducer:RTD:REFerence command).

- For 4-wire RTD measurements, the instrument automatically pairs channel n in Bank 1 with channel $n+20$ in Bank 2 (34921A, 34923A) or $n+35$ (34922A, 34924A) to provide the source and sense connections. For example, make the source connections to the HI and LO terminals on channel 2 in Bank 1 and the sense connections to the HI and LO terminals on channel 22 (or 37) in Bank 2. Specify the paired channel in Bank 1 (source) as the <ch_list> channel (channels in Bank 2 are not allowed in the <ch_list>).
- When you initiate a measurement on the selected channels (see **INITiate** or **READ?** command), the acquired temperature is stored in **volatile** memory in the reference register. Subsequent thermocouple measurements use the stored temperature as their reference.
- At power-on, the reference register is loaded with "9.9E+37". Note that until you store a reference temperature, all thermocouple measurements that specify an external reference source will be returned as "9.9E+37". Use the **[SENSe:]TEMPerature:TRANsducer:TCouple:RJUNction:EXTernal?** command to read the most-recently stored reference temperature value.
- The reference temperature can also be stored using a thermistor measurement. See the **[SENSe:]TEMPerature:TRANsducer:THERmistor:REference** command for more information.

Return Format

The query command returns "0" (OFF) or "1" (ON) for each channel specified. Multiple responses are separated by commas.

Examples

Example 1: Making Externally-Referenced Thermocouple Measurements with Multiplexer Channels

The following commands configure multiplexer channel 3 in slot 1 for thermocouple measurements and select an *external* reference junction for that channel.

```
CONF:TEMP TC,J, (@1003)
TEMP:TRAN:TC:RJUN:TYPE EXT, (@1003)
```

The following commands configure multiplexer channel 1 in slot 1 for 4-wire RTD measurements and assign this channel as the reference channel. For this 4-wire measurement, the instrument automatically pairs this channel in Bank 1 with the corresponding channel in Bank 2.

```
CONF:TEMP FRTD,85, (@1001)
TEMP:TRAN:FRTD:REF ON, (@1001)
```

The following commands set up a scan list that contains both the reference channel (channel 1) and the thermocouple channel (channel 3). If you do not include the reference channel in the active scan list, the instrument uses the temperature previously stored in the reference register. The **INITiate** command initiates the scan.

```
ROUT:SCAN (@1001:1005)
INIT
```

Example 2: Making Externally-Referenced Thermocouple Measurements with the Internal DMM

The following commands configure the internal DMM (no <ch_list> specified) for 4-wire RTD measurements and assign the internal DMM as the reference "channel".

```
CONF:TEMP FRTD,85  
TEMP:TRAN:FRTD:REF ON
```

The following command initiates an RTD measurement on the internal DMM and stores the value in the reference register.

```
INIT
```

The following commands configure the internal DMM for thermocouple measurements and select an *external* reference junction.

```
CONF:TEMP TC,J  
TEMP:TRAN:TC:RJUN:TYPE EXT
```

The following commands change the sample count to take 10 thermocouple measurements and initiate the internal DMM.

```
SAMP:COUN 10  
INIT
```

Example 3: Querying the Reference Channel State

The following command returns the state of reference channel 3 in slot 1.

```
TEMP:TRAN:FRTD:REF? (@1003)
```

Typical Response: 1

See Also

CONFigure:TEMPerature

[SENSe:]TEMPerature:TRANsducer:TCouple:RJUNction:EXTernal?

[SENSe:]TEMPerature:TRANsducer:TCouple:RJUNction:TYPE

[SENSe:]TEMPerature:TRANsducer:THERmistor:REFerence

[SENSe:]TEMPerature:TRANsdncer:FRTD:RESistance[:REFerence]

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

[SENSe:]TEMPerature:TRANsdncer:FRTD:RESistance[:REFerence] {<reference>|MIN|MAX|DEF} [, (@<ch_list>)]

[SENSe:]TEMPerature:TRANsdncer:FRTD:RESistance[:REFerence]? [{(@<ch_list>)|MIN|MAX}]

Description

The resistance of an RTD is nominal at 0 °C and is referred to as *Ro*. This command selects the nominal resistance (*Ro*) for 4-wire RTD measurements on the specified channels. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

Used With:

- 34921A Armature Multiplexer
- 34922A Armature Multiplexer
- 34923A Reed Multiplexer (differential mode only)
- 34924A Reed Multiplexer

Parameters

Name	Type	Range of Values	Default Value
<reference>	Numeric	Any value between 49Ω and 2.1 kΩ. MIN = 49Ω, MAX = 2.1 kΩ	Ro = 100Ω
<ch_list>	Numeric	One or more channels in the form (@sccc) .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.
- Since 2-wire and 4-wire resistance are related functions, changing a measurement parameter for one function will also change the corresponding parameter for the other function (see [\[SENSe:\]TEMPerature:TRANsdncer:RTD:RESistance\[:REFerence\]](#) command).

- For 4-wire RTD measurements, the instrument automatically pairs channel n in Bank 1 with channel $n+20$ in Bank 2 (34921A, 34923A) or $n+35$ (34922A, 34924A) to provide the source and sense connections. For example, make the source connections to the HI and LO terminals on channel 2 in Bank 1 and the sense connections to the HI and LO terminals on channel 22 (or 37) in Bank 2. Specify the paired channel in Bank 1 (source) as the <ch_list> channel (channels in Bank 2 are not allowed in the <ch_list>).
- Four-wire RTD measurements are not allowed on the multiplexer modules configured for the single-ended mode (see **SYSTem:MODUle:WIRE:MODE** command).
- The instrument sets the nominal resistance to 100 Ω after a Factory Reset (***RST** command). An Instrument Preset (**SYSTem:PRESet** command) or Card Reset (**SYSTem:CPON** command) does *not* change the setting.

Return Format

The query command returns the nominal resistance setting in ohms for each channel specified. Multiple responses are separated by commas.

Examples

The following command sets R_o to 1000 Ω on channels 3 and 13 in slot 1. Note that for this 4-wire measurement, channels 3 and 13 in Bank 1 are automatically paired with channels 23 and 33 in Bank 2, respectively (assumes 34921A).

```
TEMP:TRAN:FRTD:RES 1000, (@1003,1013)
```

The following query returns the R_o settings on channels 3 and 13 in slot 1.

```
TEMP:TRAN:FRTD:RES? (@1003,1013)
```

Typical Response: +1.00000000E+03,+1.00000000E+03

See Also

CONFigure:TEMPerature

[SENSe:]TEMPerature:TRANsducer:FRTD:TYPE

[SENSe:]TEMPerature:TRANsducer:FRTD:TYPE

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

[SENSe:]TEMPerature:TRANsducer:FRTD:TYPE <type> [, (@<ch_list>)]

[SENSe:]TEMPerature:TRANsducer:FRTD:TYPE? [(@<ch_list>)]

Description

This command selects the RTD type for 4-wire temperature measurements on the specified channels. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

Used With:

- 34921A Armature Multiplexer
- 34922A Armature Multiplexer
- 34923A Reed Multiplexer (differential mode only)
- 34924A Reed Multiplexer

Parameters

Name	Type	Range of Values	Default Value
<type>	Discrete	{85 91}*	85
<ch_list>	Numeric	One or more channels in the form (@sccc).	If <ch_list> is omitted, this command applies to the internal DMM.

* Using IPTS-68 software conversions.

Remarks

- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.
- For 4-wire RTD measurements, the instrument automatically pairs channel *n* in Bank 1 with channel *n+20* in Bank 2 (34921A, 34923A) or *n+35* (34922A, 34924A) to provide the source and sense connections. For example, make the source connections to the HI and LO terminals on channel 2 in Bank 1 and the sense connections to the HI and LO terminals on channel 22 (or 37) in Bank 2. Specify the paired channel in Bank 1 (source) as the <ch_list> channel (channels in Bank 2 are not allowed in the <ch_list>).

- Four-wire RTD measurements are not allowed on the multiplexer modules configured for the single-ended mode (see **SYSTem:MODule:WIRE:MODE** command).
- The instrument supports RTDs with Alpha = 0.00385 (DIN/IEC 751) using ITS-90 software conversions or Alpha = 0.00391 using IPTS-68 software conversions.
- "PT100" is a special label that is sometimes used to refer to an RTD with Alpha = 0.00385 and **Ro** = 100 Ω .
- The instrument sets the RTD type to "85" after a Factory Reset (***RST** command). An Instrument Preset (**SYSTem:PRESet** command) or Card Reset (**SYSTem:CPON** command) does not change the setting.

Return Format

The query command returns "+85" or "+91" for each channel specified. Multiple responses are separated by commas.

Examples

The following command selects Type 85 RTDs on channels 3 and 13 in slot 1. Note that for this 4-wire measurement, channels 3 and 13 in Bank 1 are automatically paired with channels 23 and 33 in Bank 2, respectively (assumes 34921A).

```
TEMP:TRAN:FRTD:TYPE 91, (@1003,1013)
```

The following query returns the RTD type selections on channels 3 and 13 in slot 1.

```
TEMP:TRAN:FRTD:TYPE? (@1003,1013)
```

Typical Response: **+91,+91**

See Also

CONFigure:TEMPerature

[SENSe:]TEMPerature:TRANsducer:RTD:RESistance

[SENSe:]TEMPerature:TRANsducer:RTD:TYPE

[SENSe:]TEMPerature:TRANsducer:RTD:OCOMpensated

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

[SENSe:]TEMPerature:TRANsducer:RTD:OCOMpensated <mode> [, (@<ch_list>)]

[SENSe:]TEMPerature:TRANsducer:RTD:OCOMpensated? [(@<ch_list>)]

Description

Offset compensation removes the effects of any dc voltages in the circuit being measured. The technique involves taking the difference between two resistance measurements on the specified channels, one with the current source turned on and one with the current source turned off. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

Used With:

- 34921A Armature Multiplexer
- 34922A Armature Multiplexer
- 34923A Reed Multiplexer
- 34924A Reed Multiplexer

Parameters

Name	Type	Range of Values	Default Value
<mode>	Boolean	{OFF 0 ON 1}	OFF 0
<ch_list>	Numeric	One or more channels in the form (@sccc) .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- Applies only to 2-wire and 4-wire RTD measurements on the 100 Ω , 1 k Ω , and 10 k Ω ranges. Once enabled, offset compensation is applied to both 2-wire and 4-wire RTD measurements on the specified channels.
- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.

- Since 2-wire and 4-wire resistance are related functions, changing a measurement parameter for one function will also change the corresponding parameter for the other function (see [\[SENSe:\]TEMPerature:TRANsducer:FRTD:OCOMpensated](#) command).
- The CONFigure and MEASure? commands automatically disable offset compensation.
- The instrument disables offset compensation after a Factory Reset (***RST** command). An Instrument Preset (**SYSTem:PRESet** command) or Card Reset (**SYSTem:CPON** command) does *not* change the setting.

Return Format

The query command returns "0" (OFF) or "1" (ON) for each channel specified. Multiple responses are separated by commas.

Examples

The following command enables offset compensation on channels 3 and 13 in slot 1.

```
TEMP:TRAN:RTD:OCOM ON, (@1003,1013)
```

The following query returns the offset compensation settings on channels 3 and 13 in slot 1.

```
TEMP:TRAN:RTD:OCOM? (@1003,1013)
```

Typical Response: 1,1

See Also

[CONFigure:TEMPerature](#)

[SENSe:]TEMPerature:TRANsducer:RTD:RESistance[:REFerence]

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

[SENSe:]TEMPerature:TRANsducer:RTD:RESistance[:REFerence] {<reference>|MIN|MAX|DEF} [, (@<ch_list>)]

[SENSe:]TEMPerature:TRANsducer:RTD:RESistance[:REFerence]? [{(@<ch_list>)|MIN|MAX}]

Description

The resistance of an RTD is nominal at 0 °C and is referred to as *Ro*. This command selects the nominal resistance (*Ro*) for 2-wire RTD measurements on the specified channels. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

Used With:

- 34921A Armature Multiplexer
- 34922A Armature Multiplexer
- 34923A Reed Multiplexer
- 34924A Reed Multiplexer

Parameters

Name	Type	Range of Values	Default Value
<reference>	Numeric	Any value between 49Ω and 2.1 kΩ. MIN = 49Ω, MAX = 2.1 kΩ	Ro = 100Ω
<ch_list>	Numeric	One or more channels in the form <u>(@sccc)</u> .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.
- Since 2-wire and 4-wire resistance are related functions, changing a measurement parameter for one function will also change the corresponding parameter for the other function (see [SENSe:]TEMPerature:TRANsducer:FRTD:RESistance[:REFerence] command).

- The instrument sets the nominal resistance to 100Ω after a Factory Reset (***RST** command). An Instrument Preset (**SYSTem:PRESet** command) or Card Reset (**SYSTem:CPON** command) does *not* change the setting.

Return Format

The query command returns the nominal resistance setting in ohms for each channel specified. Multiple responses are separated by commas.

Examples

The following command sets Ro to 1000Ω on channels 3 and 13 in slot 1.

```
TEMP:TRAN:RTD:RES 1000, (@1003,1013)
```

The following query returns the Ro settings on channels 3 and 13 in slot 1.

```
TEMP:TRAN:RTD:RES? (@1003,1013)
```

Typical Response: +1.00000000E+03,+1.00000000E+03

See Also

CONFigure:TEMPerature

[SENSe:]TEMPerature:TRANsducer:RTD:TYPE

[SENSe:]TEMPerature:TRANsducer:RTD:TYPE

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

[SENSe:]TEMPerature:TRANsducer:RTD:TYPE <type> [, (@<ch_list>)]

[SENSe:]TEMPerature:TRANsducer:RTD:TYPE? [(@<ch_list>)]

Description

This command selects the RTD type for 2-wire temperature measurements on the specified channels. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

Used With:

- 34921A Armature Multiplexer
- 34922A Armature Multiplexer
- 34923A Reed Multiplexer
- 34924A Reed Multiplexer

Parameters

Name	Type	Range of Values	Default Value
<type>	Discrete	{85 91}*	85
<ch_list>	Numeric	One or more channels in the form (@sccc).	If <ch_list> is omitted, this command applies to the internal DMM.

* Using ITS-90 (85) and IPTS-68 (91) software conversions.

Remarks

- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.
- The instrument supports RTDs with Alpha = 0.00385 (DIN/IEC 751) using ITS-90 software conversions or Alpha = 0.00391 using IPTS-68 software conversions.
- "PT100" is a special label that is sometimes used to refer to an RTD with Alpha = 0.00385 and Ro = 100Ω.
- The instrument sets the RTD type to "85" after a Factory Reset (*RST command). An Instrument Preset (SYSTem:PRESet command) or Card Reset (SYSTem:CPON command) does not change the setting.

Return Format

The query command returns "+85" or "+91" for each channel specified. Multiple responses are separated by commas.

Examples

The following command selects Type 85 RTDs on channels 3 and 13 in slot 1.

```
TEMP:TRAN:RTD:TYPE 91, (@1003, 1013)
```

The following query returns the RTD type selections on channels 3 and 13 in slot 1.

```
TEMP:TRAN:RTD:TYPE? (@1003, 1013)
```

Typical Response: **+91,+91**

See Also

[CONFigure:TEMPerature](#)

[\[SENSe:\]TEMPerature:TRANsducer:FRTD:TYPE](#)

[\[SENSe:\]TEMPerature:TRANsducer:RTD:RESistance](#)

[SENSe:]TEMPerature:TRANsducer:RTD:REFeRence

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

[SENSe:]TEMPerature:TRANsducer:RTD:REFeRence <mode> [, (@<ch_list>)]

[SENSe:]TEMPerature:TRANsducer:RTD:REFeRence? [(@<ch_list>)]

Description

This command disables or enables the specified 2-wire RTD channels to be used as the reference channel for subsequent thermocouple measurements that specify an external reference source (see [\[SENSe:\]TEMPerature:TRANsducer:TCouple:RJUNction:TYPE](#) command). If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

Used With:

- 34921A Armature Multiplexer (with optional 34921T Terminal Block)
- 34922A Armature Multiplexer
- 34923A Reed Multiplexer (differential mode only)
- 34924A Reed Multiplexer

Parameters

Name	Type	Range of Values	Default Value
<mode>	Boolean	{OFF ON 1}	OFF
<ch_list>	Numeric	One or more channels in the form (@sccc) .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.
- Since 2-wire and 4-wire resistance are related functions, changing a measurement parameter for one function will also change the corresponding parameter for the other function (see [\[SENSe:\]TEMPerature:TRANsducer:FRTD:REFeRence](#) command).

- When you initiate a measurement on the selected channels (see **INITiate** or **READ?** command), the acquired temperature is stored in **volatile** memory in the reference register. Subsequent thermocouple measurements use the stored temperature as their reference.
- At power-on, the reference register is loaded with "9.9E+37". Note that until you store a reference temperature, all thermocouple measurements that specify an external reference source will be returned as "9.9E+37". Use the **[SENSe:]TEMPerature:TRANsducer:TCouple:RJUNction:EXTErnal?** command to read the most-recently stored reference temperature value.
- The reference temperature can also be stored using a thermistor measurement. See the **[SENSe:]TEMPerature:TRANsducer:THERmistor:REFerence** command for more information.

Return Format

The query command returns "0" (OFF) or "1" (ON) for each channel specified. Multiple responses are separated by commas.

Examples

Example 1: Making Externally-Referenced Thermocouple Measurements with Multiplexer Channels

The following commands configure multiplexer channel 3 in slot 1 for thermocouple measurements and select an *external* reference junction for that channel.

```
CONF:TEMP TC,J, (@1003)
TEMP:TRAN:TC:RJUN:TYPE EXT, (@1003)
```

The following commands configure multiplexer channel 1 in slot 1 for 2-wire RTD measurements and assign this channel as the reference channel.

```
CONF:TEMP RTD,85, (@1001)
TEMP:TRAN:RTD:REF ON, (@1001)
```

The following commands set up a scan list that contains both the reference channel (channel 1) and the thermocouple channel (channel 3). If you do not include the reference channel in the active scan list, the instrument uses the temperature previously stored in the reference register. The **INITiate** command initiates the scan.

```
ROUT:SCAN (@1001:1005)
INIT
```

Example 2: Making Externally-Referenced Thermocouple Measurements with the Internal DMM

The following commands configure the internal DMM (no <ch_list> specified) for 2-wire RTD measurements and assign the internal DMM as the reference "channel".

```
CONF:TEMP RTD,85
TEMP:TRAN:RTD:REF ON
```

The following command initiates an RTD measurement on the internal DMM and stores the value in the reference register.

```
INIT
```

The following commands configure the internal DMM for thermocouple measurements and select an *external* reference junction.

```
CONF:TEMP TC,J  
TEMP:TRAN:TC:RJUN:TYPE EXT
```

The following commands change the sample count to take 10 thermocouple measurements and initiate the internal DMM.

```
SAMP:COUN 10  
INIT
```

Example 3: Querying the Reference Channel State

The following command returns the state of reference channel 3 in slot 1.

```
TEMP:TRAN:RTD:REF? (@1003)
```

Typical Response: 1

See Also

[CONFigure:TEMPerature](#)

[\[SENSe:\]TEMPerature:TRANsducer:TCouple:RJUNction:EXTernal?](#)

[\[SENSe:\]TEMPerature:TRANsducer:TCouple:RJUNction:TYPE](#)

[\[SENSe:\]TEMPerature:TRANsducer:THERmistor:REFerence](#)

[SENSe:]TEMPerature:TRANsducer:THERmistor:REFerence

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

[SENSe:]TEMPerature:TRANsducer:THERmistor:REFerence <mode> [, (@<ch_list>)]

[SENSe:]TEMPerature:TRANsducer:THERmistor:REFerence? [(@<ch_list>)]

Description

This command disables or enables the specified thermistor channels to be used as the reference channel for subsequent thermocouple measurements that specify an external reference source (see [\[SENSe:\]TEMPerature:TRANsducer:TCouple:RJUNction:TYPE](#) command). If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

Used With:

- 34921A Armature Multiplexer (with optional 34921T Terminal Block)
- 34922A Armature Multiplexer
- 34923A Reed Multiplexer (differential mode only)
- 34924A Reed Multiplexer

Parameters

Name	Type	Range of Values	Default Value
<mode>	Boolean	{OFF 0 ON 1}	OFF
<ch_list>	Numeric	One or more channels in the form (@sccc) .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.
- When you initiate a measurement on the selected channels (see [INITiate](#) or [READ?](#) command), the acquired temperature is stored in **volatile** memory in the reference register. Subsequent thermocouple measurements use the stored temperature as their reference.

- At power-on, the reference register is loaded with "9.9E+37". Note that until you store a reference temperature, all thermocouple measurements that specify an external reference source will be returned as "9.9E+37". Use the **[SENSe:]TEMPerature:TRANsducer:TCouple:RJUNction:EXTernal?** command to read the most-recently stored reference temperature value.
- The reference temperature can also be stored using a 2-wire or 4-wire RTD measurement. See the **[SENSe:]TEMPerature:TRANsducer:FRTD:REference** or **[SENSe:]TEMPerature:TRANsducer:RTD:REference** command for more information.

Return Format

The query command returns "0" (OFF) or "1" (ON) for each channel specified. Multiple responses are separated by commas.

Examples

Example 1: Making Externally-Referenced Thermocouple Measurements with Multiplexer Channels

The following commands configure multiplexer channel 3 in slot 1 for thermocouple measurements and select an *external* reference junction for that channel.

```
CONF:TEMP TC,J, (@1003)
TEMP:TRAN:TC:RJUN:TYPE EXT, (@1003)
```

The following commands configure multiplexer channel 1 in slot 1 for thermistor measurements and assign this channel as the reference channel.

```
CONF:TEMP THER,5000, (@1001)
TEMP:TRAN:THER:REF ON, (@1001)
```

The following commands set up a scan list that contains both the reference channel (channel 1) and the thermocouple channel (channel 3). If you do not include the reference channel in the active scan list, the instrument uses the temperature previously stored in the reference register. The **INITiate** command initiates the scan.

```
ROUT:SCAN (@1001:1005)
INIT
```

Example 2: Making Externally-Referenced Thermocouple Measurements with the Internal DMM

The following commands configure the internal DMM (no <ch_list> specified) for thermistor measurements and assign the internal DMM as the reference "channel".

```
CONF:TEMP THER,5000
TEMP:TRAN:THER:REF ON
```

The following command initiates a thermistor measurement on the internal DMM and stores the value in the reference register.

```
INIT
```

The following commands configure the internal DMM for thermocouple measurements and select an *external* reference junction.

```
CONF:TEMP TC,J  
TEMP:TRAN:TC:RJUN:TYPE EXT
```

The following commands change the sample count to take 10 thermocouple measurements and initiate the internal DMM.

```
SAMP:COUN 10  
INIT
```

Example 3: Querying the Reference Channel State

The following command returns the state of reference channel 3 in slot 1.

```
TEMP:TRAN:THER:REF? (@1003)
```

Typical Response: 1

See Also

[CONFigure:TEMPerature](#)

[\[SENSe:\]TEMPerature:TRANsducer:FRTD:REFerence](#)

[\[SENSe:\]TEMPerature:TRANsducer:RTD:REFerence](#)

[\[SENSe:\]TEMPerature:TRANsducer:TCouple:RJUNction:EXTernal?](#)

[\[SENSe:\]TEMPerature:TRANsducer:TCouple:RJUNction:TYPE](#)

[SENSe:]TEMPerature:TRANsducer:THERmistor:TYPE

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

[SENSe:]TEMPerature:TRANsducer:THERmistor:TYPE <type> [, (@<ch_list>)]

[SENSe:]TEMPerature:TRANsducer:THERmistor:TYPE? [(@<ch_list>)]

Description

This command selects the thermistor type for temperature measurements on the specified channels. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

Used With:

- 34921A Armature Multiplexer
- 34922A Armature Multiplexer
- 34923A Reed Multiplexer
- 34924A Reed Multiplexer

Parameters

Name	Type	Range of Values	Default Value
<type>	Discrete	{ 2252 5000 10000 }	5000
<ch_list>	Numeric	One or more channels in the form (@sccc) .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- The instrument supports 2.2 k Ω (YSI 44004 Series), 5 k Ω (YSI 44007 Series), and 10 k Ω (YSI 44006 Series) thermistors.
- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.
- The instrument sets the thermistor type to "5000" after a Factory Reset (***RST** command). An Instrument Pre-set (**SYSTem:PRESet** command) or Card Reset (**SYSTem:CPON** command) does *not* change the setting.

Return Format

The query command returns "+2252", "+5000", or "+10000" for each channel specified. Multiple responses are separated by commas.

Examples

The following command selects 10 k Ω thermistors on channels 3 and 13 in slot 1.

```
TEMP:TRAN:THER:TYPE 10000, (@1003,1013)
```

The following query returns the thermistor type selections on channels 3 and 13 in slot 1.

```
TEMP:TRAN:THER:TYPE? (@1003,1013)
```

Typical Response: **+10000,+10000**

See Also

CONFigure:TEMPerature

[SENSe:]TEMPerature:RJUNction[:INTernal]?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

[SENSe:]TEMPerature:RJUNction[:INTernal]? (@<ch_list>)

Description

This command reads the internal reference junction temperature for thermocouple measurements on the specified channels (useful only for an internal reference source).

Used With:

- 34921A Armature Multiplexer (with optional 34921T Terminal Block)

Parameters

Name	Type	Range of Values	Default Value
<ch_list>	Numeric	One or more channels in the form (@sccc) .	This is a required parameter

Remarks

- This command is useful only for an internal reference source (see [TEMPerature:TRANsducer:TCouple:RJUNction:TYPE](#) command).
- An error is generated if the optional 34921T Terminal Block is not attached to the module (the transducer is located on the terminal block).
- The command always returns a temperature in degrees Celsius regardless of the temperature units currently selected (see [UNIT:TEMPerature](#) command).

Return Format

The query command returns the internal reference temperature in the form "+0.00000000E+00" for each channel specified (always in degrees Celsius). Multiple responses are separated by commas.

Example

The following query reads the internal reference junction temperature (always in degrees Celsius) on channels 3 and 13 in slot 1.

```
TEMP:RJUN:INT? (@1003,1013)
```

Typical Response: +2.91170000E+01,+3.00230000E+01

See Also

[CONFigure:TEMPerature](#)

[TEMPerature:TRANsducer:TCouple:RJUNction:TYPE](#)

[UNIT:TEMPerature](#)

[SENSe:]TEMPerature:TRANsducer:TCouple:CHECK

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

[SENSe:]TEMPerature:TRANsducer:TCouple:CHECK <mode> [, (@<ch_list>)]

[SENSe:]TEMPerature:TRANsducer:TCouple:CHECK? [(@<ch_list>)]

Description

This command disables or enables the *thermocouple check* feature to verify that your thermocouples are properly connected for measurements. If you enable this feature, the instrument measures the channel resistance after each thermocouple measurement to ensure a proper connection. If an open connection is detected (greater than 5 k Ω on the 10 k Ω range), the instrument reports an overload condition for that channel's temperature reading. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

Used With:

- 34921A Armature Multiplexer (with optional 34921T Terminal Block)
- 34922A Armature Multiplexer
- 34923A Reed Multiplexer (differential mode only)
- 34924A Reed Multiplexer

Parameters

Name	Type	Range of Values	Default Value
<mode>	Boolean	{OFF 0 ON 1}	OFF
<ch_list>	Numeric	One or more channels in the form <u>(@sccc)</u> .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.
- The instrument disables the thermocouple check feature after a Factory Reset (***RST** command). An Instrument Preset (**SYSTem:PRESet** command) or Card Reset (**SYSTem:CPON** command) does not change the setting.

Return Format

The query command returns "0" (OFF) or "1" (ON) for each channel specified. Multiple responses are separated by commas.

Examples

The following command enables the thermocouple check feature on channels 3 and 13 in slot 1.

```
TEMP:TRAN:TC:CHECK ON, (@1003,1013)
```

The following query returns the thermocouple check settings on channels 3 and 13 in slot 1.

```
TEMP:TRAN:TC:CHECK? (@1003,1013)
```

Typical Response: 1,1

See Also

[CONFigure:TEMPerature](#)

[SENSe:]TEMPerature:TRANsducer:TCouple:IMPedance:AUTO

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

[SENSe:]TEMPerature:TRANsducer:TCouple:IMPedance:AUTO <mode> [, (@<ch_list>)]

[SENSe:]TEMPerature:TRANsducer:TCouple:IMPedance:AUTO? [(@<ch_list>)]

Description

This command disables or enables the automatic input resistance mode for thermocouple measurements on the specified channels. Normally, the instrument's input resistance is fixed at 10 M Ω for all ranges to minimize noise pickup. To reduce the effects of measurement loading errors, you can set the input resistance to greater than 10 G Ω for the 100 mVdc, 1 Vdc, and 10 Vdc ranges. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

Used With:

- 34921A Armature Multiplexer (with optional 34921T Terminal Block)
- 34922A Armature Multiplexer
- 34923A Reed Multiplexer (differential mode only)
- 34924A Reed Multiplexer

Parameters

Name	Type	Range of Values	Default Value
<mode>	Boolean	{OFF 0 ON 1}	OFF 0 (fixed at 10 M Ω for all ranges)
<ch_list>	Numeric	One or more channels in the form (@sccc) .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.
- With AUTO OFF (default), the input resistance is fixed at 10 M Ω for all ranges. With AUTO ON, the input resistance is set to >10 G Ω for the 100 mV, 1 V, and 10 V ranges.

Input Resistance Setting	Input Resistance for: 100 mV, 1 V, 10 V ranges	Input Resistance for: 100 V, 300 V ranges

TEMPerature:IMPedance:AUTO OFF	10 MΩ	10 MΩ
TEMPerature:IMPedance:AUTO ON	> 10 GΩ	10 MΩ

- The CONFigure and MEASure? commands automatically select AUTO OFF (fixed at 10 MΩ for all ranges).
- The instrument selects 10 MΩ (fixed input resistance on all ranges) after a ***RST** command. An Instrument Preset (**SYSTem:PRESet** command) or Card Reset (**SYSTem:CPON** command) does *not* change the input resistance setting.

Return Format

The query command returns "0" (OFF) or "1" (ON) for each channel specified. Multiple responses are separated by commas.

Examples

The following command enables the automatic input resistance mode (AUTO ON) on channels 3 and 13 in slot 1.

```
TEMP:TRAN:TC:IMP:AUTO ON, (@1003,1013)
```

The following query returns the automatic input resistance mode settings on channels 3 and 13 in slot 1.

```
TEMP:TRAN:TC:IMP:AUTO? (@1003,1013)
```

Typical Response: 1,1

See Also

CONFigure:TEMPerature

[SENSe:]TEMPerature:TRANsducer:TCouple:RJUNction

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

[SENSe:]TEMPerature:TRANsducer:TCouple:RJUNction {<temperature>|MIN|MAX|DEF} [, (@<ch_list>)]

[SENSe:]TEMPerature:TRANsducer:TCouple:RJUNction? [{(@<ch_list>)|MIN|MAX}]

Description

This command sets the *fixed* reference junction temperature in degrees Celsius for thermocouple measurements on the specified channels. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

Used With:

- 34921A Armature Multiplexer (with optional 34921T Terminal Block)
- 34922A Armature Multiplexer
- 34923A Reed Multiplexer (differential mode only)
- 34924A Reed Multiplexer

Parameters

Name	Type	Range of Values	Default Value
<temperature>	Discrete	Any temperature between -20 °C and +80 °C. MIN = -20 °C, MAX = +80 °C	0.0 °C
<ch_list>	Numeric	One or more channels in the form (@sccc).	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.
- Thermocouple measurements directed at the internal DMM (i.e., no <ch_list> specified) require that a *fixed* reference junction temperature be used (see [\[SENSe:\]TEMPerature:TRANsducer:TCouple:RJUNction:TYPE](#) command).
- For this command, you must always specify the temperature in degrees Celsius regardless of the temperature units currently selected (see [UNIT:TEMPerature](#) command).

- The instrument sets the thermocouple junction to 0 °C after a Factory Reset (***RST** command). An Instrument Preset (**SYSTem:PRESet** command) or Card Reset (**SYSTem:CPON** command) does *not* change the setting.

Return Format

The query command returns the fixed reference junction temperature in the form "+0.00000000E+00" for each channel specified (always in degrees Celsius). Multiple responses are separated by commas.

Examples

The following command sets the fixed reference junction temperature to 20 °C on channels 3 and 13 in slot 1.

```
TEMP:TRAN:TC:RJUN 20.0, (@1003,1013)
```

The following query reads the fixed reference junction temperature (always in degrees Celsius) on channels 3 and 13 in slot 1.

```
TEMP:TRAN:TC:RJUN? (@1003,1013)
```

Typical Response: +2.00000000E+01,+2.00000000E+01

See Also

CONFigure:TEMPerature

UNIT:TEMPerature

[SENSe:]TEMPerature:TRANsducer:TCouple:RJUNction:EXTernal?

Syntax | Description | Parameters | Remarks | Return Format | Example

Syntax

[SENSe:]TEMPerature:TRANsducer:TCouple:RJUNction:EXTernal?

Description

This command returns the most-recently stored *external* reference temperature value for thermocouple measurements. This temperature is used for all subsequent thermocouple measurements that specify an external reference source (see [SENSe:]TEMPerature:TRANsducer:TCouple:RJUNction:TYPE command).

Used With:

- 34921A Armature Multiplexer (with optional 34921T Terminal Block)
- 34922A Armature Multiplexer
- 34923A Reed Multiplexer (differential mode only)
- 34924A Reed Multiplexer

Remarks

- To store a reference temperature, first configure a multiplexer channel for an RTD or thermistor measurement (see CONFigure:TEMPerature command). Then assign the measurement from that channel as the external reference using one of the following commands:

[SENSe:]TEMPerature:TRANsducer:FRTD:REFeRence

[SENSe:]TEMPerature:TRANsducer:RTD:REFeRence

[SENSe:]TEMPerature:TRANsducer:THERmistor:REFeRence

When you initiate a measurement on the selected channel (see INITiate or READ? command), the acquired temperature is stored in **volatile** memory in the reference register. Subsequent thermocouple measurements use the stored temperature as their reference. The temperature remains in memory until you store a different value in the reference register or remove the mainframe power.

- At power-on, the reference register is loaded with "9.9E+37". Note that until you store a reference temperature, all thermocouple measurements that specify an external reference source will be returned as "9.9E+37".

Return Format

The query command returns the reference temperature in the form "+0.00000000E+00" (always in degrees Celsius).

Example

The following query reads reference register and returns the most-recently stored temperature measurement.

```
TEMP:TRAN:TC:RJUN:EXT?
```

Typical Response: **+2.00000000E+01**

See Also

CONFigure:TEMPerature

[SENSe:]TEMPerature:TRANsducer:FRTD:REFerence

[SENSe:]TEMPerature:TRANsducer:RTD:REFerence

[SENSe:]TEMPerature:TRANsducer:TCouple:RJUNction:TYPE

[SENSe:]TEMPerature:TRANsducer:THERmistor:REFerence

[SENSe:]TEMPerature:TRANsducer:TCouple:RJUNction:TYPE

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

[SENSe:]TEMPerature:TRANsducer:TCouple:RJUNction:TYPE <source> [, (@<ch_list>)]

[SENSe:]TEMPerature:TRANsducer:TCouple:RJUNction:TYPE? [(@<ch_list>)]

Description

Thermocouple measurements require a reference junction temperature. For the reference junction temperature, you can use an *internal* measurement on the module's terminal block (34921A only), an *external* thermistor or RTD measurement, or a known *fixed* junction temperature. This command selects the reference junction source for thermocouple measurements on the specified channels. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

Used With:

- 34921A Armature Multiplexer (with optional 34921T Terminal Block)
- 34922A Armature Multiplexer
- 34923A Reed Multiplexer (differential mode only)
- 34924A Reed Multiplexer

Parameters

Name	Type	Range of Values	Default Value
<source>	Discrete	{EXTeRnal FIXed INTeRnal*}	FIXed
<ch_list>	Numeric	One or more channels in the form (@sccc) .	If <ch_list> is omitted, this command applies to the internal DMM.

* *INTeRnal* is a valid source only on the 34921A Multiplexer with a 34921A Terminal Block installed.

Remarks

- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.

- The accuracy of the measurement is highly dependent upon the thermocouple connections and the type of reference junction used. Use a *fixed* temperature reference for the highest accuracy measurements (you must maintain the known junction temperature). The *internal* isothermal block reference (34921A only) requires no external wiring but provides lower accuracy measurements than a fixed reference.
- If you select an *external* reference, the instrument makes thermocouple measurements relative to a previously-stored RTD or thermistor measurement stored in the reference register (see **[SENSe:]TEMPerature:TRANsducer:TCouple:RJUNction:EXTErnal?** command). To store a reference temperature, first configure a multiplexer channel for an RTD or thermistor measurement (see **CONFigure:TEMPerature** command). Then assign the measurement from that channel as the external reference using one of the following commands:

[SENSe:]TEMPerature:TRANsducer:FRTD:REFerence
[SENSe:]TEMPerature:TRANsducer:RTD:REFerence
[SENSe:]TEMPerature:TRANsducer:THERmistor:REFerence

When you initiate a measurement on an external reference channel (see **INITiate** or **READ?** command), the acquired temperature is stored in **volatile** memory in the reference register. Subsequent thermocouple measurements use the stored temperature as their reference. The temperature remains in memory until you measure a subsequent external reference value in the reference register or remove the mainframe power.

- If you select a *fixed* reference junction source, you can specify a value between -20 °C and +80 °C using the **[SENSe:]TEMPerature:TRANsducer:TCouple:RJUNction** command. You must always specify the temperature in degrees Celsius regardless of the temperature units currently selected (see **UNIT:TEMPerature** command).
- The *internal* reference junction source is valid *only* on channels 1 through 40 on the 34921A with the 34921T terminal block installed. An error is generated if you select the internal source on any other module. You can read the internal reference junction temperature using the **[SENSe:]TEMPerature:RJUNction[:INTernAl]** command.
- The instrument selects the *fixed* source after a Factory Reset (***RST** command). An Instrument Preset (**SYSTem:PRESet** command) or Card Reset (**SYSTem:CPON** command) does *not* change the setting.

Return Format

The query command returns "EXT", "FIX", or "INT" (34921A only) for each channel specified. Multiple responses are separated by commas.

Examples

Example 1: Selecting a Fixed Reference Junction Source

The following commands select the fixed reference junction source and set the junction temperature to 20 °C on channels 2 and 11 in slot 5.

```
TEMP:TRAN:TC:RJUN:TYPE FIX, (@5002,5011)
TEMP:TRAN:TC:RJUN 20, (@5002,5011)
```

Example 2: Selecting an Externally-Referenced Source

The following commands configure multiplexer channel 3 in slot 1 for thermocouple measurements and select an external reference junction for that channel.

```
CONF:TEMP TC,J, (@1003)
TEMP:TRAN:TC:RJUN:TYPE EXT, (@1003)
```

The following commands configure multiplexer channel 1 in slot 1 for thermistor measurements and assign this channel as the reference channel.

```
CONF:TEMP THER,5000, (@1001)
TEMP:TRAN:THER:REF ON, (@1001)
```

The following command sets up a scan list that contains both the reference channel (channel 1) and the thermocouple channel (channel 3). If you do not include the reference channel in the active scan list, the instrument uses the temperature previously stored in the reference register. The INITiate command initiates the scan.

```
ROUT:SCAN (@1001:1005)
INIT
```

Example 3: Querying the Reference Source

The following query reads the reference junction source on channels 2 and 11 in slot 5.

```
TEMP:TRAN:TC:RJUN:TYPE? (@5002,5011)
```

Typical Response: **FIX,FIX**

See Also

CONFigure:TEMPerature

[SENSe:]TEMPerature:RJUNction[:INTernal]

[SENSe:]TEMPerature:TRANsducer:FRTD:REFerence

[SENSe:]TEMPerature:TRANsducer:RTD:REFerence

[SENSe:]TEMPerature:TRANsducer:TCouple:RJUNction

[SENSe:]TEMPerature:TRANsducer:TCouple:RJUNction:EXTernal?

[SENSe:]TEMPerature:TRANsducer:THERmistor:REFerence

UNIT:TEMPerature

[SENSe:]TEMPerature:TRANsducer:TCouple:TYPE

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

[SENSe:]TEMPerature:TRANsducer:TCouple:TYPE <type> [, (@<ch_list>)]

[SENSe:]TEMPerature:TRANsducer:TCouple:TYPE? [(@<ch_list>)]

Description

This command selects the thermocouple type to use for measurements on the specified channels.

Used With:

- 34921A Armature Multiplexer (with optional 34921T Terminal Block)
- 34922A Armature Multiplexer
- 34923A Reed Multiplexer (differential mode only)
- 34924A Reed Multiplexer

Parameters

Name	Type	Range of Values	Default Value
<type>	Discrete	{B E J K N R S T}* * Using ITS-90 software conversions.	J Type
<ch_list>	Numeric	One or more channels in the form (@sccc).	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.
- Thermocouple measurements require a reference junction temperature (see [SENSe:]TEMPerature:TRANsducer:TCouple:RJUNction:TYPE command). For the reference junction temperature, you can use an *internal* measurement on the module's terminal block (34921A only), an *external* thermistor or RTD measurement, or a known *fixed* junction temperature. By default, a fixed reference junction temperature of 0.0 °C is used.
- The instrument sets the thermocouple type to "J" after a Factory Reset (*RST command). An Instrument Pre-set (SYSTem:PRESet command) or Card Reset (SYSTem:CPON command) does *not* change the setting.

Return Format

The query command returns "B", "E", "J", "K", "N", "R", "S", or "T" for each channel specified. Multiple responses are separated by commas.

Examples

The following command selects T-Type thermocouples on channels 3 and 13 in slot 1.

```
TEMP:TRAN:TC:TYPE T, (@1003,1013)
```

The following query returns the thermocouple type selections on channels 3 and 13 in slot 1.

```
TEMP:TRAN:TC:TYPE? (@1003,1013)
```

Typical Response: T,T

See Also

[CONFigure:TEMPerature](#)

[\[SENSe:\]TEMPerature:TRANsducer:TCouple:RJUNction:TYPE](#)

[\[SENSe:\]TEMPerature:TRANsducer:TYPE](#)

[SENSe:]VOLTage:AC:BANDwidth

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

[SENSe:]VOLTage:AC:BANDwidth {<filter>|MIN|MAX|DEF} [, (@<ch_list>)]

[SENSe:]VOLTage:AC:BANDwidth? [(@<ch_list>)|MIN|MAX]

Description

The instrument uses three different ac filters which enable you to either optimize low-frequency accuracy or achieve faster ac settling times. The instrument selects the slow (3 Hz), medium (20 Hz), or fast (300 Hz) filter based on the input frequency that you specify with this command for the selected channels. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

Used With:

- 34921A through 34925A Multiplexer Modules

Parameters

Name	Type	Range of Values	Default Value
<filter>	Discrete	{3 20 200} MIN = 3 Hz (slow), MAX = 200 Hz (fast)	20 Hz (medium)
<ch_list>	Numeric	One or more channels in the form <u>(@sccc)</u> .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- Applies to ac voltage measurements only.
- For the <filter> parameter, specify the lowest frequency expected in the input signal on the specified channels. The instrument selects the appropriate filter based on the frequency you specify.

Input Frequency	Default Settling Delay	Minimum Settling Delay
3 Hz to 300 kHz (Slow)	7 seconds / reading	1.5 seconds
20 Hz to 300 kHz (Medium)	1 second / reading	200 ms
200 Hz to 300 kHz (Fast)	0.12 seconds / reading	20 ms

- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.
- The CONFigure and MEASure? commands automatically select the default 20 Hz (medium) filter.
- The instrument selects the default 20 Hz (medium) filter after a Factory Reset (***RST** command). An Instrument Preset (**SYSTem:PRESet** command) or Card Reset (**SYSTem:CPON** command) does *not* change the setting.

Return Format

The query command returns "3" (slow), "20" (medium), or "200" (fast) for each channel specified. Multiple responses are separated by commas.

Examples

The following command selects the slow filter (3 Hz) on channels 3 and 13 in slot 1.

```
VOLT:AC:BAND 3, (@1003,1013)
```

The following query returns the ac filter settings on channels 3 and 13 in slot 1.

```
VOLT:AC:BAND? (@1003,1013)
```

Typical Response: **3,3**

See Also

CONFigure[:VOLTage]:AC

[SENSe:]VOLTage:AC:RANGe

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

[SENSe:]VOLTage:AC:RANGe {<range>|MIN|MAX|DEF} [, (@<ch_list>)]

[SENSe:]VOLTage:AC:RANGe? [(@<ch_list>)|MIN|MAX]

Description

This command selects the measurement range for ac voltage measurements on the specified channels. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

Used With:

- 34921A through 34925A Multiplexer Modules

Parameters

Name	Type	Range of Values	Default Value
<range>	Discrete	Desired range in volts: 100 mV (MIN) 1 V 10 V 100 V 300 V (MAX)	This is a required parameter
<ch_list>	Numeric	One or more channels in the form <u>(@sccc)</u> .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.
- Selecting a discrete range will disable autoranging on the specified channels (see [\[SENSe:\]VOLTage:AC:RANGe:AUTO](#) command).
- The CONFigure and MEASure? commands automatically enable autoranging.
- If the input signal is greater than can be measured on the selected range (manual ranging), the instrument gives an *overload indication*: "±OVLd" from the front panel or "±9.9E+37" from the remote interface.

- The instrument enables autoranging after a Factory Reset (***RST** command). An Instrument Preset (**SYSTem:PRESet** command) or Card Reset (**SYSTem:CPON** command) does not change the setting.

Return Format

The query command returns the range in the form "+1.00000000E+01" for each channel specified. Multiple responses are separated by commas.

Examples

The following command selects the 10 volt range on channels 3 and 13 in slot 1.

```
VOLT:AC:RANG 10, (@1003,1013)
```

The following query returns the range selected on channels 3 and 13 in slot 1.

```
VOLT:AC:RANG? (@1003,1013)
```

Typical Response: +1.00000000E+01,+1.00000000E+01

See Also

CONFigure[:VOLTage]:AC

[SENSe:]VOLTage:AC:RANGe:AUTO

[SENSe:]VOLTage:AC:RANGe:AUTO

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

[SENSe:]VOLTage:AC:RANGe:AUTO <mode> [, (@<ch_list>)]

[SENSe:]VOLTage:AC:RANGe:AUTO? [(@<ch_list>)]

Description

This command disables or enables autoranging for ac voltage measurements on the specified channels. Autoranging is convenient because the instrument automatically selects the range for each measurement based on the input signal detected. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

Used With:

- 34921A through 34925A Multiplexer Modules

Parameters

Name	Type	Range of Values	Default Value
<mode>	Boolean	{OFF 0 ON 1}	Autorange ON
<ch_list>	Numeric	One or more channels in the form (@sccc) .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.
- Autorange thresholds:

Down range at: <10% of range
Up range at: >120% of range

- With autoranging enabled, the instrument selects one of the following ranges based on the input signal detected:

100 mV, 1 V, 10 V, 100 V, 300 V

- Selecting a discrete range (see **[SENSe:]VOLTage:AC:RANGe** command) will disable autoranging on the specified channels.
- The CONFigure and MEASure? commands automatically enable autoranging.
- The instrument enables autoranging after a Factory Reset (***RST** command). An Instrument Preset (**SYSTem:PRESet** command) or Card Reset (**SYSTem:CPON** command) does not change the setting.

Return Format

The query command returns "0" (OFF) or "1" (ON) for each channel specified. Multiple responses are separated by commas.

Examples

The following command disables autoranging on channels 3 and 13 in slot 1.

```
VOLT:AC:RANG:AUTO OFF, (@1003,1013)
```

The following query returns the autoranging settings on channels 3 and 13 in slot 1.

```
VOLT:AC:RANG:AUTO? (@1003,1013)
```

Typical Response: 0,0

See Also

CONFigure[:VOLTage]:AC

[SENSe:]VOLTage:AC:RANGe

[SENSe:]VOLTage[:DC]:APERture

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

[SENSe:]VOLTage[:DC]:APERture {<seconds>|MIN|MAX|DEF} [, (@<ch_list>)]

[SENSe:]VOLTage[:DC]:APERture? [(@<ch_list>)|MIN|MAX]

Description

This command enables the aperture mode and sets the integration time in seconds (called *aperture time*) for dc voltage measurements on the specified channels. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

NOTE

You should use this command only when you want precise control of the integration time of the internal DMM. Otherwise, specifying integration time using NPLC (see [\[SENSe:\]VOLTage\[:DC\]:NPLC](#) command) executes faster and offers better noise rejection characteristics for values of NPLC greater than 1.

Used With:

- 34921A through 34925A Multiplexer Modules

Parameters

Name	Type	Range of Values	Default Value
<seconds>	Numeric	Desired aperture time in seconds between 300 μ s and 1 second, with 4 μ s resolution. MIN = 300 μ s, MAX = 1 second	Aperture disabled.
<ch_list>	Numeric	One or more channels in the form (@sccc) .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- For the <seconds> parameter, you can substitute MIN or MAX for a numeric value. MIN selects the smallest value accepted, which gives the lowest resolution; MAX selects the largest value accepted, which gives the highest resolution.
- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.

- Only the integral number of power line cycles (1, 2, 10, 20, 100, or 200 PLCs) provide normal mode (line frequency noise) rejection.
- The `CONFigure`, `MEASure?`, `[SENSe:]VOLTage[:DC]:NPLC`, and `[SENSe:]VOLTage[:DC]:RESolution` commands disable the aperture time mode (these commands select an integration time in number of power line cycles). You can use the `[SENSe:]VOLTage[:DC]:APERture:ENABLEd?` command to query whether the aperture mode is currently enabled or disabled.
- The aperture mode is disabled after a Factory Reset (`*RST` command). An Instrument Preset (`SYSTem:PRESet` command) or Card Reset (`SYSTem:CPON` command) does not change the setting.

Return Format

The query command returns the aperture time in the form `"+1.00000000E-01"` for each channel specified. Multiple responses are separated by commas. Note that if the aperture mode is currently disabled (see `[SENSe:]VOLTage[:DC]:APERture:ENABLEd?` command), the value returned will represent the previous value specified, *not* the actual integration time.

Examples

The following command enables the aperture mode and sets the aperture time to 300 ms on channels 3 and 13 in slot 1.

```
VOLT:DC:APER 300E-03, (@1003,1013)
```

The following query returns the aperture time selected on channels 3 and 13 in slot 1.

```
VOLT:DC:APER? (@1003,1013)
VOLT:DC:APER:ENAB? !Verify that aperture mode is enabled ("1")
```

Typical	<code>+3.00000000E-</code>
Response:	<code>01,+3.00000000E-01</code>
	<code>1</code>

See Also

`CONFigure[:VOLTage][:DC]`

`[SENSe:]VOLTage[:DC]:APERture:ENABLEd?`

`[SENSe:]VOLTage[:DC]:NPLC`

[SENSe:]VOLTage[:DC]:APERture:ENABled?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

[SENSe:]VOLTage[:DC]:APERture:ENABled? [(@<ch_list>)]

Description

This command queries whether the aperture mode is enabled or disabled for dc voltage measurements on the specified channels. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

Used With:

- 34921A through 34925A Multiplexer Modules

Parameters

Name	Type	Range of Values	Default Value
<ch_list>	Numeric	One or more channels in the form (@sccc) .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- The CONFIGure, MEASure?, [SENSe:]VOLTage[:DC]:NPLC, and [SENSe:]VOLTage[:DC]:RESolution commands disable the aperture time mode (these commands select an integration time in number of power line cycles).

Return Format

The query command returns "0" if the aperture mode is disabled or "1" if the aperture mode is enabled for each channel specified. Multiple responses are separated by commas.

Example

The following command returns the state of the aperture mode on channels 3 and 13 in slot 1.

```
VOLT:DC:APER:ENAB? (@1003,1013)
```

Typical Response: 0,0

See Also

`CONFigure[:VOLTage][:DC]`

`[SENSe:]VOLTage[:DC]:APERture`

`[SENSe:]VOLTage[:DC]:NPLC`

[SENSe:]VOLTage[:DC]:IMPedance:AUTO

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

[SENSe:]VOLTage[:DC]:IMPedance:AUTO <mode> [, (@<ch_list>)]

[SENSe:]VOLTage[:DC]:IMPedance:AUTO? [(@<ch_list>)]

Description

This command disables or enables the automatic input resistance mode for dc voltage measurements on the specified channels. Normally, the instrument's input resistance is fixed at 10 M Ω for all dc voltage ranges to minimize noise pickup. To reduce the effects of measurement loading errors, you can set the input resistance to greater than 10 G Ω for the 100 mVdc, 1 Vdc, and 10 Vdc ranges. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

Used With:

- 34921A through 34925A Multiplexer Modules

Parameters

Name	Type	Range of Values	Default Value
<mode>	Boolean	{OFF 0 ON 1}	OFF 0 (fixed at 10 M Ω for all ranges)
<ch_list>	Numeric	One or more channels in the form (@sccc) .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.
- With AUTO OFF (default), the input resistance is fixed at 10 M Ω for all ranges. With AUTO ON, the input resistance is set to >10 G Ω for the 100 mV, 1 V, and 10 V ranges.

Input Resistance Setting	Input Resistance for: 100 mV, 1 V, 10 V ranges	Input Resistance for: 100 V, 300 V ranges
VOLTage:IMPedance:AUTO OFF	10 M Ω	10 M Ω
VOLTage:IMPedance:AUTO ON	> 10 G Ω	10 M Ω

- The CONFigure and MEASure? commands automatically select AUTO OFF (fixed at 10 M Ω for all ranges).

- The instrument selects 10 M Ω (fixed input resistance on all dc voltage ranges) after a Factory Reset (***RST** command). An Instrument Preset (**SYSTem:PRESet** command) or Card Reset (**SYSTem:CPON** command) does *not* change the input resistance setting.

Return Format

The query command returns "0" (OFF) or "1" (ON) for each channel specified. Multiple responses are separated by commas.

Examples

The following command enables the automatic input resistance mode (AUTO ON) on channels 3 and 13 in slot 1.

```
VOLT:IMP:AUTO ON, (@1003,1013)
```

The following query returns the automatic input resistance mode settings on channels 3 and 13 in slot 1.

```
VOLT:IMP:AUTO? (@1003,1013)
```

Typical Response: 1,1

See Also

CONFigure[:VOLTage][:DC]

[SENSe:]VOLTage[:DC]:NPLC

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

[SENSe:]VOLTage[:DC]:NPLC {<PLCs>|MIN|MAX|DEF} [, (@<ch_list>)]

[SENSe:]VOLTage[:DC]:NPLC? [(@<ch_list>)|MIN|MAX]

Description

This command sets the **integration time** in number of power line cycles (PLCs) on the specified channels. Integration time affects the measurement resolution (for better resolution, use a longer integration time) and measurement speed (for faster measurements, use a shorter integration time). If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

Used With:

- 34921A through 34925A Multiplexer Modules

Parameters

Name	Type	Range of Values	Default Value
<PLCs>	Discrete	{0.02 0.2 1 2 10 20 100 200} MIN = 0.02 PLC, MAX = 200 PLC	1 PLC
<ch_list>	Numeric	One or more channels in the form (@sccc) .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- Only the integral number of power line cycles (1, 2, 10, 20, 100, or 200 PLCs) provide normal mode (line frequency noise) rejection.
- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.
- Setting the integration time also sets the resolution for the measurement. Click [here](#) to see the relationship between integration time, measurement resolution, number of digits, and number of bits.
- The specified integration time is used for all measurements on the selected channels. If you have applied Mx+B scaling or have assigned alarms to the selected channel, those measurements are also made using the specified integration time. Measurements taken during the Monitor function also use the specified integration time.

- You can also set the integration time by specifying an *aperture time* (see **[SENSe:]VOLTage[:DC]:APERture** command). However, note that specifying integration time using NPLCs executes faster and offers better noise rejection characteristics for values of NPLC greater than 1.
- The CONFigure, MEASure?, [SENSe:]VOLTage[:DC]:NPLC, and [SENSe:]VOLTage[:DC]:RESolution commands disable the aperture time mode (these commands select an integration time in number of power line cycles). You can use the **[SENSe:]VOLTage[:DC]:APERture:ENABLEd?** command to query whether the aperture mode is currently enabled or disabled.
- The instrument sets the integration time to 1 PLC after a Factory Reset (***RST** command). An Instrument Pre-set (**SYSTem:PRESet** command) or Card Reset (**SYSTem:CPON** command) does *not* change the setting.

Return Format

The query command returns the integration time in the form "+1.00000000E+00" for each channel specified. Multiple responses are separated by commas. Note that if the aperture mode is currently enabled (see **[SENSe:]VOLTage[:DC]:APERture:ENABLEd?** command), the value returned will represent the previous value specified, *not* the actual integration time.

Examples

The following command set the integration time to 0.2 PLCs on channels 3 and 13 in slot 1.

```
VOLT:DC:NPLC 0.2, (@1003,1013)
```

The following query returns the integration time settings on channels 3 and 13 in slot 1.

```
VOLT:DC:NPLC? (@1003,1013)
VOLT:DC:APER:ENAB? !Verify that aperture mode is disabled ("0")
```

Typical	+2.00000000E-
Response:	01,+2.00000000E-01
	0

See Also

CONFigure[:VOLTage][:DC]

[SENSe:]VOLTage[:DC]:APERture

[SENSe:]VOLTage[:DC]:APERture:ENABLEd?

[SENSe:]VOLTage[:DC]:RESolution

[SENSe:]VOLTage[:DC]:RANGe

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

[SENSe:]VOLTage[:DC]:RANGe {<range>|MIN|MAX|DEF} [, (@<ch_list>)]

[SENSe:]VOLTage[:DC]:RANGe? [{(@<ch_list>)|MIN|MAX}]

Description

This command selects the measurement range for dc voltage measurements on the specified channels. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

Used With:

- 34921A through 34925A Multiplexer Modules

Parameters

Name	Type	Range of Values	Default Value
<range>	Discrete	Desired range in volts: 100 mV (MIN) 1 V 10 V 100 V 300 V (MAX)	This is a required parameter
<ch_list>	Numeric	One or more channels in the form (@sccc) .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.
- Selecting a discrete range will disable autoranging on the specified channels (see [\[SENSe:\]VOLTage\[:DC\]:RANGe:AUTO](#) command).
- The CONFigure and MEASure? commands automatically enable autoranging.
- If the input signal is greater than can be measured on the selected range (manual ranging), the instrument gives an *overload indication*: "±OVLD" from the front panel or "±9.9E+37" from the remote interface.

- The instrument enables autoranging after a Factory Reset (***RST** command). An Instrument Preset (**SYSTem:PRESet** command) or Card Reset (**SYSTem:CPON** command) does not change the setting.

Return Format

The query command returns the range in the form "+1.00000000E+01" for each channel specified. Multiple responses are separated by commas.

Examples

The following command selects the 10 volt range on channels 3 and 13 in slot 1.

```
VOLT:DC:RANG 10, (@1003,1013)
```

The following query returns the range selected on channels 3 and 13 in slot 1.

```
VOLT:DC:RANG? (@1003,1013)
```

Typical Response: +1.00000000E+01,+1.00000000E+01

See Also

CONFigure[:VOLTage][:DC]

[SENSe:]VOLTage[:DC]:RANGe:AUTO

[SENSe:]VOLTage[:DC]:RANGe:AUTO

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

[SENSe:]VOLTage[:DC]:RANGe:AUTO <mode> [, (@<ch_list>)]

[SENSe:]VOLTage[:DC]:RANGe:AUTO? [(@<ch_list>)]

Description

This command disables or enables autoranging for dc voltage measurements on the specified channels. Autoranging is convenient because the instrument automatically selects the range for each measurement based on the input signal detected. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

Used With:

- 34921A through 34925A Multiplexer Modules

Parameters

Name	Type	Range of Values	Default Value
<mode>	Boolean	{OFF 0 ON 1}	Autorange ON
<ch_list>	Numeric	One or more channels in the form <u>(@sccc)</u> .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.
- Autorange thresholds:

Down range <10% of range
at:
Up range at: >120% of range

- With autoranging enabled, the instrument selects one of the following ranges based on the input signal detected:

100 mV, 1 V, 10 V, 100 V, 300 V

- Selecting a discrete range (see `[SENSe:]VOLTage[:DC]:RANGe` command) will disable autoranging on the specified channels.
- The `CONFigure` and `MEASure?` commands automatically enable autoranging.
- The instrument enables autoranging after a Factory Reset (`*RST` command). An Instrument Preset (`SYSTem:PRESet` command) or Card Reset (`SYSTem:CPON` command) does not change the setting.

Return Format

The query command returns "0" (OFF) or "1" (ON) for each channel specified. Multiple responses are separated by commas.

Examples

The following command disables autoranging on channels 3 and 13 in slot 1.

```
VOLT:DC:RANG:AUTO OFF, (@1003,1013)
```

The following query returns the autoranging settings on channels 3 and 13 in slot 1.

```
VOLT:DC:RANG:AUTO? (@1003,1013)
```

Typical Response: 0,0

See Also

`CONFigure[:VOLTage][:DC]`

`[SENSe:]VOLTage[:DC]:RANGe`

[SENSe:]VOLTage[:DC]:RESolution

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

[SENSe:]VOLTage[:DC]:RESolution {<resolution>|MIN|MAX|DEF} [, (@<ch_list>)]

[SENSe:]VOLTage[:DC]:RESolution? [(@<ch_list>)|MIN|MAX]

Description

This command selects the measurement resolution for dc voltage measurements on the specified channels. Specify the resolution in the same units as the selected measurement function, *not in number of digits*. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

Used With:

- 34921A through 34925A Multiplexer Modules

Parameters

Name	Type	Range of Values	Default Value
<resolution>	Numeric	Desired resolution in volts.	0.000003 x Range (1 PLC)
<ch_list>	Numeric	One or more channels in the form (@sccc).	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- For the <resolution> parameter, you can substitute MIN or MAX for a numeric value. MIN selects the smallest value accepted, which gives the highest resolution; MAX selects the largest value accepted, which gives the least resolution.
- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.
- Setting the resolution also sets the integration time for the measurement. The following table shows the relationship between integration time, measurement resolution, number of digits, and number of bits.

Integration Time	Resolution	Digits	Bits
0.02 PLC	< 0.0001 x Range	4½ Digits	15

0.2 PLC	< 0.00001 x Range	5½ Digits	18
1 PLC	< 0.000003 x Range	5½ Digits	20
2 PLC	< 0.0000022 x Range	6½ Digits	21
10 PLC	< 0.000001 x Range	6½ Digits	24
20 PLC	< 0.0000008 x Range	6½ Digits	25
100 PLC	< 0.0000003 x Range	6½ Digits	26
200 PLC	< 0.00000022 x Range	6½ Digits	26

- You can also set the integration time by specifying an *aperture time* (see `[SENSe:]VOLTage[:DC]:APERture` command). However, note that specifying integration time using NPLCs executes faster and offers better noise rejection characteristics for values of NPLC greater than 1.
- The `CONFigure`, `MEASure?`, `[SENSe:]VOLTage[:DC]:NPLC`, and `[SENSe:]VOLTage[:DC]:RESolution` commands disable the aperture time mode (these commands select an integration time in number of power line cycles). You can use the `[SENSe:]VOLTage[:DC]:APERture:ENABLEd?` command to query whether the aperture mode is currently enabled or disabled.
- The instrument sets the resolution to 1 PLC after a Factory Reset (`*RST` command). An Instrument Preset (`SYSTem:PRESet` command) or Card Reset (`SYSTem:CPON` command) does *not* change the setting.

Return Format

The query command returns the resolution in the form `"+1.00000000E-03"` for each channel specified. Multiple responses are separated by commas. Note that if the aperture mode is currently enabled (see `[SENSe:]VOLTage[:DC]:APERture:ENABLEd?` command), the value returned will represent the previous value specified, *not* the actual integration time.

Examples

The following command sets the measurement resolution to 1 mV on channels 3 and 13 in slot 1.

```
VOLT:DC:RES 1E-03, (@1003,1013)
```

The following query returns the resolution selected on channels 3 and 13 in slot 1.

```
VOLT:DC:RES? (@1003,1013)
VOLT:DC:APER:ENAB? !Verify that aperture mode is disabled ("0")
```

Typical
Response: `+1.00000000E-03,+1.00000000E-03`
`0`

See Also

`CONFigure[:VOLTage][:DC]`

`[SENSe:]VOLTage[:DC]:APERture`

`[SENSe:]VOLTage[:DC]:APERture:ENABLEd?`

[SENSe:]VOLTage[:DC]:NPLC

[SENSe:]VOLTage[:DC]:ZERO:AUTO

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

[SENSe:]VOLTage[:DC]:ZERO:AUTO <mode> [, (@<ch_list>)]

[SENSe:]VOLTage[:DC]:ZERO:AUTO? [(@<ch_list>)]

Description

This command disables or enables the autozero mode on the specified channels. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

When autozero is enabled (default), the instrument internally disconnects the input signal following each measurement, and takes a *zero* reading. It then subtracts the zero reading from the preceding reading. This prevents offset voltages present on the instrument's input circuitry from affecting measurement accuracy.

When autozero is disabled, the instrument takes one zero reading and subtracts it from all subsequent measurements. It takes a new zero reading each time you change the function, range, or integration time.

Used With:

- 34921A through 34925A Multiplexer Modules

Parameters

Name	Type	Range of Values	Default Value
<mode>	Discrete	{OFF ONCE 0 ON 1}	Autozero ON
<ch_list>	Numeric	One or more channels in the form <u>(@sccc)</u> .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- Applies to dc voltage measurements only.
- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.
- The OFF and ONCE parameters have a similar effect. Autozero OFF does *not* issue a new zero measurement. Autozero ONCE issues an immediate zero measurement.

- The autozero mode is set indirectly when you set the **resolution** and integration time. Autozero is automatically turned off when you select an integration time less than 1 PLC.
- The CONFigure and MEASure? commands automatically enable autozero.
- The autozero setting is stored in **volatile** memory and will be enabled (autozero ON) when power is turned off or after a Factory Reset (***RST** command).

Return Format

The query command returns "0" (OFF or ONCE) or "1" (ON) for each channel specified. Multiple responses are separated by commas.

Examples

The following command disables autozero on channels 3 and 13 in slot 1. With autozero disabled, a new zero measurement is not issued until the next time the instrument goes to the "wait-for-trigger" state.

```
VOLT:ZERO:AUTO OFF, (@1003,1013)
```

The following query returns the autozero settings on channels 3 and 13 in slot 1.

```
VOLT:ZERO:AUTO? (@1003,1013)
```

Typical Response: 0,0

See Also

CONFigure[:VOLTage][:DC]

[SENSe:]CURRent[:DC]:ZERO:AUTO

[SENSe:]RESistance:ZERO:AUTO

[SENSe:]TEMPerature[:DC]:ZERO:AUTO

SOURce Subsystem Introduction

Command Summary

NOTE

Hold the mouse cursor over a command to view the full syntax statement.

SOURce:CURRent[:LEVel]
SOURce:CURRent[:LEVel]?
SOURce:DIGital:DATA[:<width>]
SOURce:DIGital:DATA[:<width>]?
SOURce:DIGital:DATA:BIT
SOURce:DIGital:DATA:BIT?
SOURce:DIGital:DRIVE
SOURce:DIGital:DRIVE?
SOURce:DIGital:HANDshake:LEVel
SOURce:DIGital:HANDshake:LEVel?
SOURce:DIGital:INTerrupt[:ENABle]
SOURce:DIGital:INTerrupt[:ENABle]?
SOURce:DIGital:INTerrupt:MODE
SOURce:DIGital:INTerrupt:MODE?
SOURce:DIGital:LEVel
SOURce:DIGital:LEVel?
SOURce:DIGital:MEMory:ABORT
SOURce:DIGital:MEMory:ENABle
SOURce:DIGital:MEMory:ENABle?
SOURce:DIGital:MEMory:NCYCles
SOURce:DIGital:MEMory:NCYCles?
SOURce:DIGital:MEMory:START
SOURce:DIGital:MEMory:STEP
SOURce:DIGital:MEMory:STOP
SOURce:DIGital:MEMory:TRACe
SOURce:DIGital:MEMory:TRACe?
SOURce:DIGital:STATe
SOURce:DIGital:STATe?
SOURce:FUNCTion:CLOCK:EXTernal:DIVisor
SOURce:FUNCTion:CLOCK:EXTernal:DIVisor?
SOURce:FUNCTion:CLOCK:SOURce
SOURce:FUNCTion:CLOCK:SOURce?
SOURce:FUNCTion:CURRent:GAIN
SOURce:FUNCTion:CURRent:GAIN?
SOURce:FUNCTion:CURRent:OFFSet
SOURce:FUNCTion:CURRent:OFFSet?

SOURce:FUNction:ENABle
SOURce:FUNction:ENABle?
SOURce:FUNction:FREQuency
SOURce:FUNction:FREQuency?
SOURce:FUNction:HALT
SOURce:FUNction:SAMPlE:PERiod
SOURce:FUNction:SAMPlE:PERiod?
SOURce:FUNction:TRACe:NCYCles
SOURce:FUNction:TRACe:NCYCles?
SOURce:FUNction:TRACe:SINDex
SOURce:FUNction:TRACe:SINDex?
SOURce:FUNction:TRACe[:NAME]
SOURce:FUNction:TRACe[:NAME]?
SOURce:FUNction:TRIGger:IMMediate
SOURce:FUNction:TRIGger:SOURce
SOURce:FUNction:TRIGger:SOURce?
SOURce:FUNction:VOLTage:GAIN
SOURce:FUNction:VOLTage:GAIN?
SOURce:FUNction:VOLTage:OFFSet
SOURce:FUNction:VOLTage:OFFSet?
SOURce:MODE
SOURce:MODE?
SOURce:MODule:CLOCK:FREQuency
SOURce:MODule:CLOCK:FREQuency?
SOURce:MODule:CLOCK:LEVel
SOURce:MODule:CLOCK:LEVel?
SOURce:MODule:CLOCK:STATe
SOURce:MODule:CLOCK:STATe?
SOURce:MODule:TRIGger:EXTeRnal:IMMediate
SOURce:MODule:TRIGger:OUTPut
SOURce:MODule:TRIGger:OUTPut?
SOURce:VOLTage[:LEVel]
SOURce:VOLTage[:LEVel]?

SOURce:CURRent[:LEVel]

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

SOURce:CURRent[:LEVel] {<current>|MIN|MAX|DEF}, (@<ch_list>)

SOURce:CURRent[:LEVel]? [{MIN|MAX},] (@<ch_list>)

Description

This command sets the output current level on the specified channels on the 34951A Isolated DAC Module. After setting the desired level, send the **OUTPut[:STATe]** command to close the corresponding output relay and enable outputs from the specified channels.

NOTE

This command outputs a dc current level. To output a trace waveform from the module, see the **TRACe** commands.

Used With:

- 34951A Isolated DAC Module

Parameters

Name	Type	Range of Values	Default Value
<current>	Numeric	Desired current level in Amps. Specify any value between -20 mA and +20 mA, with 630 nA resolution. MIN = -20 mA, MAX = +20 mA	0 Amps
<ch_list>	Numeric	One or more channels in the form (@sccc) . Select from s001, s002, s003, or s004.	This is a required parameter

Remarks

- After setting the desired level, send the **OUTPut[:STATe]** command to close the corresponding output relay and enable outputs from the specified channels. For subsequent SOURce:CURRent commands, the output relay remain closed.
- The **SOURce:MODE** command gives you the capability to predefine voltage and current levels on the specified channels and then switch from one mode to the other. Sending the SOURce:CURRent[:LEVel] or **SOURce:VOLTage[:LEVel]** command will automatically enable the corresponding mode.
- If a trace waveform is being output at the time this command is sent, the waveform will stop and the trace mode will be disabled (equivalent to **SOURce:FUNCTION:ENABLE OFF**).

- To control the current level for trace outputs, use the **SOURce:FUNCtion:CURRent:GAIN** command.
- The **SOURce:FUNCtion:CURRent:GAIN** and **SOURce:FUNCtion:CURRent:OFFSet** commands are used to control the gain and offset of trace waveform outputs. These commands are ignored while in the level mode.
- The DAC channels on 34952A Multifunction Module do not support current level outputs.
- A Factory Reset (***RST** command), Instrument Preset (**SYSTem:PRESet** command), and Card Reset (**SYSTem:CPON** command) will reset the DAC outputs to 0 mA. In addition, storing the instrument state (***SAV** command) will reset the DAC outputs to 0 mA.

Return Format

The query command returns the output current in the form "+1.00000000E-03" for each DAC channel specified. Multiple responses are separated by commas.

Examples

The following command outputs +5 mA on DAC channels 1 and 2 in slot 4 and closes the output relay.

```
SOUR:CURR 5E-3, (@4001,4002)
OUTP:STAT ON, (@4001,4002)
```

The following query returns the current outputs on DAC channels 1 and 2 in slot 4.

```
SOUR:CURR? (@4001,4002)
```

Typical Response: +5.00000000E-03,+5.00000000E-03

See Also

OUTPut[:STATe]

SOURce:FUNCtion:ENABle

SOURce:MODE

SOURce:VOLTage[:LEVel]

SOURce:DIGital:DATA:BIT

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

SOURce:DIGital:DATA:BIT {0|1}, <bit>, (@<ch_list>)

SOURce:DIGital:DATA:BIT? <bit>, (@<ch_list>)

Description

This command sets or clears individual bits on the specified digital output channels. The channels associated with the specified operation are automatically reconfigured as output channels.

Used With:

- 34950A Digital I/O Module (digital output channels only)
- 34952A Multifunction Module (digital output channels only)
- 34959A Breadboard Module (digital output channels only)

Parameters

Name	Type	Range of Values	Default Value
<bit>	Numeric	Bit number on the specified channel. The acceptable range is based on the channel width set by the CONFigure:DIGital:WIDTh command. BYTE (8 Bits): 0 (LSB) to 7 (MSB) WORD (16 Bits): 0 (LSB) to 15 (MSB) LWORD (32 Bits): 0 (LSB) to 31 (MSB) <i>34959A: Only valid configurations are BYTE/WORD.</i>	This is a required parameter
<ch_list>	Numeric	One or more digital output channels in the form (@sccc) . 34950A: s101 through s104, s201 through s204 34952A: s001 through s004 34959A: s001 or s002	This is a required parameter

Remarks

- This command automatically reconfigures the channels associated with the specified operation as output channels. You can use the **CONFigure:DIGital:DIRection?** or **SOURce:DIGital:STATe?** command to determine whether the specified channels are configured for input or output operations.
- Changing the direction will disable buffered (memory) operations on the specified digital channels (see **SOURce:DIGital:MEMory:ENABle** command).
- If the specified channels are part of a scan list (see **ROUTE:SCAN** command), changing the direction will to an output will clear the scan list.

Return Format

The query command returns "0" or "1" indicating the value of the bit on each digital output channel specified. Multiple responses are separated by commas.

Examples

The following program segment outputs a "1" to bit 10 on channels 101 and 103 on the **34950A** in slot 3.

```
CONF:DIG:WIDTH WORD, (@3101,3103) !Set channel width
SOUR:DIG:DATA:BIT 1,10, (@3101,3103) !Set bit 10 to "1"
```

The following command queries the state of bit 10 on channels 101 and 103 on the **34950A** in slot 3. The values are transferred to the instrument's output buffer.

```
SOUR:DIG:DATA:BIT? 10, (@3101,3103)
```

Typical Response: 1,1

The following program segment outputs a "1" to bit 6 on channel 1 on the **34952A** in slot 5.

```
CONF:DIG:WIDTH BYTE, (@5001) !Set channel width
SOUR:DIG:DATA:BIT 1,6, (@5001) !Set bit 6 to "1"
```

The following command queries the state of bit 6 on channel 1 on the **34952A** in slot 5. The value is transferred to the instrument's output buffer.

```
SOUR:DIG:DATA:BIT? 6, (@5001)
```

Typical Response: 1

See Also

CONFigure:DIGital:DIRection

CONFigure:DIGital:WIDTh

SOURce:DIGital:DATA[:<width>]

SOURce:DIGital:STATe

SOURce:DIGital:DATA[:<width>]

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

SOURce:DIGital:DATA[:<width>] <data>, (@<ch_list>)

SOURce:DIGital:DATA[:<width>]? [<format>,] (@<ch_list>)

Description

This command outputs an 8-, 16-, or 32-bit digital pattern to the specified digital output channels. The specified channels are reconfigured as output channels.

Used With:

- 34950A Digital I/O Module (digital output channels only)
- 34952A Multifunction Module (digital output channels only)
- 34959A Breadboard Module (digital output channels only)

Parameters

Name	Type	Range of Values	Default Value
<width>	Discrete	{BYTE 1 WORD 2 LWORD 4} BYTE (or "1" byte): 8 bits WORD (or "2" bytes): 16 bits LWORD (or "4" bytes): 32 bits <i>34959A: Only valid configurations are BYTE/WORD.</i>	If no <width> is specified, the currently configured width is used (see CONFigure:DIGital:WIDTh command).
<data>	Numeric	Specify the bit pattern as a decimal, binary, or hexadecimal value. For binary, "#B" must be added as a prefix (e.g., #B11001100). For hex, "#H" must be added as a prefix (e.g., #HCC).	This is a required parameter
<format>	Discrete	{DECimal BINary HEXadecimal OCTal}	DECimal

<ch_ list>	Numeric	One or more digital output channels in the form (@sccc). 34950A: s101 through s104, s201 through s204 34952A: s001 through s004 34959A: s001 or s002	This is a required parameter

Remarks

- This command reconfigures the specified channels as output channels. You can use the **CONFig-ure:DiGital:DiRection?** or **SOURce:DiGital:STATe?** command to determine whether the specified channels are configured for input or output operations.
- Changing the direction will disable buffered (memory) operations on the specified digital channels (see **SOURce:DiGital:MEMory:ENABLe** command). In addition, changing the channel width will disable buffered operations and clear memory on the specified digital channels.
- Depending on the width specified, the channel numbering is modified as shown below. For example, if you specify the width as a 16-bit WORD on the 34950A, channels 101 and 102 are combined and addressed collectively as channel 101.

34950A	Bank 2				Bank 1			
BYTE (8 Bits):	Ch 204	Ch 203	Ch 202	Ch 201	Ch 104	Ch 103	Ch 102	Ch 101
WORD (16 Bits):	Ch 203		Ch 201		Ch 103		Ch 101	
LWORD (32 Bits):	Ch 201				Ch 101			

34952A	Bank 1			
BYTE (8 Bits):	Ch 4	Ch 3	Ch 2	Ch1
WORD (16 Bits):	Ch 3		Ch 1	
LWORD (32 Bits):	Ch 1			

- Use the **SOURce:DiGital:DATA:BIT** command to set individual bits on the specified digital output channels.
- The selected width is stored in **volatile** memory and will be set to BYTE when power is turned off or after a Factory Reset (***RST** command).

Return Format

The query command returns a value representing the bit pattern on each digital output channel specified. Multiple responses are separated by commas.

Examples

The following command outputs a 16-bit digital pattern to channels 101 and 103 on the **34950A** in slot 3.

```
SOUR:DIG:DATA:WORD 52287, (@3101, 3103)
```

The following command generates an error since a 16-bit word can only be sent to channel 101 on Bank 1 (**34950A**).

```
SOUR:DIG:DATA:WORD 10493, (@3102) !Generates an error
```

The following command queries the last word sent to channels 101 and 103 on the **34950A** in slot 5. The decimal values are transferred to the instrument's output buffer.

```
SOUR:DIG:DATA:BYTE? (@3101, 3103)
```

Typical Response: **52287,52287**

The following command outputs an 8-bit hexadecimal pattern to channel 1 on the **34952A** in slot 5.

```
SOUR:DIG:DATA:BYTE #HFF, (@5001)
```

The following command queries the last word sent to channel 1 on the **34952A** in slot 5. The decimal value is transferred to the instrument's output buffer.

```
SOUR:DIG:DATA:BYTE? (@5001)
```

Typical Response: **255**

See Also

CONFigure:DIGital:DIRection

CONFigure:DIGital:WIDTh

SOURce:DIGital:DATA:BIT

SOURce:DIGital:STATe

SOURce:DIGital:DRIVE

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

SOURce:DIGital:DRIVE <mode>, (@<ch_list>)

SOURce:DIGital:DRIVE? (@<ch_list>)

Description

This command selects the drive mode for digital output operations on the 34950A Digital I/O Module. In the "active" drive mode, the digital output lines are driven directly by the module. In the "open collector" drive mode, the digital output lines are driven low by the module, but will go to a high-impedance state when asserted (external pullup resistors are required). You can send this command at any time, but the setting applies only to output channels.

Used With:

- 34950A Digital I/O Module

Parameters

Name	Type	Range of Values	Default Value
<mode>	Discrete	{ACTive OCOLlector}	ACTive
<ch_list>	Numeric	One or more digital output channels in the form (@sccc). Select from s101 through s104, s201 through s204.	This is a required parameter

Remarks

- The selected drive mode applies to the specified channel, independent of the current channel width (see SOURce:DIGital:DATA[:<width>] command).
- The selected drive mode is stored in volatile memory and will be set to "ACT" when power is turned off or after a Factory Reset (*RST command).

Return Format

The query command returns "ACT" or "OCOL" for the specified channels. Multiple responses are separated by commas.

Examples

The following command selects the open collector drive mode on channels 101 and 103 on the module in slot 3.

```
SOUR:DIG:DRIVE OCOL, (@3101, 3103) !External pullup resistors are required
```

The following query returns the drive setting on channels 101 and 103 on the module in slot 3.

```
SOUR:DIG:DRIVE? (@3101, 3103)
```

Typical Response: **OCOL,OCOL**

See Also

SOURce:DIGital:DATA[:<width>]

SOURce:DIGital:LEVel

SOURce:DIGital:HANDshake:LEVel

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

SOURce:DIGital:HANDshake:LEVel {<voltage>|MIN|MAX|DEF}, (@<ch_list>)

SOURce:DIGital:HANDshake:LEVel? [{MIN|MAX},] (@<ch_list>)

Description

This command sets the logic "1" voltage level for the H0 and H1 handshake lines on the specified bank on the 34950A Digital I/O Module. Since handshaking is used only for transfers involving the first channel on a bank, this command must be directed to the first channel (i.e., channel 101 or 201 only), and extends to all channels involved in the channel width (see [CONFigure:DIGital:WIDTh](#) command).

This command also sets the output voltage level for the INTR (interrupt) line on the specified bank. The INTR line is an *output* when the specified channels are configured for buffered memory *input* operations (see [\[SENSe:\]DIGital:MEMory:ENABle](#) command).

Used With:

- 34950A Digital I/O Module

Parameters

Name	Type	Range of Values	Default Value
<voltage>	Numeric	Desired voltage level between 1.66V and 5V, with 20 mV resolution. MIN = 1.66V, MAX = 5V	1.66V
<ch_list>	Numeric	The first channel on a bank in the form (@sccc). Select from s101 or s201.	This is a required parameter

Remarks

- The behavior of the three handshake lines depends on whether buffered memory input operations are enabled (see **[SENSe:]DIGital:MEMory:ENABle** command).

	H0 Line	H1 Line	H2 Line
Unbuffered Transfers	I/O Direction (output)	Strobe (output)	Not Used (Hi-Z)
Buffered Transfers	Start/Stop (output)	Strobe (output)	Input Strobe (input)

- If desired, you can use the **CONFigure:DIGital:HANDshake** command to select all of the handshake line parameters with one command. Use this command to select the input threshold voltage, output logic "1" voltage level, and logic polarity.
- The selected voltage level is stored in **volatile** memory and will be set to 1.66V when power is turned off or after a Factory Reset (***RST** command).

Return Format

The query command returns the voltage level in the form **" $+1.00000000E+00$ "** for each channel specified. Multiple responses are separated by commas.

Examples

The following program segment sets the voltage level to 2.4V on channels 101 and 201 on the module in slot 3.

```
CONF:DIG:WIDTH WORD, (@3101,3201) !Width = 16 bits
DIG:MEM:ENAB ON, (@3101,3201) !Enable buffered read
SOUR:DIG:HAND:LEVEL 2.4, (@3101,3201) !Set voltage level
```

The following query returns the voltage level settings on channels 101 and 201 on the module in slot 3.

```
SOUR:DIG:HAND:LEVEL? (@3101,3201)
```

Typical Response: **$+2.40000000E+00,+2.40000000E+00$**

See Also

CONFigure:DIGital:HANDshake

CONFigure:DIGital:HANDshake:POLarity

CONFigure:DIGital:WIDTH

[SENSe:]DIGital:MEMory:ENABle

SOURce:DIGital:INTerrupt[:ENABLE]

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

SOURce:DIGital:INTerrupt[:ENABLE] <mode>, (@<ch_list>)

SOURce:DIGital:INTerrupt[:ENABLE]? (@<ch_list>)

Description

This command disables or enables the hardware INTR (interrupt) line as an input on the 34950A Digital I/O Module. The INTR line is an *input* when the specified channels are configured for buffered memory *output* operations (see [SOURce:DIGital:MEMory:ENABLE](#) command). Since interrupts are used for transfers involving the first channel on a bank only, this command must be directed to the first channel (i.e., channel 101 or 201 only), and extends to all channels involved in the channel width (see [CONFigure:DIGital:WIDTh](#) command). You can send this command at any time, but the setting applies only if buffered memory output operations are enabled.

Used With:

- 34950A Digital I/O Module

Parameters

Name	Type	Range of Values	Default Value
<mode>	Boolean	{OFF 0 ON 1}	OFF (disabled)
<ch_list>	Numeric	The first channel on a bank in the form (@sccc). Select from s101 or s201.	This is a required parameter

Remarks

- During buffered memory *output* operations, the INTR line is an *input* and the output state will be based on the level present on the INTR line (see [SOURce:DIGital:INTerrupt:MODE](#) command).
- The INTR lines and handshake lines (H0, H1, and H2) on each bank share their input threshold and output level setting. See the [\[SENSe:\]DIGital:HANDshake:THReshold](#) command to set the input threshold voltage (the INTR line is an *input* when the specified channels are configured for buffered memory *output* operations). See the [SOURce:DIGital:HANDshake:LEVel](#) command to set the output voltage level (the INTR line is an *output* when the specified channels are configured for buffered memory *input* operations).
- The instrument disables interrupts after a Factory Reset ([*RST](#) command) and sets the INTR line to a high-impedance state. An Instrument Preset ([SYSTem:PRESet](#) command) or Card Reset ([SYSTem:CPON](#) command) does not change the status of the interrupt lines.

Return Format

The query command returns "0" (OFF) or "1" (ON) for each channel specified. Multiple responses are separated by commas.

Examples

The following program segment enables inputs to the INTR line on channels 101 and 201 in slot 3. The output will start when a rising edge is detected on the INTR line.

```
CONF:DIG:WIDTH WORD, (@3101,3201) !Width = 16 bits
SOUR:DIG:MEM:ENAB ON, (@3101,3201) !Enable buffered write
SOUR:DIG:INT:MODE START, (@3101,3201) !Output starts on rising edge
SOUR:DIG:INT:ENAB ON, (@3101,3201) !Enable interrupt input
```

The following query returns the interrupt settings on channels 101 and 201 in slot 3.

```
SOUR:DIG:INT:ENAB? (@3101,3201)
```

Typical Response: 1,1

See Also

[CONFigure:DIGital:INTerrupt:POLarity](#)

[CONFigure:DIGital:WIDTh](#)

[\[SENSe:\]DIGital:HANDshake:THReshold](#)

[SOURce:DIGital:HANDshake:LEVel](#)

[SOURce:DIGital:INTerrupt:MODE](#)

[SOURce:DIGital:MEMory:ENABLE](#)

SOURce:DIGital:INTerrupt:MODE

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

SOURce:DIGital:INTerrupt:MODE <mode>, (@<ch_list>)

SOURce:DIGital:INTerrupt:MODE? (@<ch_list>)

Description

This command selects the condition on the hardware INTR (interrupt) line that enables buffered memory output operations on the 34950A Digital I/O Module. When buffered memory *output* operations are enabled on the specified bank (see **SOURce:DIGital:MEMory:ENABLE** command), you can select an edge or level on the INTR line to enable or disable output operations.

Since interrupts are used for transfers involving the first channel on a bank only, this command must be directed to the first channel (i.e., channel 101 or 201 only), and extends to all channels involved in the channel width (see **CONFigure:DIGital:WIDTh** command). You can send this command at any time, but the setting applies only if buffered memory output operations are enabled and interrupts are enabled (see **SOURce:DIGital:INTerrupt[:ENABLE]** command).

Used With:

- 34950A Digital I/O Module

Parameters

Name	Type	Range of Values	Default Value

<mode>	Discrete	{START STOP GATE} The behavior is affected by the INTR line polarity as set by the CONFigure:DIGital:INTerrupt:POLarity command. <u>NORMAL Polarity</u> START: Output is enabled on <i>rising</i> edge of INTR line. STOP: Output is disabled on <i>rising</i> edge of INTR line. GATE: Output is enabled while INTR line is asserted (high). <u>INVerted (Active Low) Polarity</u> START: Output is enabled on <i>falling</i> edge of INTR line. STOP: Output is disabled on <i>falling</i> edge of INTR line.	START

		GATE: Output is enabled while INTR line is asserted (low).	
<ch_list>	Numeric	The first channel on a bank in the form (@sccc). Select from s101 or s201.	This is a required parameter

Remarks

- The instrument disables interrupts after a Factory Reset (***RST** command) and sets the INTR line to a high-impedance state. An Instrument Preset (**SYSTem:PRESet** command) or Card Reset (**SYSTem:CPON** command) does not change the setting.

Return Format

The query command returns "STAR", "STOP", or "GATE" for each channel specified. Multiple responses are separated by commas.

Examples

The following program segment configures the module in slot 3 for one 16-bit word and enables the buffered memory output mode. By selecting the "STOP" mode, the output will be disabled on the *rising* edge transition of the INTR line (the polarity is set to "NORM").

```
CONF:DIG:WIDTH WORD, (@3101)  !Width = 16 bits
SOUR:DIG:MEM:ENAB ON, (@3101)  !Enable buffered memory mode
SOUR:DIG:MEM:START (@3101)  !Start buffered write operation
CONF:DIG:INT:POL NORM, (@3101)  !Polarity on INTR line is active high
SOUR:DIG:INT:MODE STOP, (@3101)  !Output is disabled on rising edge
SOUR:DIG:INT:ENAB ON, (@3101)  !Enable interrupts (Bank 1)
```

The following query returns the interrupt mode settings on channel 101 in slot 3.

```
SOUR:DIG:INT:MODE? (@3101)
```

Typical Response: **STOP**

See Also

CONFigure:DIGital:INTerrupt:POLarity

CONFigure:DIGital:WIDTh

SOURce:DIGital:INTerrupt[:ENABle]

SOURce:DIGital:MEMory:ENABle

SOURce:DIGital:LEVel

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

SOURce:DIGital:LEVel {<voltage>|MIN|MAX|DEF}, (@<ch_list>)

SOURce:DIGital:LEVel? [{MIN|MAX},] (@<ch_list>)

Description

This command sets the logic "1" voltage level for digital output operations on the 34950A Digital I/O Module. You can send this command at any time, but the setting applies only to output channels.

Used With:

- 34950A Digital I/O Module

Parameters

Name	Type	Range of Values	Default Value
<voltage>	Numeric	Desired voltage level between 1.66V and 5V, with 20 mV resolution. MIN = 1.66V, MAX = 5V	1.66V
<ch_list>	Numeric	One or more digital output channels in the form (@sccc). Select from s101 through s104, s201 through s204.	This is a required parameter

Remarks

- The selected voltage level applies to the specified channel, independent of the current channel width (see [SOURce:DIGital:DATA\[:<width>\]](#) command).
- The selected voltage level is stored in **volatile** memory and will be set to 1.66V when power is turned off or after a Factory Reset (***RST** command).

Return Format

The query command returns the voltage level in the form "+1.00000000E+00" for each channel specified. Multiple responses are separated by commas.

Examples

The following command sets the voltage level to 2.4V on channels 101 and 103 on the module in slot 3.

```
SOUR:DIG:LEVEL 2.4, (@3101, 3103) !Logic "1" = 2.4V
```

The following query returns the voltage level settings on channels 101 and 103 on the module in slot 3.

```
SOUR:DIG:LEVEL? (@3101, 3103)
```

Typical Response: +2.40000000E+00,+2.40000000E+00

See Also

[SOURce:DIGital:DATA\[:<width>\]](#)

[SOURce:DIGital:DRIVE](#)

SOURce:DIGital:MEMory:ABORt

Syntax | Description | Parameters | Remarks | Return Format | Example

Syntax

SOURce:DIGital:MEMory:ABORt (@<ch_list>)

Description

This command aborts buffered (memory) output operations on the 34950A Digital I/O Module. You can execute this command while a buffered output operation is in progress. The width of the first channel in each bank (i.e., channels 101 and 201) controls the width of the memory operations (64K x 8 Bits, 64K x 16 Bits, or 32K x 32 Bits). The first channel on the specified bank must be configured as an output prior to starting a buffered write (see SOURce:DIGital:DATA[:<width>] command) and a trace must be downloaded to memory and assigned to the specified bank (see SOURce:DIGital:MEMory:TRACe command).

Used With:

- 34950A Digital I/O Module

Parameters

Name	Type	Range of Values	Default Value
<ch_list>	Numeric	The first channel on a bank in the form (@sccc). Select from s101 or s201.	This is a required parameter

Remarks

- Depending on the width specified (see SOURce:DIGital:DATA[:<width>] command), the channel numbering is modified as shown below. For example, if you specify the width as a 16-bit WORD, channels 101 and 102 are combined and addressed collectively as channel 101.

	Bank 2				Bank 1			
BYTE (8 Bits):	Ch 204	Ch 203	Ch 202	Ch 201	Ch 104	Ch 103	Ch 102	Ch 101
WORD (16 Bits):	Ch 203		Ch 201		Ch 103		Ch 101	
LWORD (32 Bits):	Ch 201				Ch 101			

Example

The following command aborts the buffered output operations on channels 101 and 201 on the module in slot 3.

See Also

SOURce: DIGital: DATA[:<width>]

SOURce: DIGital: MEMory: ABORt

SOURce: DIGital: MEMory: NCYCles

SOURce: DIGital: MEMory: STEP

SOURce: DIGital: MEMory: STOP

SOURce: DIGital: MEMory: TRACe

TRACe[:DATA]: DIGital: FUNCtion

SOURce:DIGital:MEMory:ENABle

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

SOURce:DIGital:MEMory:ENABle <mode>, (@<ch_list>)

SOURce:DIGital:MEMory:ENABle? (@<ch_list>)

Description

This command enables buffered (memory) output operations on the 34950A Digital I/O Module and places the specified channels in the wait-for-trigger state. The width of the first channel in each bank (i.e., channels 101 and 201) controls the width of the memory operations (64K x 8 Bits, 64K x 16 Bits, or 32K x 32 Bits). The first channel on the specified bank must be configured as an output prior to starting a buffered write (see **SOURce:DIGital:DATA[:<width>]** command) and a trace must be downloaded to memory and assigned to the specified bank (see **SOURce:DIGital:MEMory:TRACe** command).

Used With:

- 34950A Digital I/O Module

Parameters

Name	Type	Range of Values	Default Value
<mode>	Boolean	{OFF ON 1}	OFF (disabled)
<ch_list>	Numeric	The first channel on a bank in the form (@sccc). Select from s101 or s201.	This is a required parameter

Remarks

- Depending on the width specified (see **SOURce:DIGital:DATA[:<width>]** command), the channel numbering is modified as shown below. For example, if you specify the width as a 16-bit WORD, channels 101 and 102 are combined and addressed collectively as channel 101.

	Bank 2				Bank 1			
BYTE (8 Bits):	Ch 204	Ch 203	Ch 202	Ch 201	Ch 104	Ch 103	Ch 102	Ch 101
WORD (16 Bits):	Ch 203		Ch 201		Ch 103		Ch 101	
LWORD (32 Bits):	Ch 201				Ch 101			

- Once memory is enabled, send the **SOURce:DIGital:MEMory:START** or **SOURce:DIGital:MEMory:STEP** command to start the buffered write. You can also start a buffered write operation using the hardware INTR (interrupt) line as an input to the module (see **SOURce:DIGital:INTerrupt[:ENABLE]** command).
- If memory is currently disabled, sending the **SOURce:DIGital:MEMory:START** command will enable memory and start the buffered write.
- Changing the direction will disable buffered operations on the specified digital channels. In addition, changing the channel width will disable buffered operations and clear memory on the specified digital channels.
- The instrument disables buffered memory after a Factory Reset (***RST** command). An Instrument Preset (**SYSTem:PRESet** command) or Card Reset (**SYSTem:CPON** command) does *not* change the setting.

Return Format

The query command returns "0" (OFF) or "1" (ON) for each channel specified. Multiple responses are separated by commas.

Examples

The following program segment downloads and outputs a "walking ones" pattern from channel 101 on the module in slot 3. The length of the trace is set to 32 samples. In addition, the cycle count is set to output the complete trace three times. Once memory is enabled, a software trigger is used to trigger the memory output.

```
SOUR:DIG:DATA:WORD #HFFFF, (@3101) !Set initial output pattern
SOUR:DIG:MEM:NCYC 3, (@3101) !Output complete trace 3 times
TRAC:DIG:FUNC (@3101), WONES, PATTERN_1, 32 !Download "walking ones" pattern
SOUR:DIG:MEM:TRAC PATTERN_1, (@3101) !Assign trace to channel 101
SOUR:DIG:MEM:ENAB ON, (@3101) !Enable memory on channel 101
SOUR:DIG:MEM:START (@3101) !Trigger memory output
```

The following program segment enables inputs to the INTR line on channels 101 and 201 in slot 3. The output will start when a rising edge is detected on the INTR line.

```
CONF:DIG:WIDTH WORD, (@3101, 3201) !Width = 16 bits
SOUR:DIG:MEM:ENAB ON, (@3101, 3201) !Enable memory on channels 101 and 201
SOUR:DIG:INT:MODE START, (@3101, 3201) !Output starts on rising edge
SOUR:DIG:INT:ENAB ON, (@3101, 3201) !Enable interrupt input
```

The following query returns the memory setting.

```
SOUR:DIG:MEM:ENAB? (@3101, 3201)
```

Typical Response: 1,1

See Also

CONFigure:DIGital:HANDshake:SYNChronous:STRobe[:SOURce]

SOURce:DIGital:DATA[:<width>]
SOURce:DIGital:INTerrupt[:ENABLE]
SOURce:DIGital:MEMory:NCYCles
SOURce:DIGital:MEMory:START
SOURce:DIGital:MEMory:STOP
SOURce:DIGital:MEMory:TRACe
TRACe[:DATA]:DIGital:FUNCTion

SOURce:DIGital:MEMory:NCYCles

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

SOURce:DIGital:MEMory:NCYCles {<count>|MIN|MAX|DEF|INFinity}, (@<ch_list>)

SOURce:DIGital:MEMory:NCYCles? [{MIN|MAX},] (@<ch_list>)

Description

This command sets the number of times to output the trace pattern for buffered (memory) output operations on the 34950A Digital I/O Module. The specified cycle count can be set at any time, but it will not take effect until the *next* time you enable memory (see **SOURce:DIGital:MEMory:ENABLE** command), execute the **SOURce:DIGital:MEMory:ABORT** command, or execute the **SOURce:DIGital:MEMory:START** command.

The width of the first channel in each bank (i.e., channels 101 and 201) controls the width of the memory operations (64K x 8 Bits, 64K x 16 Bits, or 32K x 32 Bits). The first channel on the specified bank must be configured as an output prior to starting a buffered write (see **SOURce:DIGital:DATA[:<width>]** command) and a trace must be downloaded to memory and assigned to the specified bank (see **SOURce:DIGital:MEMory:TRACe** command).

Used With:

- 34950A Digital I/O Module

Parameters

Name	Type	Range of Values	Default Value
<count>	Numeric	Desired cycle count between 1 and 255. MIN = 1, MAX = 255, INF = continuous	0 (continuous)
<ch_list>	Numeric	The first channel on a bank in the form (@sccc). Select from s101 or s201.	This is a required parameter

Remarks

- Depending on the width specified (see **SOURce:DIGital:DATA[:<width>]** command), the channel numbering is modified as shown below. For example, if you specify the width as a 16-bit WORD, channels 101 and 102 are combined and addressed collectively as channel 101.

	Bank 2	Bank 1

BYTE (8 Bits):	Ch 204	Ch 203	Ch 202	Ch 201	Ch 104	Ch 103	Ch 102	Ch 101
WORD (16 Bits):	Ch 203		Ch 201		Ch 103		Ch 101	
LWORD (32 Bits):	Ch 201				Ch 101			

- If you specify an infinite cycle count (default, INFinity or "0"), the bank will continue to write traces until you stop it (see **SOURce:DIGital:MEMory:STOP** or **SOURce:DIGital:MEMory:ABORT** commands).
- For a finite cycle count, the bank will automatically stop after outputting the trace the specified number of times.
- The selected cycle count is stored in **volatile** memory and will be set to 0 (continuous) when power is turned off or after a Factory Reset (***RST** command).

Return Format

The query command returns the cycle count for each channel specified. Multiple responses are separated by commas. For a continuous count ("0" or INFinity), the query command returns "0".

Examples

The following program segment configures a buffered write on channel 101 on the module in slot 3. The cycle count is set to output the complete trace 50 times.

```
SOUR:DIG:DATA:WORD #HFFFF,(@3101) !Set initial output pattern
SOUR:DIG:MEM:NCYC 50,(@3101) !Output complete trace 50 times
TRAC:DIG:FUNC (@3101),WONES,PATTERN_1,32 !Download "walking ones" pattern
SOUR:DIG:MEM:TRAC PATTERN_1,(@3101) !Assign trace to channel 101
SOUR:DIG:MEM:ENAB ON,(@3101) !Enable memory on channel 101
SOUR:DIG:MEM:START (@3101) !Trigger memory output
```

The following query returns the cycle count on channel 101 on the module in slot 3.

```
SOUR:DIG:MEM:NCYC? (@3101)
```

Typical Response: **50**

See Also

SOURce:DIGital:DATA[:<width>]

SOURce:DIGital:MEMory:ABORT

SOURce:DIGital:MEMory:START

SOURce:DIGital:MEMory:STEP

SOURce:DIGital:MEMory:STOP

SOURce:DIGital:MEMory:TRACe
TRACe[:DATA]:DIGital:FUNction

SOURce:DIGital:MEMory:START

Syntax | Description | Parameters | Remarks | Return Format | Example

Syntax

SOURce:DIGital:MEMory:START (@<ch_list>)

Description

This command starts buffered (memory) output operations on the 34950A Digital I/O Module. If memory is currently disabled (see **SOURce:DIGital:MEMory:ENABLE** command), this command will enable memory and start the buffered write. The width of the first channel in each bank (i.e., channels 101 and 201) controls the width of the memory operations (64K x 8 Bits, 64K x 16 Bits, or 32K x 32 Bits). The first channel on the specified bank must be configured as an output prior to starting a buffered write (see **SOURce:DIGital:DATA[:<width>]** command) and a trace must be downloaded to memory and assigned to the specified bank (see **SOURce:DIGital:MEMory:TRACe** command).

Used With:

- 34950A Digital I/O Module

Parameters

Name	Type	Range of Values	Default Value
<ch_list>	Numeric	The first channel on a bank in the form (@sccc). Select from s101 or s201.	This is a required parameter

Remarks

- Depending on the width specified (see **SOURce:DIGital:DATA[:<width>]** command), the channel numbering is modified as shown below. For example, if you specify the width as a 16-bit WORD, channels 101 and 102 are combined and addressed collectively as channel 101.

	Bank 2				Bank 1			
BYTE (8 Bits):	Ch 204	Ch 203	Ch 202	Ch 201	Ch 104	Ch 103	Ch 102	Ch 101
WORD (16 Bits):	Ch 203		Ch 201		Ch 103		Ch 101	
LWORD (32 Bits):	Ch 201				Ch 101			

- You can also use this command to resume a stopped buffered write (see **SOURce:DIGital:MEMory:STOP** command).

- You can use the **SOURce:DIGital:MEMory:ABORt** command prior to sending the SOURce:DIGital:MEMory:STARt command to restart the buffered write from the beginning.
- This command overrides the hardware INTR (interrupt) line (see **SOURce:DIGital:INTerrupt[:ENABLE]** command); therefore, you can use the SOURce:DIGital:MEMory:STARt command to start the buffered write even if the bank is configured to start on an interrupt.
- If you send this command while a buffered write is already running, additional SOURce:DIGital:MEMory:STARt commands are ignored (no error is generated).

Example

The following program segment downloads and outputs a "walking ones" pattern from channel 101 on the module in slot 3. The length of the trace is set to 32 samples. In addition, the cycle count is set to output the complete trace three times. Once memory is enabled, the SOURce:DIGital:MEMory:STARt command is used to trigger the memory output.

```
SOUR:DIG:DATA:WORD #HFFFF, (@3101)  !Set initial output pattern
SOUR:DIG:MEM:NCYC 3, (@3101)  !Output complete trace 3 times
TRAC:DIG:FUNC (@3101), WONES, PATTERN_1, 32  !Download "walking ones" pattern
SOUR:DIG:MEM:TRAC PATTERN_1, (@3101)  !Assign trace to channel 101
SOUR:DIG:MEM:ENAB ON, (@3101)  !Enable memory on channel 101
SOUR:DIG:MEM:STARt (@3101)  !Trigger memory output
```

See Also

SOURce:DIGital:DATA[:<width>]

SOURce:DIGital:INTerrupt[:ENABLE]

SOURce:DIGital:MEMory:ABORt

SOURce:DIGital:MEMory:NCYCles

SOURce:DIGital:MEMory:STEP

SOURce:DIGital:MEMory:STOP

SOURce:DIGital:MEMory:TRACe

TRACe[:DATA]:DIGital:FUNCtion

SOURce:DIGital:MEMory:STEP

Syntax | Description | Parameters | Remarks | Return Format | Example

Syntax

SOURce:DIGital:MEMory:STEP (@<ch_list>)

Description

This command handshakes one sample onto the data lines on the 34950A Digital I/O Module and then places buffered memory in the "stopped" state. If memory is currently *disabled* (see **SOURce:DIGital:MEMory:ENABLE** command), this command will output the first sample and then stop. The width of the first channel in each bank (i.e., channels 101 and 201) controls the width of the memory operations (64K x 8 Bits, 64K x 16 Bits, or 32K x 32 Bits). The first channel on the specified bank must be configured as an output prior to starting a buffered write (see **SOURce:DIGital:DATA[:<width>]** command) and a trace must be downloaded to memory and assigned to the specified bank (see **SOURce:DIGital:MEMory:TRACe** command).

Used With:

- 34950A Digital I/O Module

Parameters

Name	Type	Range of Values	Default Value
<ch_list>	Numeric	The first channel on a bank in the form (@sccc). Select from s101 or s201.	This is a required parameter

Remarks

- Depending on the width specified (see **SOURce:DIGital:DATA[:<width>]** command), the channel numbering is modified as shown below. For example, if you specify the width as a 16-bit WORD, channels 101 and 102 are combined and addressed collectively as channel 101.

	Bank 2				Bank 1			
BYTE (8 Bits):	Ch 204	Ch 203	Ch 202	Ch 201	Ch 104	Ch 103	Ch 102	Ch 101
WORD (16 Bits):	Ch 203		Ch 201		Ch 103		Ch 101	
LWORD (32 Bits):	Ch 201				Ch 101			

- This command overrides the hardware INTR (interrupt) line (see **SOURce:DIGital:INTerrupt[:ENABLE]** command); therefore, you can use the SOURce:DIGital:MEMory:STEP command to step a buffered write even if the bank is configured to start on an interrupt.

- If you send this command while a buffered write is already running, it will stop memory and step once. To resume a stopped buffered write, send the **SOURce:DIGital:MEMory:START** command.

Example

The following program segment configures a buffered write on channel 101 on the module in slot 3 and then writes one sample from memory.

```
SOUR:DIG:DATA:WORD #HFFFF, (@3101)  !Set initial output pattern
SOUR:DIG:MEM:NCYC 3, (@3101)  !Output complete trace 3 times
TRAC:DIG:FUNC (@3101),WONES,PATTERN_1,32  !Download "walking ones" pattern
SOUR:DIG:MEM:TRAC PATTERN_1, (@3101)  !Assign trace to channel 101
SOUR:DIG:MEM:ENAB ON, (@3101)  !Enable memory on channel 101
SOUR:DIG:MEM:STEP (@3101)  !Write one sample from memory
```

See Also

SOURce:DIGital:DATA[:<width>]

SOURce:DIGital:INTerrupt[:ENABLE]

SOURce:DIGital:MEMory:ABORT

SOURce:DIGital:MEMory:NCYCles

SOURce:DIGital:MEMory:START

SOURce:DIGital:MEMory:STOP

SOURce:DIGital:MEMory:TRACe

TRACe[:DATA]:DIGital:FUNCtion

SOURce:DIGital:MEMory:STOP

Syntax | Description | Parameters | Remarks | Return Format | Example

Syntax

SOURce:DIGital:MEMory:STOP (@<ch_list>)

Description

This command stops a buffered (memory) output operation in progress on the 34950A Digital I/O Module. To resume a stopped buffered write, send the **SOURce:DIGital:MEMory:START** command. The width of the first channel in each bank (i.e., channels 101 and 201) controls the width of the memory operations (64K x 8 Bits, 64K x 16 Bits, or 32K x 32 Bits). The first channel on the specified bank must be configured as an output prior to starting a buffered write (see **SOURce:DIGital:DATA[:<width>]** command) and a trace must be downloaded to memory and assigned to the specified bank (see **SOURce:DIGital:MEMory:TRACe** command).

Used With:

- 34950A Digital I/O Module

Parameters

Name	Type	Range of Values	Default Value
<ch_list>	Numeric	The first channel on a bank in the form (@sccc). Select from s101 or s201.	This is a required parameter

Remarks

- Depending on the width specified (see **SOURce:DIGital:DATA[:<width>]** command), the channel numbering is modified as shown below. For example, if you specify the width as a 16-bit WORD, channels 101 and 102 are combined and addressed collectively as channel 101.

	Bank 2				Bank 1			
BYTE (8 Bits):	Ch 204	Ch 203	Ch 202	Ch 201	Ch 104	Ch 103	Ch 102	Ch 101
WORD (16 Bits):	Ch 203		Ch 201		Ch 103		Ch 101	
LWORD (32 Bits):	Ch 201				Ch 101			

- This command overrides the hardware INTR (interrupt) line (see **SOURce:DIGital:INTerrupt[:ENABLE]** command); therefore, you can use the SOURce:DIGital:MEMory:START command to start the buffered write even if the bank is configured to start on an interrupt.

Example

The following program segment configures a buffered write on channel 101 on the module in slot 3 and then stops the write.

```
SOUR:DIG:DATA:WORD #HFFFF, (@3101)  !Set initial output pattern
SOUR:DIG:MEM:NCYC 3, (@3101)  !Output complete trace 3 times
TRAC:DIG:FUNC (@3101), WONES, PATTERN_1, 32  !Download "walking ones" pattern
SOUR:DIG:MEM:TRAC PATTERN_1, (@3101)  !Assign trace to channel 101
SOUR:DIG:MEM:ENAB ON, (@3101)  !Enable memory on channel 101
SOUR:DIG:MEM:START (@3101)  !Trigger memory output
SOUR:DIG:MEM:STOP (@3101)  !Stop memory output
```

See Also

[SOURce:DIGital:DATA\[:<width>\]](#)

[SOURce:DIGital:INTerrupt\[:ENABLE\]](#)

[SOURce:DIGital:MEMory:ABORt](#)

[SOURce:DIGital:MEMory:NCYCles](#)

[SOURce:DIGital:MEMory:STEP](#)

[SOURce:DIGital:MEMory:START](#)

[SOURce:DIGital:MEMory:TRACe](#)

[TRACe\[:DATA\]:DIGital:FUNCtion](#)

SOURce:DIGital:MEMory:TRACe

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Syntax

SOURce:DIGital:MEMory:TRACe <name>, (@<channel>)

SOURce:DIGital:MEMory:TRACe? (@<channel>)

Description

This command assigns a trace to the specified bank on the 34950A Digital I/O Module. The width of the first channel in each bank (i.e., channels 101 and 201) controls the width of the memory operations (64K x 8 Bits, 64K x 16 Bits, or 32K x 32 Bits). Before enabling memory (see **SOURce:DIGital:MEMory:ENABle** command), you must download a trace to memory (see **TRACe[:DATA]:DIGital[:<width>]** command) and assign it to the specified bank.

Used With:

- 34950A Digital I/O Module

Parameters

Name	Type	Range of Values	Default Value
<name>	ASCII String	A trace name consisting of up to 12 characters. The first character must be a letter (A-Z), but the remaining 11 characters can be letters, numbers (0-9), or an underscore (_). Blank spaces are not allowed. The name must be unique to the specified channel (bank).	This is a required parameter
<channel>	Numeric	One channel in the form (@sccc). Select from s101 or s201.	This is a required parameter

Remarks

- Each bank has its own memory (64K bytes each) for use in buffered output transfers. You can download up to 32 traces into each bank. Use the **TRACe:DELeTe[:NAME]** command to delete traces from memory.
- If you change the width of a bank (see **CONFigure:DIGital:WIDTh** command), all traces in memory are cleared.

- A Factory Reset (***RST** command), Instrument Preset (**SYSTem:PRESet** command), and Card Reset (**SYSTem:CPON** command) deletes the trace from memory and removes all trace name associations. In addition, storing the instrument state (***SAV** command) will delete the trace from memory and remove all trace name associations.

Return Format

The query command reads the trace name currently assigned to the specified channel. If the specified channel has no trace name assigned, a null string (" ") is returned.

Examples

The following program segment downloads a "walking ones" pattern and assigns it to channel 101 on the module in slot 3.

```
SOUR:DIG:DATA:WORD #HFFFF, (@3101) !Set initial output pattern
SOUR:DIG:MEM:NCYC 3, (@3101) !Output complete trace 3 times
TRAC:DIG:FUNC (@3101), WONES, PATTERN_1, 32 !Download "walking ones" pattern
SOUR:DIG:MEM:TRAC PATTERN_1, (@3101) !Assign trace to channel 101
SOUR:DIG:MEM:ENAB ON, (@3101) !Enable memory on channel 101
SOUR:DIG:MEM:START (@3101) !Trigger memory output
```

The following query returns the trace name currently assigned to channel 101 on the module in slot 3 (the quotes are also returned).

```
SOUR:DIG:MEM:TRAC? (@3101)
```

Typical Response: "PATTERN_1"

See Also

SOURce:DIGital:DATA[:<width>]

SOURce:DIGital:MEMory:ABORT

SOURce:DIGital:MEMory:NCYCles

SOURce:DIGital:MEMory:START

SOURce:DIGital:MEMory:STOP

TRACe[:DATA]:DIGital[:<width>]

TRACe[:DATA]:DIGital:FUNCtion

SOURce:DIGital:STATe

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

SOURce:DIGital:STATe <mode>, (@<ch_list>)

SOURce:DIGital:STATe? (@<ch_list>)

Description

This command enables or disables output operations on the specified digital channels.

Used With:

- 34950A Digital I/O Module (digital input/output channels only)
- 34952A Multifunction Module (digital input/output channels only)
- 34959A Breadboard Module

Parameters

Name	Type	Range of Values	Default Value
<mode>	Boolean	{OFF 0 ON 1}	0 (INPut)
<ch_list>	Numeric	One or more digital output channels in the form (@sccc). 34950A: s101 through s104, s201 through s204 34952A: s001 through s004	This is a required parameter

Remarks

- Depending on the width specified (see SOURce:DIGital:DATA[:<width>] command), the channel numbering is modified as shown below. For example, if you specify the width as a 16-bit WORD on the 34950A, channels 101 and 102 are combined and addressed collectively as channel 101.

34950A	Bank 2				Bank 1			
BYTE (8 Bits):	Ch 204	Ch 203	Ch 202	Ch 201	Ch 104	Ch 103	Ch 102	Ch 101
WORD (16 Bits):	Ch 203		Ch 201		Ch 103		Ch 101	
LWORD (32 Bits):	Ch 201				Ch 101			

34952A	Bank 1			
BYTE (8 Bits):	Ch 4	Ch 3	Ch 2	Ch1
WORD (16 Bits):	Ch 3		Ch 1	
LWORD (32 Bits):	Ch 1			

- The channel setting is stored in **volatile** memory and will be disabled (output OFF) when power is turned off or after a Factory Reset (***RST** command).

Return Format

The query command returns "0" if the specified channel is an input channel or "1" if the channel is an output channel. Multiple responses are separated by commas.

Examples

The following program segment enables 16-bit operations on channels 101 and 103 on the **34950A** in slot 3.

```
CONF:DIG:WIDTH WORD, (@3101, 3103)
SOUR:DIG:STAT 1, (@3101, 3103)
```

The following command queries the input/output state of channels 101 and 103 on the **34950A** in slot 3. The values are transferred to the instrument's output buffer.

```
SOUR:DIG:STAT? (@3101, 3103)
```

Typical Response: 1,1

The following program segment enables 8-bit output operations on channel 1 on the **34952A** in slot 5.

```
CONF:DIG:WIDTH BYTE, (@5001)
SOUR:DIG:STAT 1, (@5001)
```

The following command queries the input/output state of channel 1 on the **34952A** in slot 5. The value is transferred to the instrument's output buffer.

```
SOUR:DIG:STAT? (@5001)
```

Typical Response: 1

See Also

CONFigure:DIGital:WIDTH

SOURce:DIGital:DATA[:<width>]

SOURce:DIGital:DATA:BIT

SOURce:FUNCTION:CLOCK:EXTeRnal:DIVisor

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

SOURce:FUNCTION:CLOCK:EXTeRnal:DIVisor {<value>|MIN|MAX|DEF}, (@<ch_list>)

SOURce:FUNCTION:CLOCK:EXTeRnal:DIVisor? [{MIN|MAX},] (@<ch_list>)

Description

This command sets an external clock divisor for trace outputs on the specified channels on the 34951A Isolated DAC Module. This provides a way to divide an externally-supplied clock input to a frequency that is usable for outputting trace waveforms. The specified value is used only if the clock source is set to EXTeRnal (see [SOURce:FUNCTION:CLOCK:SOURce](#) command).

Used With:

- 34951A Isolated DAC Module

Parameters

Name	Type	Range of Values	Default Value
<value>	Numeric	Specify any integer value between 1 and 4.0E+9. MIN = 1, MAX = 4.0E+9	1
<ch_list>	Numeric	One or more channels in the form (@sccc) . Select from s001, s002, s003, or s004.	This is a required parameter

Remarks

- The valid frequency range for external clock inputs to the module is 1 Hz to 10 MHz.
- Since the maximum point-to-point rate for trace waveforms on the 34951A is 200 kHz, you must set the divisor such that the resulting clock input is *less than* 200 kHz. For example, with an external clock input of 2 MHz, the *minimum* divisor would be: 2 MHz/200 kHz = 10.
- The external **clock signal** is applied to Pin 24 on the module's D-Sub connector. The external clock input is shared among all four DAC channels (i.e., there are no channel-specific clock inputs available). The valid frequency range for external clock inputs to the module is 1 Hz to 10 MHz.
- A Factory Reset (***RST** command), Instrument Preset (**SYSTem:PRESet** command), and Card Reset (**SYSTem:CPON** command) will reset the divisor to 1. In addition, storing the instrument state (***SAV** command) will reset the divisor to 1.

Return Format

The query command returns the clock divisor in the form "+1.00000000E+02" for each DAC channel specified. Multiple responses are separated by commas.

Examples

The following command sets the clock divisor to 100 on DAC channels 1 and 2 in slot 4 (the external clock input signal is divided by 100).

```
SOUR:FUNC:CLOC:SOUR EXT, (@4001,4002)  
SOUR:FUNC:CLOC:EXT:DIV 100, (@4001,4002)
```

The following query returns the clock divisor in use on DAC channels 1 and 2 in slot 4.

```
SOUR:FUNC:CLOC:EXT:DIV? (@4001,4002)
```

Typical Response: +1.00000000E+02,+1.00000000E+02

See Also

SOURce:FUNCtion:CLOCK:SOURce

SOURce:FUNCtion:TRIGger:IMMediate

SOURce:FUNCTION:CLOCK:SOURce

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

SOURce:FUNCTION:CLOCK:SOURce <source>, (@<ch_list>)

SOURce:FUNCTION:CLOCK:SOURce? (@<ch_list>)

Description

This command selects the clock source for pacing trace outputs on the specified channels on the 34951A Isolated DAC Module. The module will accept an internal clock, an external clock, or a software (bus) command. If desired, you can assign different clock sources to each of the four DAC channels.

Used With:

- 34951A Isolated DAC Module

Parameters

Name	Type	Range of Values	Default Value
<source>	Discrete	{INTernal EXTernal STEP}	INTernal
<ch_list>	Numeric	One or more channels in the form (@sccc). Select from s001, s002, s003, or s004.	This is a required parameter

Remarks

- If you select the INTernal source, the pacing is controlled by the **SOURce:FUNCTION:SAMPLE:PERiod** command.
- If you select the EXTernal source, the pacing is controlled by an external **clock signal** which you supply to the module (Pin 24 on the module's D-Sub connector). The external clock input is shared among all four DAC channels (i.e., there are no channel-specific clock inputs available). The valid frequency range for external clock inputs to the module is 1 Hz to 10 MHz.
- If desired, you can use the **SOURce:FUNCTION:CLOCK:EXTernal:DIVisor** command to divide the external clock frequency. Since the maximum point-to-point rate for trace waveforms on the 34951A is 200 kHz, you must set the divisor such that the resulting clock input is *less than* 200 kHz. For example, with an external clock input of 2 MHz, the *minimum* divisor would be: 2 MHz/200 kHz = 10.
- If you select the STEP source, the pacing is controlled by the **SOURce:FUNCTION:TRIGger:IMMEDIATE** command. Successive values are output each time the command is received.

- If you select the EXTERNAL or STEP source, the internal sample period specified by the SOURce:FUNCTION:SAMPLE:PERIOD command is ignored.
- A Factory Reset (*RST command), Instrument Preset (SYSTem:PRESet command), and Card Reset (SYSTem:CPON command) will reset the clock source to INTERNAL. In addition, storing the instrument state (*SAV command) will reset the clock source to INTERNAL.

Return Format

The query command returns the present clock source for the specified channels: "INT", "EXT", or "STEP". Multiple responses are separated by commas.

Examples

The following command selects the external clock source on DAC channels 1 and 2 in slot 4. The external clock input is shared between these two channels.

```
SOUR:FUNC:CLOC:SOUR EXT, (@4001, 4002)
```

The following query returns the clock source in use on DAC channels 1 and 2 in slot 4.

```
SOUR:FUNC:CLOC:SOUR? (@4001, 4002)
```

Typical Response: EXT,EXT

See Also

[SOURce:FUNCTION:CLOCK:EXTERNAL:DIVisor](#)

[SOURce:FUNCTION:SAMPLE:PERiod](#)

[SOURce:FUNCTION:TRIGger:IMMediate](#)

SOURce:FUNCTION:CURRent:GAIN

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

SOURce:FUNCTION:CURRent:GAIN {<gain>|MIN|MAX|DEF}, (@<ch_list>)

SOURce:FUNCTION:CURRent:GAIN? [{MIN|MAX},] (@<ch_list>)

Description

This command sets a current gain for scaled trace outputs on the specified channels on the 34951A Isolated DAC Module. Scaling is applied using the following equation:

$$\text{Scaled Value} = (\text{Gain} \times \text{Trace Data}) + \text{Offset}$$

Used With:

- 34951A Isolated DAC Module

Parameters

Name	Type	Range of Values	Default Value
<gain>	Numeric	Specify any value between 0 and 20 mA. MIN = 0, MAX = 20 mA.	1 mA
<ch_list>	Numeric	One or more channels in the form (@sccc). Select from s001, s002, s003, or s004.	This is a required parameter

Remarks

- If the resulting scaled value goes outside the current limit of the DAC channel (± 20 mA), an error is generated and the value is not applied. For example, if the offset is set to 1 mA, the maximum gain allowed will be 19 mA.
- To control the output current in the level mode, use the **SOURce:CURRent[:LEVel]** command.
- A Factory Reset (***RST** command), Instrument Preset (**SYSTem:PRESet** command), and Card Reset (**SYSTem:CPON** command) will reset the gain to 1 mA. In addition, storing the instrument state (***SAV** command) will reset the gain to 1 mA.

Return Format

The query command returns the gain in the form "+1.00000000E-03" for each DAC channel specified. Multiple responses are separated by commas.

Examples

The following command downloads a 1000-point square waveform to memory on the module in slot 4 and outputs the waveform from DAC channel 1. The gain and offset are adjusted on the waveform. The trace name is "TEST_SQU".

```
TRAC:FUNC 4,SQU, TEST_SQU, 1000 !Download 1000-point square wave to memory
SOUR:FUNC:TRAC TEST_SQU, (@4001) !Assign trace to channel 1
SOUR:FUNC:CURRE:OFFS 0.01, (@4001) !Set offset to 10 mA
SOUR:FUNC:CURRE:GAIN 0.005, (@4001) !Set gain to 5 mA
OUTP:STAT ON, (@4001) !Enable outputs from channel 1
SOUR:FUNC:ENAB ON, (@4001) !Enable trace mode on channel 1
```

The following query returns the gain on DAC channel 1 in slot 4.

```
SOUR:FUNC:CURRE:GAIN? (@4001)
```

Typical Response: **+5.00000000E-03**

See Also

SOURce:FUNCtion:CURREnt:OFFSet

SOURce:FUNCtion:VOLTage:GAIN

TRACe[:DATA]

TRACe[:DATA]:DAC

TRACe[:DATA]:FUNCtion

SOURce:FUNCTION:CURRent:OFFSet

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

SOURce:FUNCTION:CURRent:OFFSet {<offset>|MIN|MAX|DEF}, (@<ch_list>)

SOURce:FUNCTION:CURRent:OFFSet? [{MIN|MAX},] (@<ch_list>)

Description

This command sets a current offset for scaled trace outputs on the specified channels on the 34951A Isolated DAC Module. Scaling is applied using the following equation:

$$\text{Scaled Value} = (\text{Gain} \times \text{Trace Data}) + \text{Offset}$$

Used With:

- 34951A Isolated DAC Module

Parameters

Name	Type	Range of Values	Default Value
<offset>	Numeric	Specify any value between -20 mA and +20 mA. MIN = -20 mA, MAX = +20 mA.	0
<ch_list>	Numeric	One or more channels in the form (@sccc) . Select from s001, s002, s003, or s004.	This is a required parameter

Remarks

- If the resulting scaled value goes outside the current limit of the DAC channel (± 20 mA), an error is generated and the value is not applied. For example, if the gain is set to 5 mA, the maximum offset allowed will be 15 mA.
- A Factory Reset (***RST** command), Instrument Preset (**SYSTem:PRESet** command), and Card Reset (**SYSTem:CPON** command) will reset the offset to 0. In addition, storing the instrument state (***SAV** command) will reset the offset to 0.

Return Format

The query command returns the offset in the form "+0.00000000E+00" for each DAC channel specified. Multiple responses are separated by commas.

Examples

The following command downloads a 1000-point square waveform to memory on the module in slot 4 and outputs the waveform from DAC channel 1. The gain and offset are adjusted on the waveform. The trace name is "TEST_SQU".

```
TRAC:FUNC 4,SQU, TEST_SQU, 1000 !Download 1000-point square wave to memory
SOUR:FUNC:TRAC TEST_SQU, (@4001) !Assign trace to channel 1
SOUR:FUNC:CURRENTOFFS 0.01, (@4001) !Set offset to 10 mA
SOUR:FUNC:CURRENTOFFS 0.005, (@4001) !Set gain to 5 mA
OUTP:STAT ON, (@4001) !Enable outputs from channel 1
SOUR:FUNC:ENAB ON, (@4001) !Enable trace mode on channel 1
```

The following query returns the offset on DAC channel 1 in slot 4.

```
SOUR:FUNC:CURRENTOFFS? (@4001,4002)
```

Typical Response: +5.00000000E-05,+5.00000000E-05

See Also

[SOURce:FUNCTION:CURRENTOFFS](#)

[SOURce:FUNCTION:VOLTAGE:OFFSet](#)

[TRACe\[:DATA\]](#)

[TRACe\[:DATA\]:DAC](#)

[TRACe\[:DATA\]:FUNCTION](#)

SOURce:FUNCTION:ENABle

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

SOURce:FUNCTION:ENABle <mode>, (@<ch_list>)

SOURce:FUNCTION:ENABle? (@<ch_list>)

Description

This command disables or enables the trace output mode on the specified channels on the 34951A Isolated DAC Module.

Used With:

- 34951A Isolated DAC Module

Parameters

Name	Type	Range of Values	Default Value
<mode>	Boolean	{OFF 0 ON 1}	OFF
<ch_list>	Numeric	One or more channels in the form (@sccc) . Select from s001, s002, s003, or s004.	This is a required parameter

Remarks

- If you have not associated a trace name with the specified channels (see [SOURce:FUNCTION:TRACe\[:NAME\]](#) command), an error is generated if you attempt to enable the specified channels.
- Sending the [SOURce:CURREnt\[:LEVel\]](#) or [SOURce:VOLTage\[:LEVel\]](#) command to set a current or voltage level will stop a trace waveform in progress and turn off the trace output mode.
- A Factory Reset ([*RST](#) command), Instrument Preset ([SYSTem:PRESet](#) command), and Card Reset ([SYSTem:CPON](#) command) will turn off the trace output mode. In addition, storing the instrument state ([*SAV](#) command) will turn off the trace output mode.

Return Format

The query command returns "0" (OFF) or "1" (ON). Multiple responses are separated by commas.

Examples

The following command enables the trace output mode on DAC channels 1 and 2 in slot 4.

```
SOUR:FUNC:ENAB ON, (@4001, 4002)
```

The following query returns the state of the trace output mode on DAC channels 1 and 2 in slot 4.

```
SOUR:FUNC:ENAB? (@4001, 4002)
```

Typical Response: **1,1**

See Also

[SOURce:CURRent\[:LEVel\]](#)

[SOURce:FUNCtion:TRACe\[:NAME\]](#)

[SOURce:VOLTage\[:LEVel\]](#)

SOURce:FUNCTION:FREQuency

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

SOURce:FUNCTION:FREQuency {<frequency>|MIN|MAX|DEF}, (@<ch_list>)

SOURce:FUNCTION:FREQuency? [{MIN|MAX},] (@<ch_list>)

Description

This command sets the frequency of trace waveform outputs for the 34951A Isolated DAC Module. The maximum allowed frequency is for the entire trace waveform and is a function of the time between consecutive trace values (see **SOURce:FUNCTION:SAMPLE:PERiod** command) and the number of waveform points.

Used With:

- 34951A Isolated DAC Module

Parameters

Name	Type	Range of Values	Default Value
<frequency>	Numeric	Desired frequency in Hz.	The default is a function of the sample period and the number of points in the trace waveform.
<ch_list>	Numeric	One or more channels in the form (@sccc) . Select from s001, s002, s003, or s004.	This is a required parameter

Remarks

- If you have not associated a trace name with the specified channels (see **SOURce:FUNCTION:TRACe[:NAME]** command), the command is accepted but no error is generated if you attempt to set the frequency.
- Since the maximum point-to-point rate for trace waveforms on the 34951A is 200 kHz, the maximum output frequency is:

$$\text{Maximum Frequency} = 200,000 / \text{Number of Points}$$

For example, a 1,000-point waveform will have a maximum frequency of: $200,000/1,000 = 200$ Hz; a 100-point waveform will have a maximum frequency of: $200,000/100 = 2,000$ Hz.

- This command is valid only with an INTERNAL clock source (see **SOURce:FUNCTION:CLOCK:SOURce** command). If the clock source is set to EXTERNAL or STEP, the specified frequency is ignored.
- All of the built-in waveforms are 1 cycle in length (see **TRACe[:DATA]:FUNCTION** command).
- A Factory Reset (***RST** command), Instrument Preset (**SYSTem:PRESet** command), and Card Reset (**SYSTem:CPON** command) will reset the frequency to its default (a function of the sample period and the number of points in the trace waveform). In addition, storing the instrument state (***SAV** command) will reset the frequency to its default.

Return Format

The query command returns the output frequency in the form "+1.00000000E+03" for each DAC channel specified. Multiple responses are separated by commas. If you have not associated a trace name with the specified channels, "+0.00000000E+00" is returned for each channel (no error generated).

Examples

The following command sets the output frequency to 1 kHz on DAC channels 1 and 2 in slot 4.

```
SOUR:FUNC:FREQ 1000, (@4001, 4002)
```

The following query returns the output frequency on DAC channels 1 and 2 in slot 4.

```
SOUR:FUNC:FREQ? (@4001, 4002)
```

Typical Response: +1.00000000E+03,+1.00000000E+03

See Also

SOURce:FUNCTION:CLOCK:SOURce

SOURce:FUNCTION:SAMPLE:PERiod

SOURce:FUNCTION:HALT

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

SOURce:FUNCTION:HALT (@<ch_list>)

Description

This command immediately stops the trace outputs from the specified channels on the 34951A Isolated DAC Module. The output remains enabled and is maintained at the level presently being output at the time the waveform was stopped.

Used With:

- 34951A Isolated DAC Module

Parameters

Name	Type	Range of Values	Default Value
<ch_list>	Numeric	One or more channels in the form (@sccc). Select from s001, s002, s003, or s004.	This is a required parameter

Remarks

- To restart a halted waveform, use the **SOURce:FUNCTION:TRIGger:IMMediate** command. The waveform begins at the specified starting index and the specified gain and offset remain in effect.

Example

The following command stops trace outputs on DAC channels 1 and 2 in slot 4.

```
SOUR:FUNC:HALT (@4001,4002)
```

See Also

[SOURce:FUNCTION:CURRENT:GAIN](#)

[SOURce:FUNCTION:CURRENT:OFFSet](#)

[SOURce:FUNCTION:TRACE:SINdex](#)

[SOURce:FUNCTION:TRIGger:IMMediate](#)

[SOURce:FUNCTION:VOLTage:GAIN](#)

SOURce:FUNctIon:VOLTage:OFFSet

SOURce:FUNCTION:SAMPLE:PERiod

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

SOURce:FUNCTION:SAMPLE:PERiod {<period>|MIN|MAX|DEF}, (@<ch_list>)

SOURce:FUNCTION:SAMPLE:PERiod? [{MIN|MAX},] (@<ch_list>)

Description

This command sets the internal sample period for trace outputs on the specified channels on the 34951A Isolated DAC Module. The specified period sets the time between consecutive trace values in memory, independent of the number of waveform points.

Used With:

- 34951A Isolated DAC Module

Parameters

Name	Type	Range of Values	Default Value
<period>	Numeric	Desired period in seconds. Specify any value between 5 μ s and 200 seconds, with 10 ns resolution. MIN =5 μ s , MAX = 200 seconds	5 μ s
<ch_list>	Numeric	One or more channels in the form (@sccc) . Select from s001, s002, s003, or s004.	This is a required parameter

Remarks

- This command is similar to the **SOURce:FUNCTION:FREQuency** command, which sets the frequency of trace waveform. However, since the frequency is a function of the sample period and the number of points in the trace waveform, you must first associated a trace name with the specified channels (see **SOURce:FUNCTION:TRACe[:NAME]** command).
- This command is valid only with an INTERNAL clock source (see **SOURce:FUNCTION:CLOCK:SOURce** command). If you have set the clock source to EXTERNAL or STEP, the specified sample period is ignored (but the period will be applied if you change the clock source back to INTERNAL).
- All of the built-in waveforms are 1 cycle in length (see **TRACe[:DATA]:FUNCTION** command).
- A Factory Reset (***RST** command), Instrument Preset (**SYSTem:PRESet** command), and Card Reset (**SYSTem:CPON** command) will reset the sample period to 5 μ s. In addition, storing the instrument state (***SAV** command) will reset the sample period to 5 μ s.

Return Format

The query command returns the sample period in the form "+5.00000000E-06" for each DAC channel specified. Multiple responses are separated by commas.

Examples

The following command sets the sample period to 5 ms on DAC channels 1 and 2 in slot 4.

```
SOUR:FUNC:SAMP:PER 5E-3, (@4001, 4002)
```

The following query returns the sample period on DAC channels 1 and 2 in slot 4.

```
SOUR:FUNC:SAMP:PER? (@4001, 4002)
```

Typical Response: +5.00000000E-03,+5.00000000E-03

See Also

[SOURce:FUNCtion:CLOCK:SOURce](#)

[SOURce:FUNCtion:FREQuency](#)

SOURce:FUNCTION:TRACe:NCYCles

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

SOURce:FUNCTION:TRACe:NCYCles {<count>|MIN|MAX|DEF|INFinity}, (@<ch_list>)

SOURce:FUNCTION:TRACe:NCYCles? [{MIN|MAX},] (@<ch_list>)

Description

This command sets the number of trace cycles to be output from the specified channels on the 34951A Isolated DAC Module.

Used With:

- 34951A Isolated DAC Module

Parameters

Name	Type	Range of Values	Default Value
<count>	Numeric	Specify any value between 1 and 254, or 0 (continuous). MIN = 1, MAX = 254, INF = continuous	0 (continuous)
<ch_list>	Numeric	One or more channels in the form (@sccc) . Select from s001, s002, s003, or s004.	This is a required parameter

Remarks

- If you have not associated a trace name with the specified channels (see [SOURce:FUNCTION:TRACe\[:NAME\]](#) command), an error is generated if you attempt to set the number of trace cycles.
- The maximum rate for reloading a waveform is 1 second. Therefore, an external trigger may not be recognized if it comes too quickly (see [SOURce:FUNCTION:TRIGger:SOURce](#) command).
- A Factory Reset ([*RST](#) command), Instrument Preset ([SYSTem:PRESet](#) command), and Card Reset ([SYSTem:CPON](#) command) will reset the count to 0 (continuous). In addition, storing the instrument state ([*SAV](#) command) will reset the count to 0 (continuous).

Return Format

The query command returns the count in the form "+1.00000000E+01" for each DAC channel specified. Multiple responses are separated by commas. For a continuous count ("0" or INFinity), the query command returns "+0.00000000E+00".

Examples

The following command sets the cycle count to 100 on DAC channels 1 and 2 in slot 4.

```
SOUR:FUNC:TRAC:NCYC 100, (@4001,4002)
```

The following query returns the cycle count on DAC channels 1 and 2 in slot 4.

```
SOUR:FUNC:TRAC:NCYC? (@4001,4002)
```

Typical Response: +1.00000000E+02,+1.00000000E+02

See Also

[SOURce:FUNCtion:TRIGger:SOURce](#)

[TRACe\[:DATA\]](#)

[TRACe\[:DATA\]:DAC](#)

[TRACe\[:DATA\]:FUNCtion](#)

SOURce:FUNCTION:TRACe[:NAME]

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

SOURce:FUNCTION:TRACe[:NAME] <name>, (@<ch_list>)

SOURce:FUNCTION:TRACe[:NAME]? (@<ch_list>)

Description

This command selects a trace name to be associated with the specified channels on the 34951A Isolated DAC Module. The specified trace name must be a previously-defined name downloaded to the memory using the [TRACe\[:DATA\]](#), [TRACe\[:DATA\]:DAC](#), or [TRACe\[:DATA\]:FUNCTION](#) command.

Used With:

- 34951A Isolated DAC Module

Parameters

Name	Type	Range of Values	Default Value
<name>	ASCII String	A previously-defined trace name consisting of up to 12 characters. The first character must be a letter (A-Z), but the remaining 11 characters can be letters, numbers (0-9), or the underscore character ("_"). Blank spaces are not allowed.	This is a required parameter
<ch_list>	Numeric	One or more channels in the form (@sccc) . Select from s001, s002, s003, or s004.	This is a required parameter

Remarks

- You can associate the same trace name with one to four channels on a module (i.e., you can output the same waveform from multiple channels). You cannot, however, assign the same trace name to *different* waveforms on the same module (use the [TRACe:DELeTe\[:NAME\]](#) command to delete a trace waveform from memory). Since trace names are not required to be unique to a given module, you can also assign the same trace name to channels on different modules.
- An error is generated if the specified trace name does not exist.

- A Factory Reset (***RST** command), Instrument Preset (**SYSTem:PRESet** command), and Card Reset (**SYSTem:CPON** command) deletes the trace waveform from memory and removes all trace name associations.

Return Format

The query command returns the trace name associated with the specified channels. Multiple responses are separated by commas. If no traces have been associated with a channel, a null string (" ") is returned for that channel.

Examples

The following command downloads a 1000-point sine waveform to memory on the module in slot 4 and outputs the waveform from DAC channels 1 and 2. The trace name is "TEST_SINE".

```
TRAC:FUNC 4,SIN, TEST_SINE, 1000 !Download 1000-point sine to memory
SOUR:FUNC:TRAC TEST_SINE, (@4001,4002) !Assign trace to channels 1 and 2
OUTP:STAT ON, (@4001,4002) !Enable outputs from channels 1 and 2
SOUR:FUNC:ENAB ON, (@4001,4002) !Enable trace mode on channels 1 and 2
```

The following query returns the trace name currently associated with DAC channels 1 and 2 in slot 4 (the quotes are also returned).

```
SOUR:FUNC:TRAC? (@4001,4002)
```

Typical Response: "TEST_SINE","TEST_SINE"

See Also

SOURce:FUNCtion:TRACe[:NAME]

TRACe[:DATA]

TRACe[:DATA]:DAC

TRACe[:DATA]:FUNCtion

TRACe:DELeTe[:NAME]

SOURce:FUNCTION:TRACe:SINDeX

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

SOURce:FUNCTION:TRACe:SINDeX <point>, (@<ch_list>)

SOURce:FUNCTION:TRACe:SINDeX? (@<ch_list>)

Description

This command sets the starting point (index) for trace outputs on the specified channels on the 34951A Isolated DAC Module.

Used With:

- 34951A Isolated DAC Module

Parameters

Name	Type	Range of Values	Default Value
<point>	Numeric	Desired starting point. Specify any value between 0 (first point) and the last point in the trace (last point - 1).	0 (first point)
<ch_list>	Numeric	One or more channels in the form <u>(@sccc)</u> . Select from s001, s002, s003, or s004.	This is a required parameter

Remarks

- If you have not associated a trace name with the specified channels (see SOURce:FUNCTION:TRACe[:NAME] command), an error is generated if you attempt to set the starting point.
- If you specify a starting point that is greater than or equal to the last point in the trace, an error is generated.
- If you assign a new trace name to a channel, the starting point is automatically reset to 0.
- You cannot assign a new starting point while a trace output is currently running.
- A Factory Reset (*RST command), Instrument Preset (SYSTem:PRESet command), and Card Reset (SYSTem:CPON command) will reset the starting point to 0. In addition, storing the instrument state (*SAV command) will reset the starting point to 0.

Return Format

The query command returns the starting point in the form "+0.00000000E+00" for each DAC channel specified. Multiple responses are separated by commas.

Examples

The following command sets the starting points to point number 20 on DAC channels 1 and 2 in slot 4.

```
SOUR:FUNC:TRAC:SIND 20, (@4001, 4002)
```

The following query returns the starting points for DAC channels 1 and 2 in slot 4.

```
SOUR:FUNC:TRAC:SIND? (@4001, 4002)
```

Typical Response: +2.00000000E+01,+2.00000000E+01

SOURce:FUNCTION:TRIGger:IMMediate

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

SOURce:FUNCTION:TRIGger:IMMediate (@<ch_list>)

Description

This command starts trace outputs from the specified channels on the 34951A Isolated DAC Module. If you have selected the STEPped trigger mode (see **SOURce:FUNCTION:CLOCK:SOURce** command), then this command will advance the trace output to the next data point in memory.

Used With:

- 34951A Isolated DAC Module

Parameters

Name	Type	Range of Values	Default Value
<ch_list>	Numeric	One or more channels in the form (@sccc) . Select from s001, s002, s003, or s004.	This is a required parameter

Remarks

- When the trace starts, the specified gain and offset values are applied to the trace output.
- In order to output the trace waveform from the module, you must enable the output using the **OUTPut[:STATe]** command.

Example

The following command starts trace outputs from DAC channels 1 and 2 in slot 4.

```
SOUR:FUNC:CLOC:SOUR STEP, (@4001,4002)
SOUR:FUNC:TRIG:IMM (@4001,4002)
```

See Also

OUTPut[:STATe]

SOURce:FUNCTION:CLOCK:SOURce

SOURce:FUNCTION:TRIGger:SOURce

SOURce:FUNCTION:TRIGger:SOURce

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

SOURce:FUNCTION:TRIGger:SOURce <source>, (@<ch_list>)

SOURce:FUNCTION:TRIGger:SOURce? (@<ch_list>)

Description

This command selects the trigger source for enabling outputs from the specified channels on the 34951A Isolated DAC Module (used in level mode and trace mode). The module will accept an immediate (continuous) trigger, a software (bus) command, or an external TTL trigger pulse.

Used With:

- 34951A Isolated DAC Module

Parameters

Name	Type	Range of Values	Default Value
<source>	Discrete	{IMMediate MANual EXTernal}	IMMediate
<ch_list>	Numeric	One or more channels in the form (@sccc) . Select from s001, s002, s003, or s004.	This is a required parameter

Remarks

- For the *IMMediate* (continuous) source, the trigger signal is always present. When you enable the output (see [OUTPut\[:STATe\]](#) command), the voltage/current level or trace waveform is output.
- For the *MANual* (software) source, the output is triggered by the [SOURce:FUNCTION:TRIGger:IMMediate](#) command received over the remote interface. The [SOURce:FUNCTION:TRIGger:IMMediate](#) command will not be accepted unless the output is enabled (see [OUTPut\[:STATe\]](#) command).
- For the *EXTernal* source, the module will accept a hardware **trigger pulse** applied to the module (Pin 25 on the module's D-Sub connector). If the output is enabled (see [OUTPut\[:STATe\]](#) command), the module will output the voltage/current level or trace waveform when a rising-edge TTL pulse is received. The maximum rate for reloading a waveform is 1 second. Therefore, an external trigger may not be recognized if it comes too quickly.

- To configure the 34951A to *output* an external trigger signal (used for synchronizing multiple 34951A modules), select the EXTERNAL source. See the **SOURCE:MODULE:TRIGGER:OUTPUT** command for more information. Note that when an external trigger output is issued, all channels on the module configured for an external trigger *input* will also be triggered.
- A Factory Reset (***RST** command), Instrument Preset (**SYSTEM:PRESet** command), and Card Reset (**SYSTEM:CPON** command) will reset the clock source to IMMEDIATE. In addition, storing the instrument state (***SAV** command) will reset the clock source to IMMEDIATE.

Return Format

The query command returns the present clock source: "IMM", "MAN", or "EXT". Multiple responses are separated by commas.

Examples

The following command selects the external trigger source on DAC channels 1 and 2 in slot 4.

```
SOUR:FUNC:TRIG:SOUR EXT, (@4001,4002)
```

The following query returns the trigger source in use on DAC channels 1 and 2 in slot 4.

```
SOUR:FUNC:TRIG:SOUR? (@4001,4002)
```

Typical Response: **EXT,EXT**

See Also

SOURCE:FUNCTION:TRIGGER:IMMEDIATE

SOURCE:MODULE:TRIGGER:OUTPUT

SOURce:FUNCTION:VOLTage:GAIN

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

SOURce:FUNCTION:VOLTage:GAIN {<gain>|MIN|MAX|DEF}, (@<ch_list>)

SOURce:FUNCTION:VOLTage:GAIN? [{MIN|MAX},] (@<ch_list>)

Description

This command sets a voltage gain for scaled trace outputs on the specified channels on the 34951A Isolated DAC Module. Scaling is applied using the following equation:

$$\text{Scaled Value} = (\text{Gain} \times \text{Trace Data}) + \text{Offset}$$

Used With:

- 34951A Isolated DAC Module

Parameters

Name	Type	Range of Values	Default Value
<gain>	Numeric	Specify any value between 0 and 16 volts. MIN = 0, MAX = 16 volts.	1 volt
<ch_list>	Numeric	One or more channels in the form (@sccc) . Select from s001, s002, s003, or s004.	This is a required parameter

Remarks

- If the resulting scaled value goes outside the present limit of the DAC channel (± 16 Vdc), an error is generated and the value is not applied. For example, if the offset is set to 1V, the maximum gain allowed will be 15V.
- Each DAC channel is capable of ± 16 Vdc up to 10 mA maximum current. For protection, each channel incorporates a resettable thermal fuse that will open at greater than 20 mA. If an overload condition exists, the fuse will open, but no error or Service Request will be generated. To reset the fuse, remove the overload condition and wait a few minutes for the fuse to cool.
- To control the output voltage in the level mode, use the [SOURce:VOLTage\[:LEVel\]](#) command.

- A Factory Reset (***RST** command), Instrument Preset (**SYSTem:PRESet** command), and Card Reset (**SYSTem:CPON** command) will reset the gain to 1 volt. In addition, storing the instrument state (***SAV** command) will reset the gain to 1 volt.

Return Format

The query command returns the gain in the form "+1.00000000E+00" for each DAC channel specified. Multiple responses are separated by commas.

Examples

The following command downloads a 1000-point square waveform to memory on the module in slot 4 and outputs the waveform from DAC channel 1. The gain and offset are adjusted to TTL levels. The trace name is "TEST_SQU".

```
TRAC:FUNC 4,SQU, TEST_SQU, 1000 !Download 1000-point square wave to memory
SOUR:FUNC:TRAC TEST_SQU, (@4001) !Assign trace to channel 1
SOUR:FUNC:VOLT:OFFS 2.5, (@4001) !Set offset to 2.5 volts
SOUR:FUNC:VOLT:GAIN 2.5, (@4001) !Set gain to 2.5
OUTP:STAT ON, (@4001) !Enable outputs from channel 1
SOUR:FUNC:ENAB ON, (@4001) !Enable trace mode on channel 1
```

The following query returns the gain on DAC channel 1 in slot 4.

```
SOUR:FUNC:VOLT:GAIN? (@4001)
```

Typical Response: +2.50000000E+00

See Also

SOURce:FUNCTION:CURRENT:GAIN

SOURce:FUNCTION:VOLTage:OFFSet

TRACe[:DATA]

TRACe[:DATA]:DAC

TRACe[:DATA]:FUNCTION

SOURce:FUNCTION:VOLTage:OFFSet

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

SOURce:FUNCTION:VOLTage:OFFSet {<offset>|MIN|MAX|DEF}, (@<ch_list>)

SOURce:FUNCTION:VOLTage:OFFSet? [{MIN|MAX},] (@<ch_list>)

Description

This command sets a voltage offset for scaled trace outputs on the specified channels on the 34951A Isolated DAC Module. Scaling is applied using the following equation:

$$\text{Scaled Value} = (\text{Gain} \times \text{Trace Data}) + \text{Offset}$$

Used With:

- 34951A Isolated DAC Module

Parameters

Name	Type	Range of Values	Default Value
<offset>	Numeric	Specify any value between -16 and +16. MIN = -16, MAX = 16.	0
<ch_list>	Numeric	One or more channels in the form (@sccc). Select from s001, s002, s003, or s004.	This is a required parameter

Remarks

- If the resulting scaled value goes outside the present limit of the DAC channel (± 16 Vdc), an error is generated and the value is not applied. For example, if the gain is set to 5V, the maximum offset allowed will be 15V.
- Each DAC channel is capable of ± 16 Vdc up to 10 mA maximum current. For protection, each channel incorporates a resettable thermal fuse that will open at greater than 20 mA. If an overload condition exists, the fuse will open, but no error or Service Request will be generated. To reset the fuse, remove the overload condition and wait a few minutes for the fuse to cool.
- A Factory Reset (***RST** command), Instrument Preset (**SYSTem:PRESet** command), and Card Reset (**SYSTem:CPON** command) will reset the offset to 0. In addition, storing the instrument state (***SAV** command) will reset the offset to 0.

Return Format

The query command returns the offset in the form "+0.00000000E+00" for each DAC channel specified. Multiple responses are separated by commas.

Examples

The following command downloads a 1000-point square waveform to memory on the module in slot 4 and outputs the waveform from DAC channel 1. The gain and offset are adjusted to TTL levels. The trace name is "TEST_SQU".

```
TRAC:FUNC 4,SQU, TEST_SQU, 1000 !Download 1000-point square wave to memory
SOUR:FUNC:TRAC TEST_SQU, (@4001) !Assign trace to channel 1
SOUR:FUNC:VOLT:OFFS 2.5, (@4001) !Set offset to 2.5 volts
SOUR:FUNC:VOLT:GAIN 2.5, (@4001) !Set gain to 2.5
OUTP:STAT ON, (@4001) !Enable outputs from channel 1
SOUR:FUNC:ENAB ON, (@4001) !Enable trace mode on channel 1
```

The following query returns the offset on DAC channel 1 in slot 4.

```
SOUR:FUNC:VOLT:OFFS? (@4001)
```

Typical Response: +2.50000000E+00

See Also

SOURce:FUNCtion:CURRent:OFFSet

SOURce:FUNCtion:VOLTage:GAIN

TRACe[:DATA]

TRACe[:DATA]:DAC

TRACe[:DATA]:FUNCtion

SOURce:MODE

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

SOURce:MODE <mode>, (@<ch_list>)

SOURce:MODE? (@<ch_list>)

Description

This command selects the voltage or current mode for the specified channels on the 34951A Isolated DAC Module.

Used With:

- 34951A Isolated DAC Module

Parameters

Name	Type	Range of Values	Default Value
<mode>	Discrete	{VOLTage CURRent}	VOLTage
<ch_list>	Numeric	One or more channels in the form <u>(@sccc)</u> . Select from s001, s002, s003, or s004.	This is a required parameter

Remarks

- Sending the **SOURce:CURRent[:LEVel]** or **SOURce:VOLTage[:LEVel]** command will automatically enable the corresponding mode. The SOURce:MODE command gives you the capability to predefine voltage and current levels on the specified channels and then switch from one mode to the other.
- If the output is enabled (**OUTPut[:STATe] ON**) at the time you switch modes, the output will be momentarily disabled. After the mode transition is complete, the output will be re-enabled (some settling time may occur).
- If the output is disabled (**OUTPut[:STATe] OFF**) at the time you switch modes, the output will remain off after the mode transition is complete.
- A Factory Reset (***RST** command), Instrument Preset (**SYSTem:PRESet** command), and Card Reset (**SYSTem:CPON** command) will reset the module to the voltage mode. In addition, storing the instrument state (***SAV** command) will reset the module to the voltage mode.

Return Format

The query command returns the present output mode: "VOLT" or "CURR". Multiple responses are separated by commas.

Examples

The following command sets a current level and a voltage level on DAC channels 1 and 2 in slot 4. The SOURce:MODE command selects the current mode.

```
SOUR:CURR 5E-3, (@4001,4002) !Selects the current level
SOUR:VOLT 2.5, (@4001,4002) !Selects the voltage level
SOUR:MODE CURR, (@4001,4002) !Switch to current mode
```

The following query returns the output mode in use on DAC channels 1 and 2 in slot 4.

```
SOUR:MODE? (@4001,4002)
```

Typical Response: **CURR,CURR**

See Also

[OUTPut\[:STATe\]](#)

[SOURce:CURRent\[:LEVel\]](#)

[SOURce:VOLTage\[:LEVel\]](#)

SOURce:MODule:CLOCK:FREQuency

Syntax

SOURce:MODule:CLOCK:FREQuency {<*frequency*>|MIN|MAX|DEF}, <*slot*>

SOURce:MODule:CLOCK:FREQuency? [{MIN|MAX},] <*slot*>

Although the same command syntax is used to support both modules listed below, the corresponding functionality is different for each. To simplify the explanations, two separate command pages have been created for this command. To view the individual command pages, select from the links provided below.

- [34950A Digital I/O Module](#)
- [34951A Isolated DAC Module](#)

SOURce:MODUle:CLOCK:LEVel

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

SOURce:MODUle:CLOCK:LEVel {<voltage>|MIN|MAX|DEF}, <slot>

SOURce:MODUle:CLOCK:LEVel? [{MIN|MAX},] <slot>

Description

This command sets the logic "1" voltage level for external clock outputs on the 34950A Digital I/O Module in the specified slot. The external clock frequency is derived from the internal 20 MHz timebase clock on the module. Once enabled, the clock signal is output from Pin 62 on the module's D-Sub connector (connector P2).

Used With:

- 34950A Digital I/O Module

Parameters

Name	Type	Range of Values	Default Value
<voltage>	Numeric	Desired voltage level between 1.66V and 5V, with 20 mV resolution. MIN = 1.66V, MAX = 5V	1.66V
<slot>	Discrete	{1 2 3 4 5 6 7 8}	This is a required parameter

Remarks

- To set the frequency of the external clock output, use the **SOURce:MODUle:CLOCK:FREQuency** command.
- To enable the specified clock signal to be output from the module, use the **SOURce:MODUle:CLOCK:STATe** command.
- A Factory Reset (***RST** command), Instrument Preset (**SYSTem:PRESet** command), and Card Reset (**SYSTem:CPON** command) will disable the clock output and reset the voltage level to 1.66V.

Return Format

The query command returns the voltage level in the form "+1.00000000E+00". Multiple responses are separated by commas.

Examples

The following command sets the voltage level to 2.4V on the module in slot 3.

```
SOUR:MOD:CLOCK:LEVEL 2.4,3 !Logic "1" = 2.4V
```

The following query returns the voltage level setting on the module in slot 3.

```
SOUR:MOD:CLOCK:LEVEL? 3
```

Typical Response: **+2.4000000E+00**

See Also

[SOURce:MODule:CLOCK:FREQuency](#)

[SOURce:MODule:CLOCK:STATe](#)

SOURce:MODUle:CLOCK:STATe

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

SOURce:MODUle:CLOCK:STATe <mode>, <slot>

SOURce:MODUle:CLOCK:STATe? <slot>

Description

This command disables or enables the external clock output on the module in the specified slot.

Used With:

- 34950A Digital I/O Module
- 34951A Isolated DAC Module

Parameters

Name	Type	Range of Values	Default Value
<mode>	Boolean	{OFF 0 ON 1}	OFF
<slot>	Discrete	{1 2 3 4 5 6 7 8}	This is a required parameter

Remarks

- On the 34950A, you can set the clock output frequency to any value between 10 Hz and 20 MHz using the **SOURce:MODUle:CLOCK:FREQuency** command.
- On the 34951A, you can set the clock output frequency to any value between 305.2 Hz and 10 MHz using the **SOURce:MODUle:CLOCK:FREQuency** command.
- If desired, you can use the **SOURce:FUNCTion:CLOCK:EXTernal:DIVisor** command (*34951A only*) to divide the external clock frequency. Since the maximum point-to-point rate for trace waveforms on the 34951A is 200 kHz, you must set the divisor such that the resulting clock input is *less than* 200 kHz. For example, with an external clock input of 2 MHz, the *minimum* divisor would be: 2 MHz/200 kHz = 10.
- A Factory Reset (***RST** command), Instrument Preset (**SYSTem:PRESet** command), and Card Reset (**SYSTem:CPON** command) will disable the clock output and reset the clock output frequency to 1 kHz.

Return Format

The query command returns "0" (OFF) or "1" (ON).

Examples

The following command sets the clock frequency for slot 4 to 5 kHz and enables the output.

```
SOUR:MOD:CLOCK:FREQ 5E+3,4 !Set clock frequency to 5 kHz  
SOUR:MOD:CLOCK:STATE ON,4
```

The following query returns the state of the clock output mode for slot 4.

```
SOUR:MOD:CLOCK:STATE? 4
```

Typical Response: 1

See Also

SOURce:FUNction:CLOCK:EXternal:DIVisor (34951A only)

SOURce:MODule:CLOCK:FREQuency

SOURce:MODule:CLOCK:LEVel (34950A only)

SOURce:MODule:TRIGger:EXTeRnal:IMMediate

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

SOURce:MODule:TRIGger:EXTeRnal:IMMediate <slot>

Description

This command issues an external trigger pulse from the 34951A Isolated DAC Module in the specified slot. Once the external trigger mode is enabled (see [SOURce:MODule:TRIGger:OUTPut](#) command), this command issues a **TTL pulse** (one trigger line per module). The primary use of the trigger output mode is to synchronize multiple 34951A modules.

Used With:

- 34951A Isolated DAC Module

Parameters

Name	Type	Range of Values	Default Value
<slot>	Discrete	{1 2 3 4 5 6 7 8}	This is a required parameter

Remarks

- Note that when an external trigger output is issued, all channels on the module configured for an external trigger *input* will also be triggered (see [SOURce:FUNctIon:TRIGger:SOURce EXT](#) command).
- To use the trigger output mode, first configure at least one DAC channel in the specified slot for an external trigger (see [SOURce:FUNctIon:TRIGger:SOURce EXT](#) command). Then, send the [SOURce:MODule:TRIGger:OUTPut](#) command to enable the trigger output mode on the specified slot.
- Sending the [SOURce:FUNctIon:TRIGger:IMMediate](#) command to a DAC channel configured for an immediate/manual trigger will trigger the channel, but will not pulse the trigger output line.
- One signal line is dedicated for both input and output triggering on the 34951A (Pin 25 on the module's D-Sub connector). By default, the trigger line is an input.
- A Factory Reset ([*RST](#) command), Instrument Preset ([SYSTem:PRESet](#) command), and Card Reset ([SYSTem:CPON](#) command) will turn off the trigger output mode.

Example

The following command issues an external trigger pulse from the module in slot 4.

```
SOUR:MOD:TRIG:OUTP ON,4    !Enable trigger output
SOUR:FUNC:TRIG:SOUR EXT,(@4001)  !Enable external trigger
SOUR:MOD:TRIG:EXT:IMM 4    !Pulse trigger output line and trigger DAC channel 1
```

See Also

[SOURce:FUNCtion:TRIGger:SOURce](#)

[SOURce:MODule:TRIGger:OUTPut](#)

SOURce:MODule:TRIGger:OUTPut

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

SOURce:MODule:TRIGger:OUTPut <mode>, <slot>

SOURce:MODule:TRIGger:OUTPut? <slot>

Description

This command disables or enables the trigger output mode on the 34951A Isolated DAC Module in the specified slot. Once the module is properly configured, send the **SOURce:MODule:TRIGger:EXternal:IMMediate** command to issue a **TTL pulse** (one trigger line per module). The primary use of the trigger output mode is to synchronize multiple 34951A modules.

Used With:

- 34951A Isolated DAC Module

Parameters

Name	Type	Range of Values	Default Value
<mode>	Boolean	{OFF 0 ON 1}	OFF
<slot>	Discrete	{1 2 3 4 5 6 7 8}	This is a required parameter

Remarks

- To use the trigger output mode, first configure at least one DAC channel in the specified slot for an external trigger (see **SOURce:FUNCtion:TRIGger:SOURce EXT** command). Then, send the **SOURce:MODule:TRIGger:EXternal:IMMediate** command to issue the trigger pulse (also triggers the externally-triggered DAC channel).
- Sending the **SOURce:FUNCtion:TRIGger:IMMediate** command to a DAC channel configured for an immediate/manual trigger will trigger the channel, but will not pulse the trigger output line.
- One signal line is dedicated for both input and output triggering on the 34951A (Pin 25 on the module's D-Sub connector). By default, the trigger line is an input.
- The trigger output state is stored as part of the instrument state (***SAV** command).
- A Factory Reset (***RST** command), Instrument Preset (**SYSTem:PRESet** command), and Card Reset (**SYSTem:CPON** command) will turn off the trigger output mode.

Return Format

The query command returns "0" (OFF) or "1" (ON) for the module in the specified slot.

Examples

The following command enables the trigger output mode on the 34951A installed in slot 4. Channel 1 is configured for an external trigger.

```
SOUR:MOD:TRIG:OUTP ON,4    !Enable trigger output  
SOUR:FUNC:TRIG:SOUR EXT,(@4001)  !Enable external trigger  
SOUR:MOD:TRIG:EXT:IMM (@4001)  !Pulse trigger output line and trigger DAC  
channel 1
```

The following query returns the state of the trigger output mode on the 34951A installed in slot 4.

```
SOUR:MOD:TRIG:OUTP? 4
```

Typical Response: 1

See Also

[SOURce:FUNCtion:TRIGger:IMMediate](#)

[SOURce:FUNCtion:TRIGger:SOURce](#)

[SOURce:MODule:TRIGger:EXTernal:IMMediate](#)

SOURce:VOLTage[:LEVel]

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

SOURce:VOLTage[:LEVel] {<voltage>|MIN|MAX|DEF}, (@<ch_list>)

SOURce:VOLTage[:LEVel]? [{MIN|MAX},] (@<ch_list>)

Description

This command sets the output voltage level for the specified DAC channels. After setting the desired level, send the **OUTPut[:STATe]** command to close the corresponding output relay and enable outputs from the specified channels.

NOTE

This command outputs a dc voltage level. To output a trace waveform from the module, see the **TRACe** commands.

Used With:

- 34951A Isolated DAC Module
- 34952A Multifunction Module (DAC channels only)

Parameters

Name	Type	Range of Values	Default Value
<voltage>	Numeric	34951A: ± 16 Vdc, with 500 μ V resolution MIN = -16 Vdc, MAX = +16 Vdc 34952A: ± 12 Vdc, with 1 mV resolution MIN = -12 Vdc, MAX = +12 Vdc	0 Vdc
<ch_list>	Numeric	One or more channels in the form (@sccc) . 34951A: s001, s002, s003, s004 34952A: s006, s007	This is a required parameter

Remarks

- On the 34951A, each DAC channel is capable of ± 16 Vdc up to 10 mA maximum current. For protection, each channel incorporates a resettable thermal fuse that will open at greater than 20 mA. If an overload condition exists, the fuse will open, but no error or Service Request will be generated. To reset the fuse, remove the overload condition and wait a few minutes for the fuse to cool.
- After setting the desired level, send the **OUTPut[:STATe]** command to close the corresponding output relay and enable outputs from the specified channels. For subsequent SOURce:VOLTage commands, the output relay will remain closed.
- On the 34951A, the **SOURce:MODE** command gives you the capability to predefine voltage and current levels on the specified channels and then switch from one mode to the other. Sending the SOURce:VOLTage [:LEVel] or **SOURce:CURREnt[:LEVel]** command will automatically enable the corresponding mode.
- If a trace waveform is being output (34951A only) at the time this command is sent, the waveform will stop and the trace mode will be disabled (equivalent to **SOURce:FUNCTION:ENABLE OFF**).
- The **SOURce:FUNCTION:VOLTage:GAIN** and **SOURce:FUNCTION:VOLTage:OFFSet** commands are used to control the gain and offset of trace waveform outputs. These commands are ignored while in the level mode.
- A Factory Reset (***RST** command), Instrument Preset (**SYSTem:PRESet** command), and Card Reset (**SYSTem:CPON** command) will reset the DAC outputs to 0 Vdc. On the 34951A, storing the instrument state (***SAV** command) will reset the DAC outputs to 0 Vdc.

Return Format

The query command returns the output voltage in the form "+1.00000000E+00" for each DAC channel specified. Multiple responses are separated by commas.

Examples

The following command outputs +2.5 Vdc on DAC channels 1 and 2 in slot 4 (assumes 34951A).

```
SOUR:VOLT 2.5, (@4001,4002)
OUTP:STAT ON, (@4001,4002)
```

The following query returns the voltage outputs on DAC channels 1 and 2 in slot 4.

```
SOUR:VOLT? (@4001,4002)
```

Typical Response: +2.50000000E+00,+2.50000000E+00

See Also

OUTPut[:STATe]

SOURce:CURREnt[:LEVel]

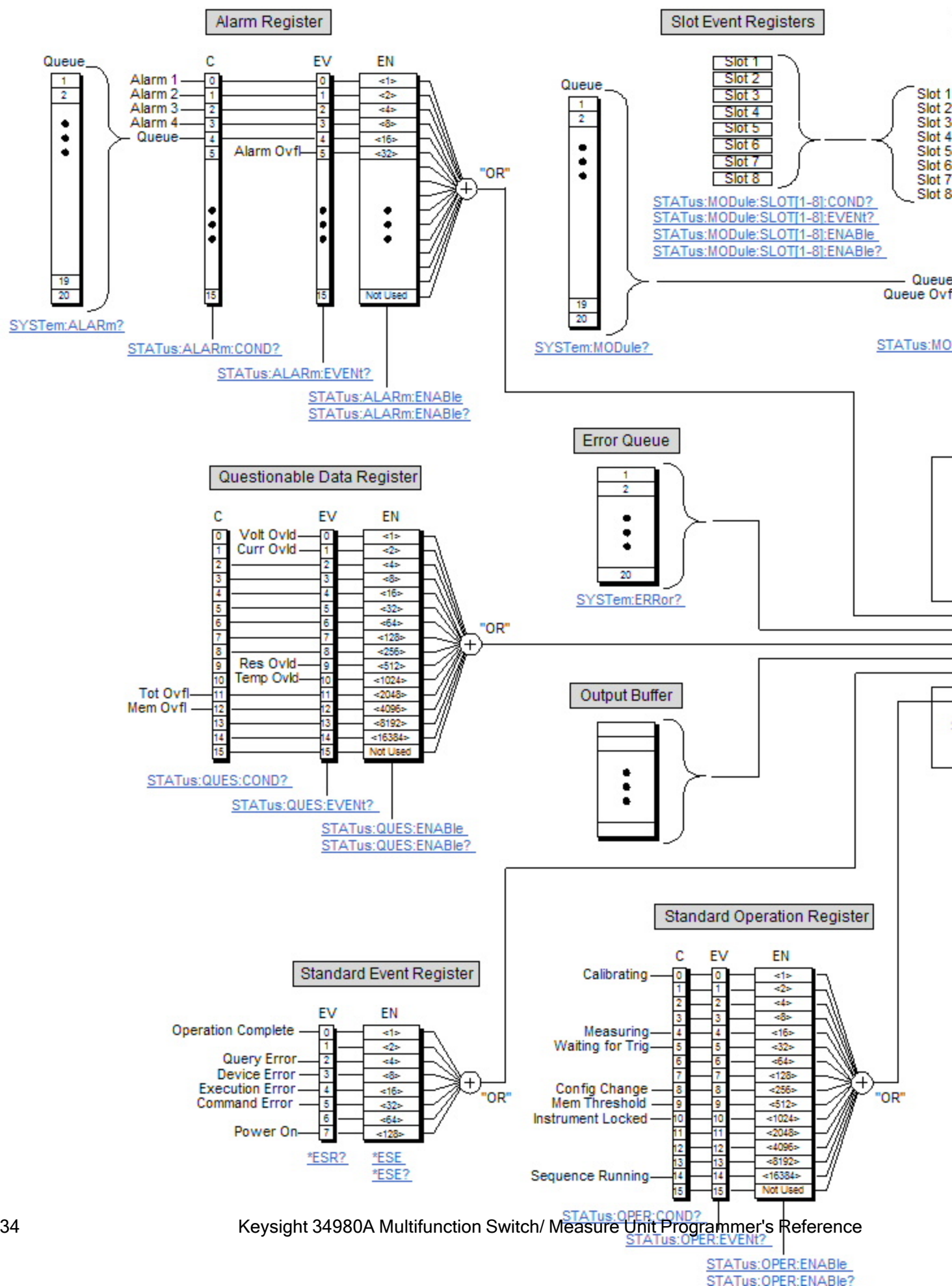
SOURce:FUNCTION:ENABLE

SOURce:MODE

STATus Subsystem Introduction

Keysight 34980A Status System Diagram

[Printable PDF Version](#)



Command Summary

NOTE

Hold the mouse cursor over a command to view the full syntax statement.

*ESE

*ESE?

*ESR?

*SRE

*SRE?

*STB?

STATus:ALARm:CONDition?

STATus:ALARm:ENABle

STATus:ALARm:ENABle?

STATus:ALARm[:EVENT]?

STATus:MODule:ENABle

STATus:MODule:ENABle?

STATus:MODule:EVENT?

STATus:MODule:SLOT[n]:CONDition?

STATus:MODule:SLOT[n]:ENABle

STATus:MODule:SLOT[n]:ENABle?

STATus:MODule:SLOT[n][:EVENT]?

STATus:OPERation:CONDition?

STATus:OPERation:ENABle

STATus:OPERation:ENABle?

STATus:OPERation[:EVENT]?

STATus:PRESet

STATus:QUEStionable:CONDition?

STATus:QUEStionable:ENABle

STATus:QUEStionable:ENABle?

STATus:QUEStionable[:EVENT]?

SYSTem:ALARm?

SYSTem:ERRor?

Plug-In Module Event Register Information

The links below take you to the Event Register definitions for each of the Keysight 34980A plug-in modules.

Low-Frequency Multiplexer Modules

[34921A 40-Channel Armature Multiplexer with Low Thermal Offset](#)

[34922A 70-Channel Armature Multiplexer](#)

[34923A 40/80-Channel Reed Multiplexer](#)

[34924A 70-Channel Reed Multiplexer](#)

[34925A 40/80-Channel FET Multiplexer](#)

Matrix Modules

[34931A Dual 4x8 Armature Matrix](#)

[34932A Dual 4x16 Armature Matrix](#)

[34933A Dual/Quad 4x8 Reed Matrix](#)

General-Purpose Switch Modules

[34937A 32-Channel Form C / Form A General-Purpose Switch](#)

[34938A 20-Channel 5A Form A Switch](#)

[34939A 64-Channel 1A Form A Switch](#)

RF Multiplexer Modules

[34941A Quad 1x4 50 \$\Omega\$ RF Multiplexer](#) *(no Event Registers implemented)*

[34942A Quad 1x4 75 \$\Omega\$ RF Multiplexer](#) *(no Event Registers implemented)*

Microwave Switch Modules

[34945A Microwave Switch/Attenuator Driver](#)

[34946A Dual 1x2 SPDT Terminated Microwave Switch](#) *(no Event Registers implemented)*

[34947A Triple 1.2 SPDT Underterminated Microwave Switch](#) *(no Event Registers implemented)*

Measurement/Control Modules

[34950A 64-Bit Digital I/O Module with Memory and Counter](#)

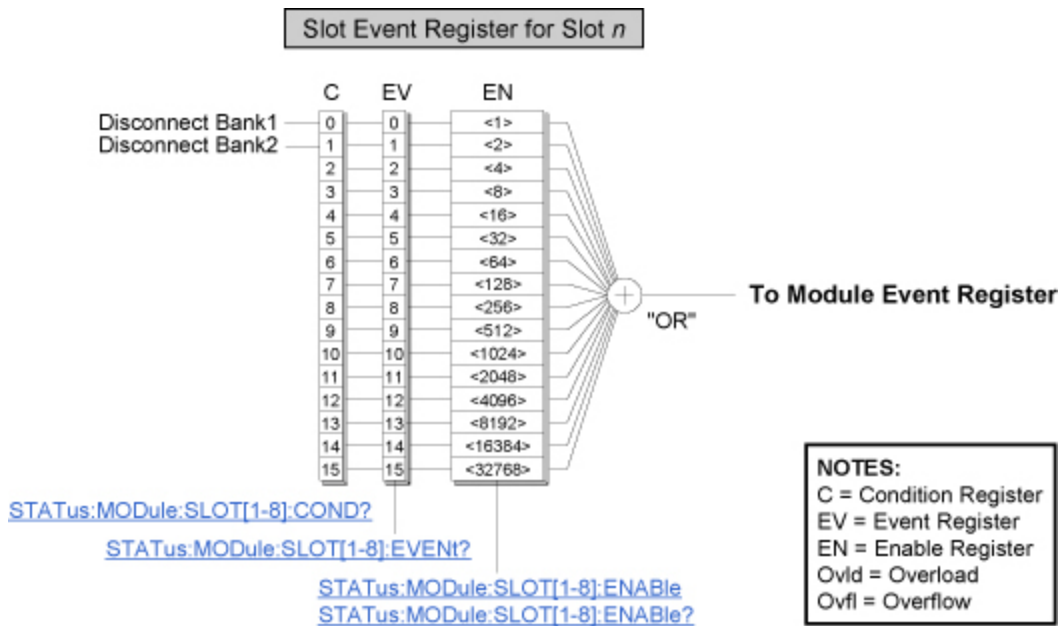
[34951A 4-Channel Isolated D/A Converter Module with Waveform Memory](#)

[34952A Multifunction Module with Digital I/O, Totalizer, and DAC](#)

34959A Breadboard Module (*no Event Registers implemented*)

Keysight 34921A Event Registers

40/80-Channel Armature Multiplexer with Low Thermal Offset

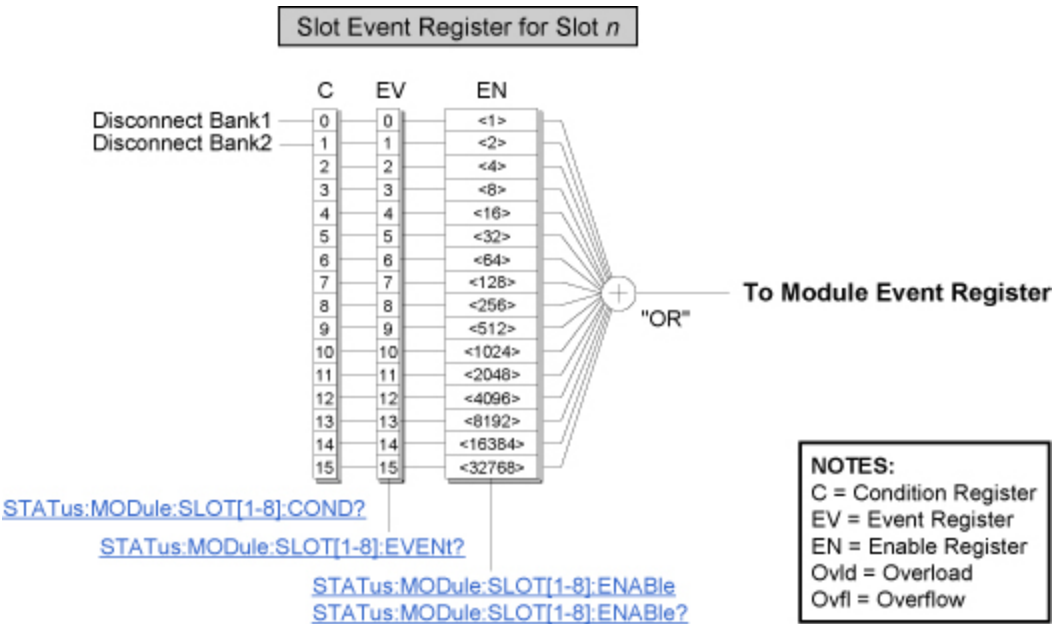


Bit Definitions

Bit Number	Decimal Value	Definition
0	1	Interlock disconnect on Bank 1 Terminal block or cable has been disconnected from Bank 1.
1	2	Interlock disconnect on Bank 2 Terminal block or cable has been disconnected from Bank 2.
2-15	Not Used	Not Used "0" is returned.

Keysight 34922A Event Registers

70-Channel Armature Multiplexer

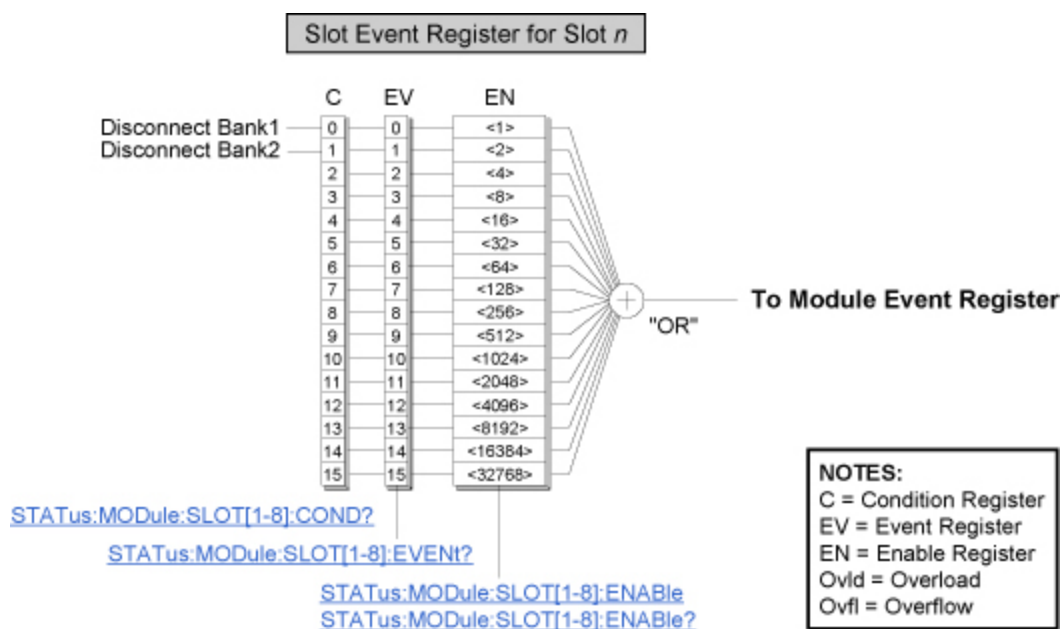


Bit Definitions

Bit Number	Decimal Value	Definition
0 Interlock disconnect on Bank 1	1	Terminal block or cable has been disconnected from Bank 1.
1 Interlock disconnect on Bank 2	2	Terminal block or cable has been disconnected from Bank 2.
2-15 Not Used	Not Used	"0" is returned.

Keysight 34923A Event Registers

40/80-Channel Reed Multiplexer

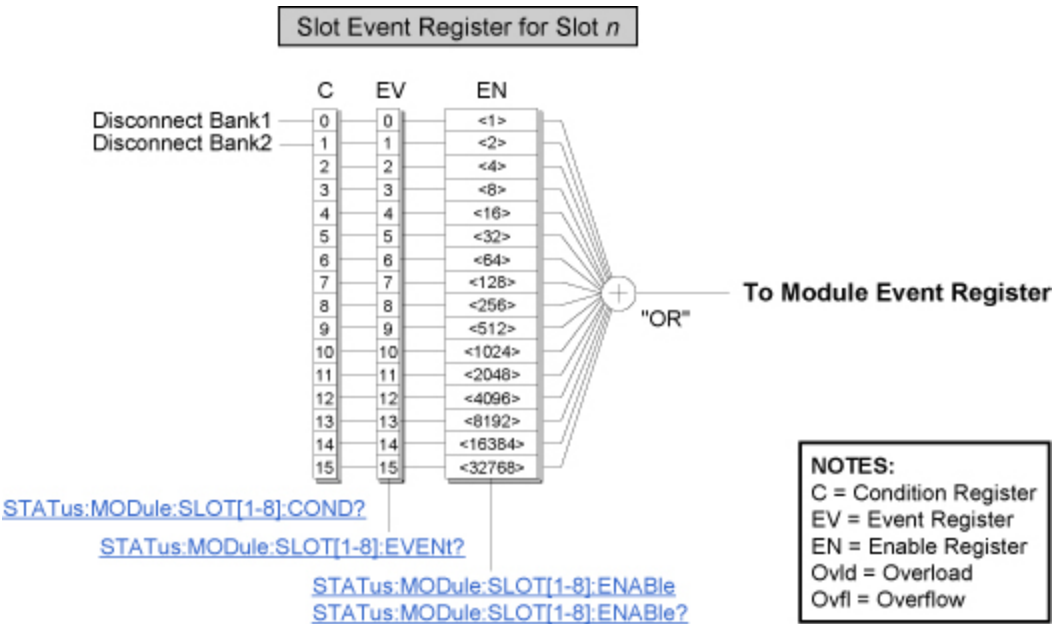


Bit Definitions

Bit Number	Decimal Value	Definition
0 Interlock disconnect on Bank 1	1	Terminal block or cable has been disconnected from Bank 1.
1 Interlock disconnect on Bank 2	2	Terminal block or cable has been disconnected from Bank 2.
2-15 Not Used	Not Used	"0" is returned.

Keysight 34924A Event Registers

70-Channel Reed Multiplexer

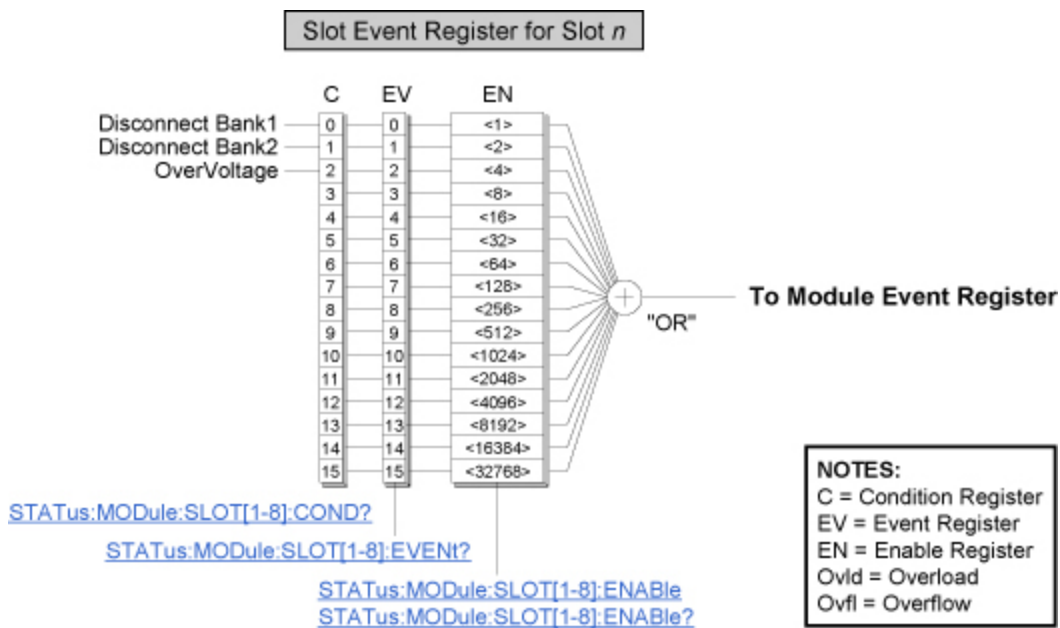


Bit Definitions

Bit Number	Decimal Value	Definition
0 Interlock disconnect on Bank 1	1	Terminal block or cable has been disconnected from Bank 1.
1 Interlock disconnect on Bank 2	2	Terminal block or cable has been disconnected from Bank 2.
2-15 Not Used	Not Used	"0" is returned.

Keysight 34925A Event Registers

40/80-Channel Opto-Coupled FET Multiplexer

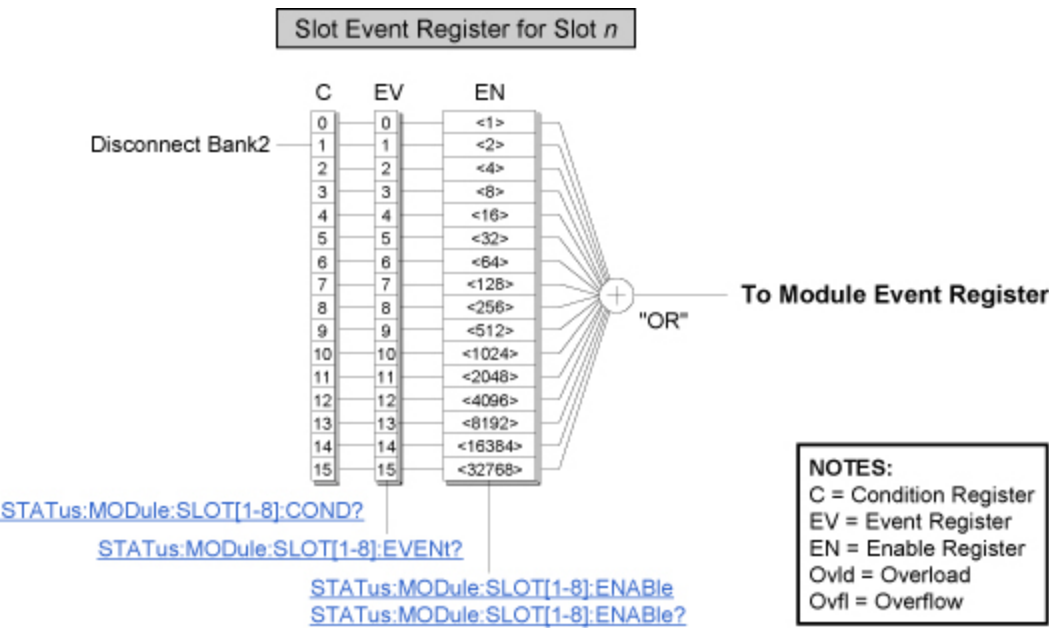


Bit Definitions

Bit Number	Decimal Value	Definition
0 Interlock disconnected on Bank 1	1	Terminal block or cable has been disconnected from Bank 1.
1 Interlock disconnected on Bank 2	2	Terminal block or cable has been disconnected from Bank 2.
2 Over-voltage detected	4	High voltage condition has been detected. All channel relays and Analog Bus relays on this module have been opened. See the SYSTem:CPON command to restore normal operation.
3-15 Not Used	Not Used	"0" is returned.

Keysight 34931A Event Registers

Dual 4x8 Armature Matrix

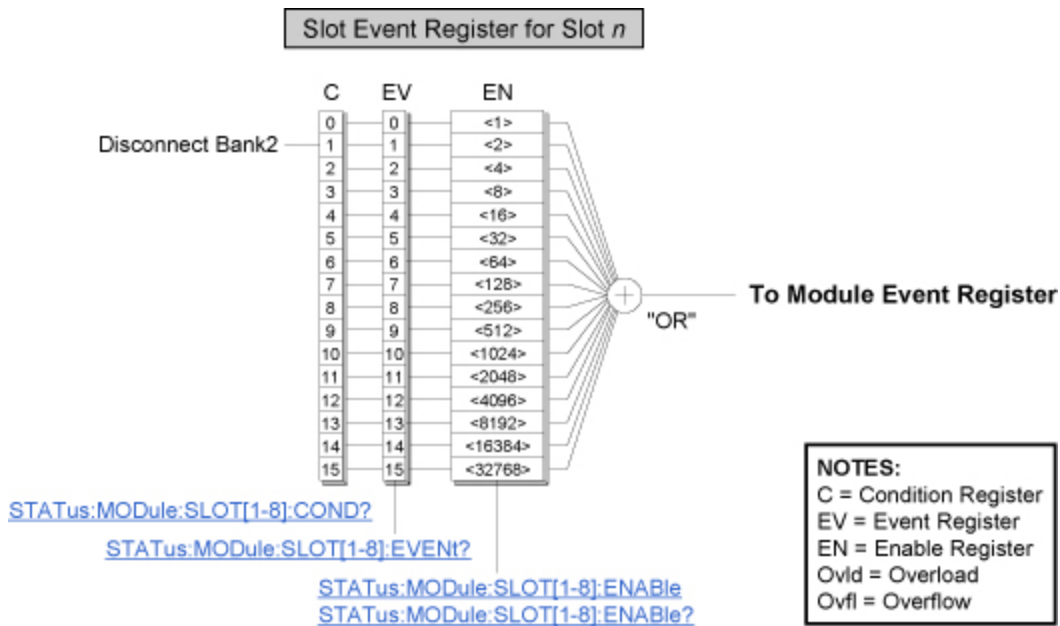


Bit Definitions

Bit Number		Decimal Value	Definition
0	Not Used	Not Used	"0" is returned.
1	Interlock disconnected on Bank 2	2	Terminal block or cable has been disconnected from Bank 2.
2-15	Not Used	Not Used	"0" is returned.

Keysight 34932A Event Registers

Dual 4x16 Armature Matrix

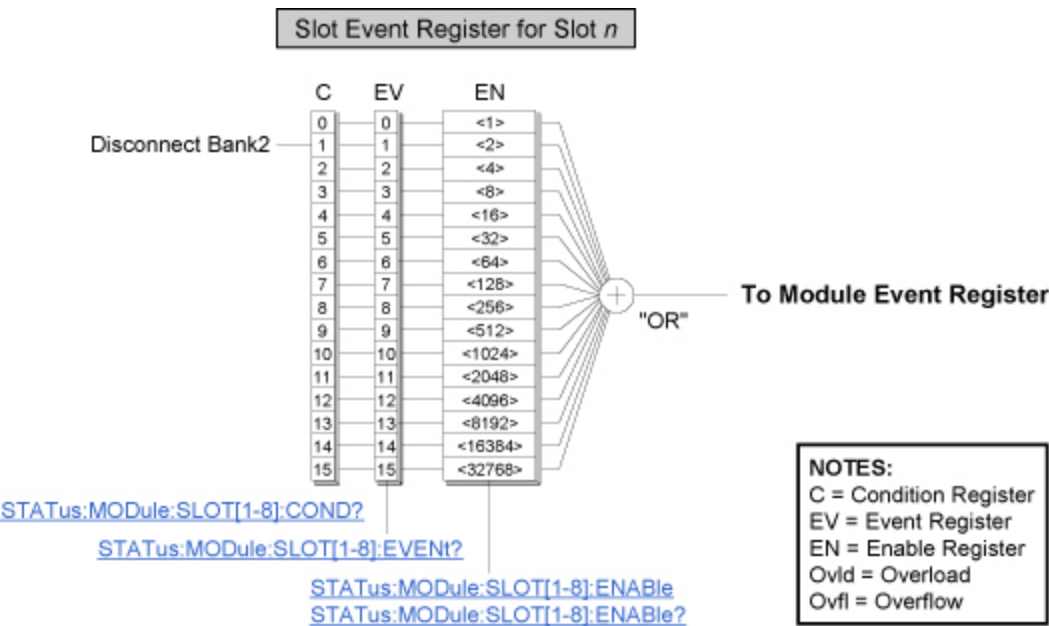


Bit Definitions

Bit Number	Decimal Value	Definition
0 Not Used	Not Used	"0" is returned.
1 Interlock disconnected on Bank 2	2	Terminal block or cable has been disconnected from Bank 2.
2-15 Not Used	Not Used	"0" is returned.

Keysight 34933A Event Registers

Dual/Quad 4x8 Reed Matrix

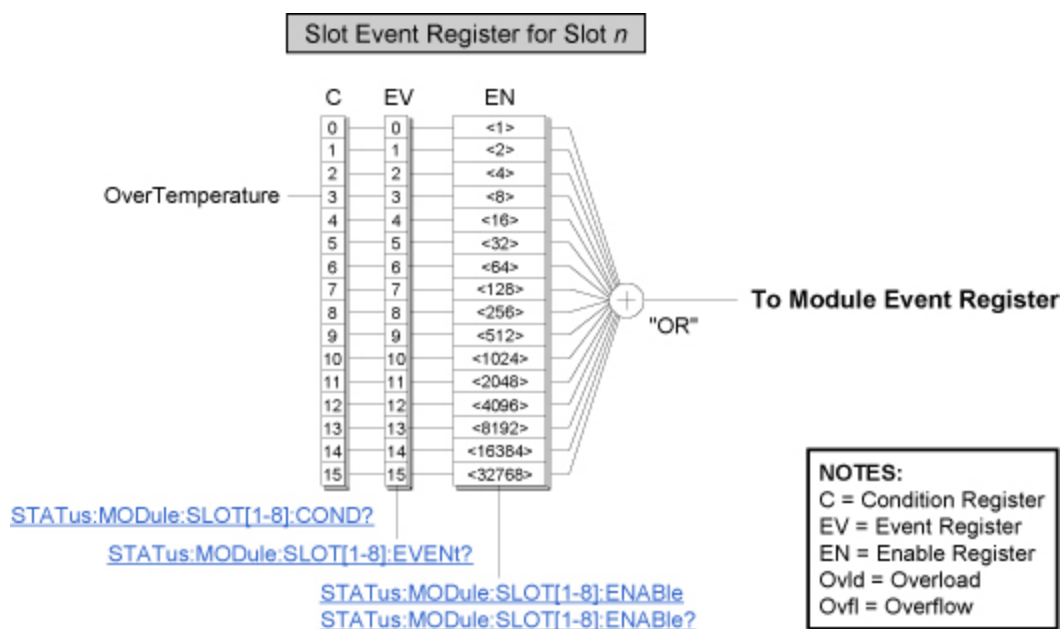


Bit Definitions

Bit Number		Decimal Value	Definition
0	Not Used	Not Used	"0" is returned.
1	Interlock disconnected on Bank 2	2	Terminal block or cable has been disconnected from Bank 2.
2-15	Not Used	Not Used	"0" is returned.

Keysight 34937A Event Registers

32-Channel Form C/Form A General-Purpose Switch

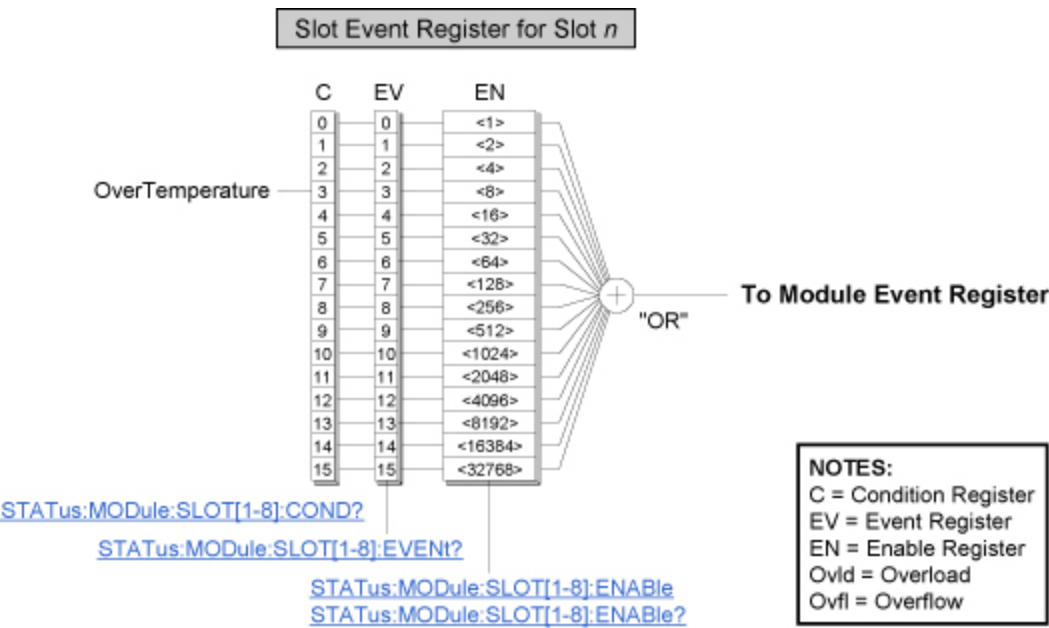


Bit Definitions

Bit Number	Decimal Value	Definition
0-2 Not Used	Not Used	"0" is returned.
3 Over-temperature detected	8	Temperature sensor on this module has detected excessive heat.
4-15 Not Used	Not Used	"0" is returned.

Keysight 34938A Event Registers

20-Channel 5A Form A Switch

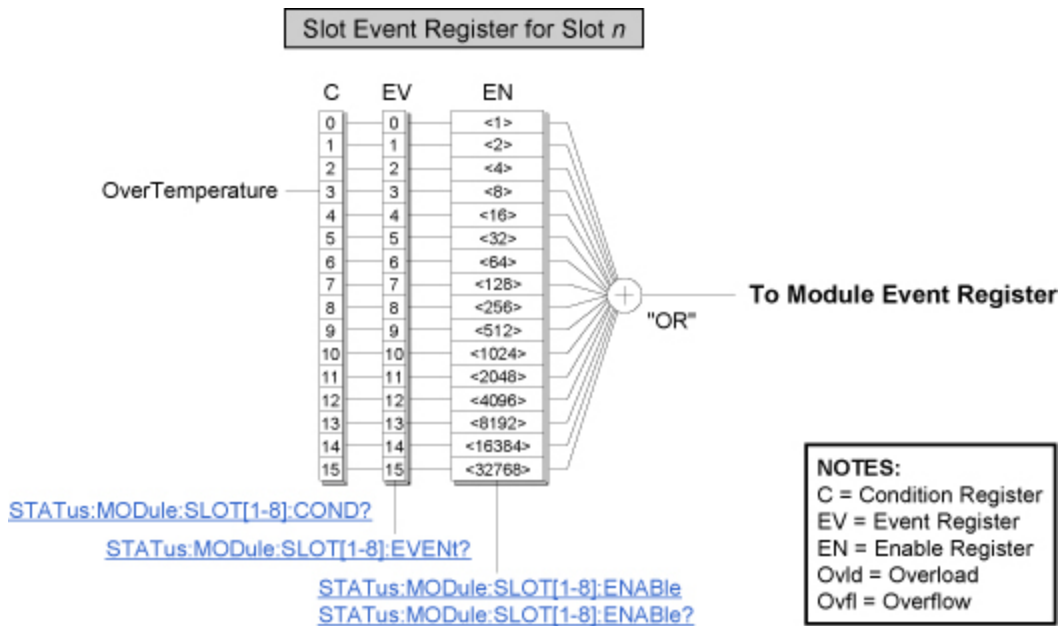


Bit Definitions

Bit Number		Decimal Value	Definition
0-2	Not Used	Not Used	"0" is returned.
3	Over-temperature detected	8	Temperature sensor on this module has detected excessive heat.
4-15	Not Used	Not Used	"0" is returned.

Keysight 34939A Event Registers

64-Channel 1A Form A Switch

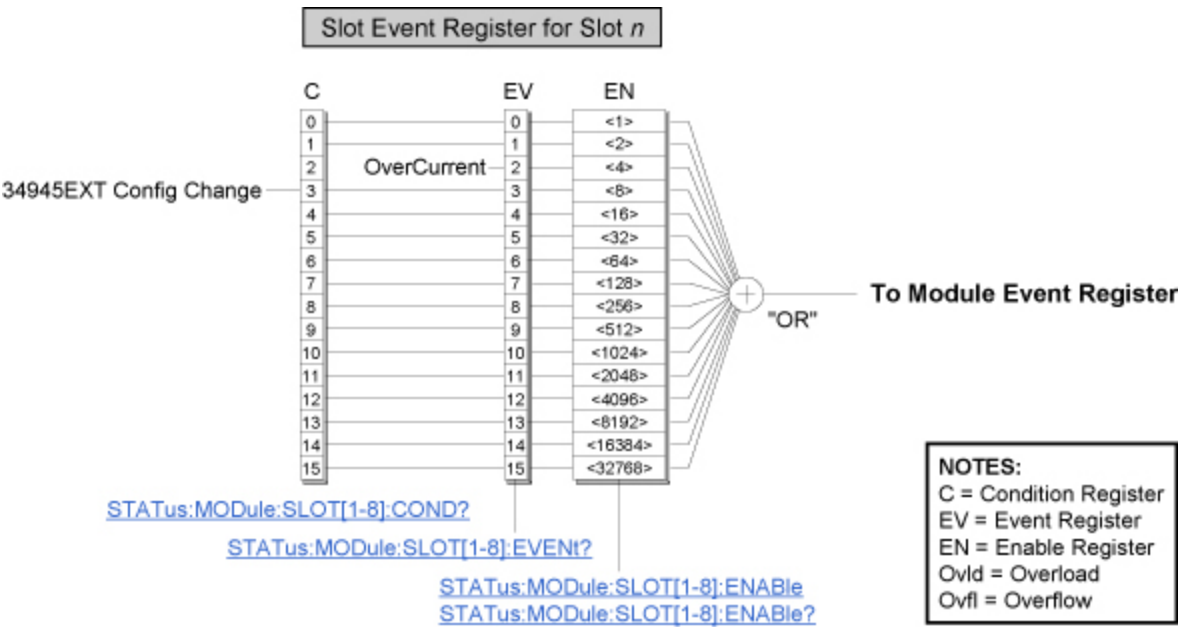


Bit Definitions

Bit Number	Decimal Value	Definition
0-2 Not Used	Not Used	"0" is returned.
3 Over-temperature detected	8	Temperature sensor on this module has detected excessive heat.
4-15 Not Used	Not Used	"0" is returned.

Keysight 34945A Event Registers

Microwave Switch/Attenuator Driver Interface

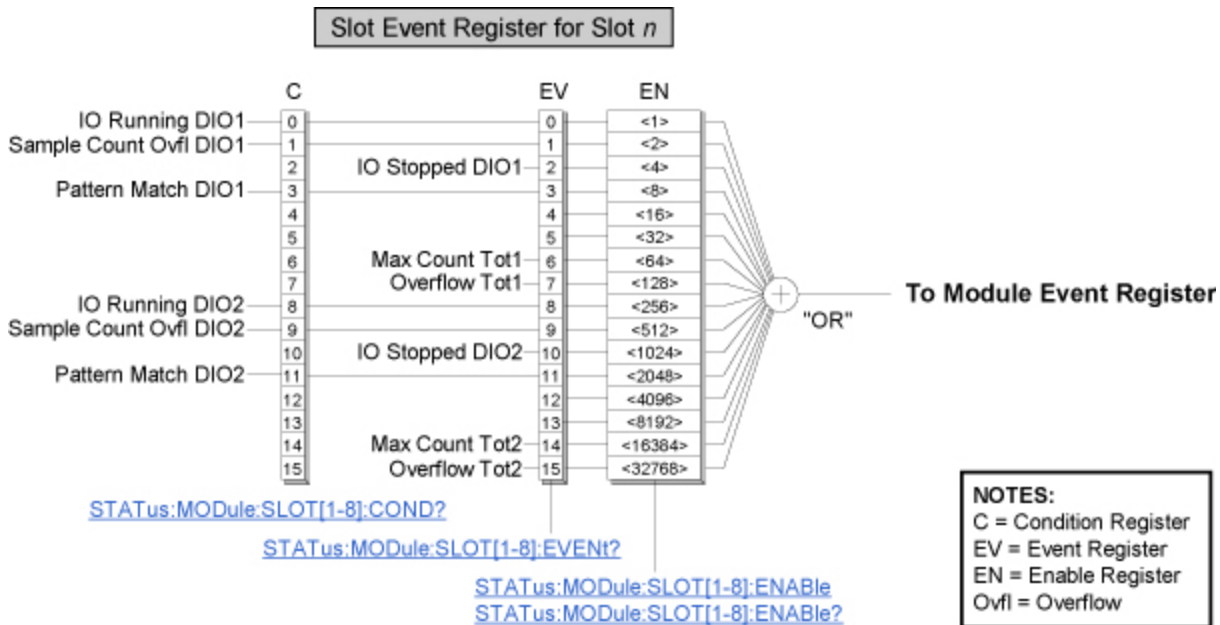


Bit Definitions

Bit Number	Decimal Value	Definition
0-1 Not Used	Not Used	"0" is returned.
2 Over-current detected	4	High current condition detected. Applies either when a 34945EXT Master module exceeds the mainframe slot power limitations -or- when a 34945EXT Slave module exceeds allowable drive current limitations.
3 34945EXT configuration changed	8	Applies either when a 34945EXT is connected or disconnected -or- when a 34945EXT Slave is powered on or off.
4-15 Not Used	Not Used	"0" is returned.

Keysight 34950A Event Registers

64-Bit Digital I/O Module with Memory and Counter



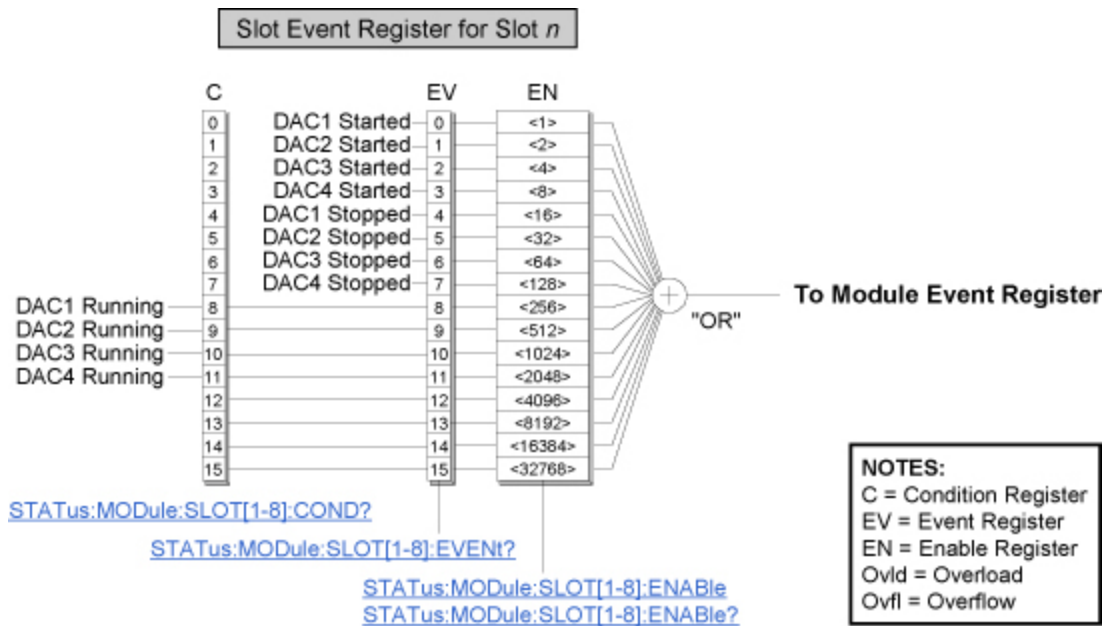
Bit Definitions

Bit Number	Decimal Value	Definition
0	1	Digital input/output operations are currently running on DIO 1.
1	2	Specified number of samples have been read into memory on DIO 1 (see [SENSe:]DIGital:MEMory:SAMple:COUNt command).
2	4	Digital input/output operations were stopped on DIO 1.
3	8	Digital pattern equal/not equal has been detected on DIO 1.
4-5	Not Used	"0" is returned.
6	64	Count threshold has been reached on Totalizer 1 (see CALCulate:LIMit:UPPer command).
7	128	Totalizer overflow has been detected on Totalizer 1.
8	256	Digital input/output operations are currently running on DIO 2.

9	Sample count overflow on DIO 2	512	Specified number of samples have been read into memory on DIO 2 (see [SENSe:]DIGital:MEMory:SAMPlE:COUNT command).
10	Digital IO stopped on DIO 2	1024	Digital input/output operations were stopped on DIO 2.
11	Pattern Match detected on DIO 2	2048	Digital pattern equal/not equal has been detected on DIO 2.
12-13	Not Used	Not Used	"0" is returned.
14	Count threshold reached on Totalizer 2	16384	Count threshold has been reached on Totalizer 2 (see CALCulate:LIMit:UPPer command).
15	Overflow on Totalizer 2	32768	Totalizer overflow has been detected on Totalizer 2.

Keysight 34951A Event Registers

4-Channel Isolated D/A Converter with Waveform Memory

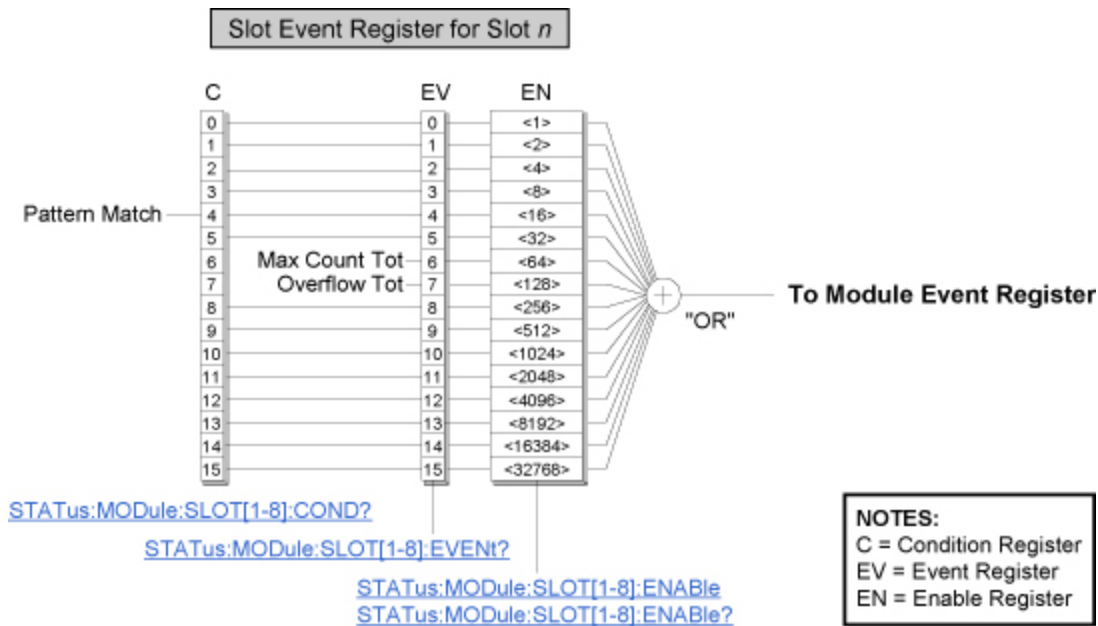


Bit Definitions

Bit Number		Decimal Value	Definition
0	DAC 1 trace output started	1	Trace output started on DAC 1.
1	DAC 2 trace output started	2	Trace output started on DAC 2.
2	DAC 3 trace output started	4	Trace output started on DAC 3.
3	DAC 4 trace output started	8	Trace output started on DAC 4.
4	DAC 1 trace output stopped	16	Trace outputs stopped on DAC 1.
5	DAC 2 trace output stopped	32	Trace outputs stopped on DAC 2.
6	DAC 3 trace output stopped	64	Trace outputs stopped on DAC 3.
7	DAC 4 trace output stopped	128	Trace outputs stopped on DAC 4.
8	DAC 1 trace output running	256	Trace output in progress on DAC 1.
9	DAC 2 trace output running	512	Trace output in progress on DAC 2.
10	DAC 3 trace output running	1024	Trace output in progress on DAC 3.
11	DAC 4 trace output running	2048	Trace output in progress on DAC 4.
12-15	Not Used	Not Used	"0" is returned.

Keysight 34952A Event Registers

Multifunction Module with Digital I/O, Totalizer, and DAC



Bit Definitions

Bit Number	Decimal Value	Definition
0-3 Not Used	Not Used	"0" is returned.
4 Pattern Match detected on DIO 1	16	Digital pattern equal/not equal detected on DIO 1.
5 Not Used	Not Used	"0" is returned.
6 Counter threshold reached on Totalizer	64	Count threshold has been reached on Totalizer (see CALCulate:LIMit:UPPer command).
7 Overflow on Totalizer	128	Totalizer overflow has been detected on Totalizer. The maximum count is 4,294,967,295 ($2^{32} - 1$). The count rolls over to "0" after reaching the maximum allowed value.
8-15 Not Used	Not Used	"0" is returned.

STATus:ALARm:CONDition?

Syntax | Description | Parameters | Remarks | Return Format | Example

Syntax

STATus:ALARm:CONDition?

Description

This command queries the **condition register** for the *Alarm Register* group (note that this condition register uses only bit 4). This is a read-only register and the bits are not cleared when you read the register.

Used With:

- 34921A through 34925A Multiplexer Modules
- 34950A Digital I/O Module (digital input and counter channels only)
- 34952A Multifunction Module (digital input and totalizer channels only)

NOTE

For more information on the SCPI Status System for the Keysight 34980A, see the [Status System Diagram](#).

Remarks

- The following table lists the bit definitions for the Alarm Register.

Bit Number	Decimal Value	Definition
0 Alarm 1	1	Alarm occurred on Alarm 1.
1 Alarm 2	2	Alarm occurred on Alarm 2.
2 Alarm 3	4	Alarm occurred on Alarm 3.
3 Alarm 4	8	Alarm occurred on Alarm 4.
4 Queue Empty	16	Alarm queue status (0 = empty, 1 = not empty).
5 Not Used	Not Used	"0" is returned.
6-15 Reserved	Reserved	Reserved for internal use.

- A Factory Reset (***RST** command) will clear the "Queue Empty" bit (bit 4) in the condition register.

Return Format

The command reads the condition register and returns a decimal value which corresponds to the binary-weighted sum of all bits set in the register (see table above). For example, if bit 1 (decimal value = 2) and bit 4 (decimal value = 16) are set, this command will return **"+18"**.

Example

The following command reads the condition register (bit 4 is set).

```
STAT:ALAR:COND?
```

Typical Response: **+16**

See Also

[STATus:ALARm:ENABLE](#)

[STATus:ALARm\[:EVENT\]?](#)

[SYSTem:ALARm?](#)

STATus:ALARm:ENABle

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

STATus:ALARm:ENABle <enable_value>

STATus:ALARm:ENABle?

Description

This command enables bits in the **enable register** for the *Alarm Register* group. The selected bits are then reported to the Status Byte.

Used With:

- 34921A through 34925A Multiplexer Modules
- 34950A Digital I/O Module (digital input and counter channels only)
- 34952A Multifunction Module (digital input and totalizer channels only)

NOTE

For more information on the SCPI Status System for the Keysight 34980A, see the [Status System Diagram](#).

Parameters

Name	Type	Range of Values	Default Value
<enable_value>	Numeric	A decimal value which corresponds to the binary-weighted sum of the bits in the register (see table below).	This is a required parameter

Remarks

- The following table lists the bit definitions for the Alarm Register.

Bit Number	Decimal Value	Definition
0 Alarm 1	1	Alarm occurred on Alarm 1.
1 Alarm 2	2	Alarm occurred on Alarm 2.
2 Alarm 3	4	Alarm occurred on Alarm 3.
3 Alarm 4	8	Alarm occurred on Alarm 4.
4 Queue Empty	16	Alarm queue status (0 = empty, 1 = not empty).
5 Queue Overflow	32	Alarm data lost due to alarm queue overflow.
6-15 Reserved	Reserved	Reserved for internal use.

- Use the <enable_value> parameter to specify which bits will be reported to the Status Byte. The decimal value specified corresponds to the binary-weighted sum of the bits you wish to enable in the register. For example, to enable bit 0 (decimal value = 1), bit 1 (decimal value = 2), and bit 4 (decimal value = 16), the corresponding decimal value would be 19 (1 + 2 + 16).
- The ***CLS** (clear status) command will not clear the enable register but it does clear all bits in the **event register**.
- The **STATus:PRESet** command will clear all bits in the enable register.

Return Format

The query command reads the enable register and returns a decimal value which corresponds to the binary-weighted sum of all bits set in the register. For example, if bit 1 (decimal value = 2) and bit 4 (decimal value = 16) are enabled, the query command will return **" $+18$ "**.

Examples

The following command enables bit 1 (decimal value = 2) and bit 4 (decimal value = 16) in the enable register.

```
STAT:ALAR:ENAB 16
```

The following query returns which bits are enabled in the register.

```
STAT:ALAR:ENAB?
```

Typical Response: **$+16$**

See Also

STATus:ALARm:CONDition?

STATus:ALARm[:EVENT]?

STATus:PRESet

STATus:ALARm[:EVENT]?

Syntax | Description | Parameters | Remarks | Return Format | Example

Syntax

STATus:ALARm[:EVENT]?

Description

This command queries the **event register** for the *Alarm Register* group.

Used With:

- 34921A through 34925A Multiplexer Modules
- 34950A Digital I/O Module (digital input and counter channels only)
- 34952A Multifunction Module (digital input and totalizer channels only)

NOTE

For more information on the SCPI Status System for the Keysight 34980A, see the [Status System Diagram](#).

Remarks

- The following table lists the bit definitions for the Alarm Register.

Bit Number	Decimal Value	Definition
0 Alarm 1	1	Alarm occurred on Alarm 1.
1 Alarm 2	2	Alarm occurred on Alarm 2.
2 Alarm 3	4	Alarm occurred on Alarm 3.
3 Alarm 4	8	Alarm occurred on Alarm 4.
4 Queue Empty	16	Alarm queue status (0 = empty, 1 = not empty).
5 Queue Overflow	32	Alarm data lost due to alarm queue overflow.
6-15 Reserved	Reserved	Reserved for internal use.

- Note that if any of bits 0 through 3 are set, bit 4 will also be set to indicate that the Alarm Queue is not empty.
- Once a bit is set, it remains set until cleared by reading the event register or the ***CLS** (clear status) command.

Return Format

The command reads the event register and returns a decimal value which corresponds to the binary-weighted sum of all bits set in the register. For example, if bit 1 (decimal value = 2) and bit 4 (decimal value = 16) are set,

this command will return "+18".

Example

The following command reads the event register (bits 1, 3, and 4 are set).

```
STAT:ALAR?
```

Typical Response: +25

See Also

[STATus:ALARm:CONDition?](#)

[STATus:ALARm:ENABle?](#)

STATus:MODule:ENABle

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

STATus:MODule:ENABle <enable_value>

STATus:MODule:ENABle?

Description

This command enables bits in the **enable register** for the *Module Event Register* group. The selected bits are then reported to the Status Byte.

NOTE

For more information on the SCPI Status System for the Keysight 34980A, see the [Status System Diagram](#).

Parameters

Name	Type	Range of Values	Default Value
<enable_value>	Numeric	A decimal value which corresponds to the binary-weighted sum of the bits in the register (see table below).	This is a required parameter

Remarks

- The following table lists the bit definitions for the Module Event Register.

Bit Number		Decimal Value	Definition
0	Not Used	Not Used	"0" is returned.
1	Slot 1 Event	2	Event occurred on module in Slot 1.
2	Slot 2 Event	4	Event occurred on module in Slot 2.
3	Slot 3 Event	8	Event occurred on module in Slot 3.
4	Slot 4 Event	16	Event occurred on module in Slot 4.
5	Slot 5 Event	32	Event occurred on module in Slot 5.
6	Slot 6 Event	64	Event occurred on module in Slot 6.
7	Slot 7 Event	128	Event occurred on module in Slot 7.
8	Slot 8 Event	256	Event occurred on module in Slot 8.
9-13	Not Used	Not Used	"0" is returned.
14	Queue Empty	16384	Event queue status (0 = empty, 1 = not empty).
15	Queue Overflow	32768	Event data lost due to event queue overflow.

- Use the <enable_value> parameter to specify which bits will be reported to the Status Byte. The decimal value specified corresponds to the binary-weighted sum of the bits you wish to enable in the register. For example, to enable bit 0 (decimal value = 1), bit 1 (decimal value = 2), and bit 8 (decimal value = 256), the corresponding decimal value would be 259 (1 + 2 + 256).
- Most of the plug-in modules have defined events that are logged in the Module Event queue. For module-specific event definitions, see [Plug-In Module Event Register Information](#).
- The ***CLS** (clear status) command will not clear the enable register but it does clear all bits in the **event register**.
- The **STATus:PRESet** command will clear all bits in the enable register.

Return Format

The query command reads the enable register and returns a decimal value which corresponds to the binary-weighted sum of all bits set in the register. For example, if bit 1 (decimal value = 2) and bit 3 (decimal value = 8) are enabled, the query command will return **"+10"**.

Examples

The following command enables bit 8 (decimal value = 256) in the enable register.

```
STAT:MOD:ENAB 256
```

The following query returns which bits are enabled in the register.

```
STAT:MOD:ENAB?
```

Typical Response: **+256**

See Also

[STATus:MODule\[:EVENT\]?](#)

[STATus:MODule:SLOT\[n\]:ENABLE](#)

[STATus:PRESet](#)

STATus:MODule:EVENT?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

STATus:MODule:EVENT?

Description

This command queries the **event register** for the *Module Event Register* group.

NOTE

For more information on the SCPI Status System for the Keysight 34980A, see the [Status System Diagram](#).

Remarks

- The following table lists the bit definitions for the Module Event Register.

Bit Number		Decimal Value	Definition
0	Not Used	Not Used	"0" is returned.
1	Slot 1 Event	2	Event occurred on module in Slot 1.
2	Slot 2 Event	4	Event occurred on module in Slot 2.
3	Slot 3 Event	8	Event occurred on module in Slot 3.
4	Slot 4 Event	16	Event occurred on module in Slot 4.
5	Slot 5 Event	32	Event occurred on module in Slot 5.
6	Slot 6 Event	64	Event occurred on module in Slot 6.
7	Slot 7 Event	128	Event occurred on module in Slot 7.
8	Slot 8 Event	256	Event occurred on module in Slot 8.
9-13	Not Used	Not Used	"0" is returned.
14	Queue Empty	16384	Event queue status (0 = empty, 1 = not empty).
15	Queue Overflow	32768	Event data lost due to event queue overflow.

- Most of the plug-in modules have defined events that are logged in the Module Event queue. For module-specific event definitions, see [Plug-In Module Event Register Information](#).
- Once a bit is set, it remains set until cleared by reading the event register or the ***CLS** (clear status) command.

Return Format

The command reads the event register and returns a decimal value which corresponds to the binary-weighted sum of all bits set in the register. For example, if bit 1 (decimal value = 2) and bit 8 (decimal value = 256) are set, this command will return **"258"**.

Example

The following command reads the event register (bit 7 is set).

```
STAT:MOD:EVEN?
```

Typical Response: **+128**

See Also

STATus:MODule:ENABle?

STATus:MODule:SLOT[n]:ENABle

STATus:MODule:SLOT[n]:CONDition?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

STATus:MODule:SLOT[n]:CONDition?

Description

Most of the plug-in modules have their own set of Slot Event Registers (see [Plug-In Module Event Register Information](#)). This command queries the **condition register** for the specified *Slot Event Register* group. This is a read-only register and the bits are not cleared when you read the register.

NOTE

For more information on the SCPI Status System for the Keysight 34980A, see the [Status System Diagram](#).

Parameters

Name	Type	Range of Values	Default Value
<n>	Discrete	{1 2 3 4 5 6 7 8}	Slot 1

Return Format

The command reads the condition register and returns a decimal value which corresponds to the binary-weighted sum of all bits set in the register (see table above). For example, if bit 1 (decimal value = 2) and bit 9 (decimal value = 512) are set, this command will return "+514".

Example

The following command reads the condition register for Slot 2 (bit 1 is set).

```
STAT:MOD:SLOT2:COND?
```

Typical Response: +2

See Also

[STATus:MODule:SLOT\[n\]:ENABLE](#)

[STATus:MODule:SLOT\[n\]:EVENT?](#)

STATus:MODUle:SLOT[n]:ENABle

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

STATus:MODUle:SLOT[n]:ENABle <enable_value>

STATus:MODUle:SLOT[n]:ENABle?

Description

Most of the plug-in modules have their own set of Slot Event Registers (see [Plug-In Module Event Register Information](#)). This command enables bits in the **enable register** for the specified *Slot Event Register* group. The selected bits are then reported to the corresponding bit in the *Module Event Register* group.

NOTE

For more information on the SCPI Status System for the Keysight 34980A, see the [Status System Diagram](#).

Parameters

Name	Type	Range of Values	Default Value
<n>	Discrete	{1 2 3 4 5 6 7 8}	Slot 1
<enable_value>	Numeric	A decimal value which corresponds to the binary-weighted sum of the bits in the register (see link above).	This is a required parameter

Remarks

- Use the <enable_value> parameter to specify which bits will be reported to the corresponding bit in the *Module Event Register* group. The decimal value specified corresponds to the binary-weighted sum of the bits you wish to enable in the register. For example, to enable bit 0 (decimal value = 1), bit 1 (decimal value = 2), and bit 11 (decimal value = 2048), the corresponding decimal value would be 2051 (1 + 2 + 2048).
- The ***CLS** (clear status) command will not clear the enable register but it does clear all bits in the **event register**.
- The **STATus:PRESet** command will clear all bits in the enable register.

Return Format

The query command reads the enable register and returns a decimal value which corresponds to the binary-weighted sum of all bits set in the register. For example, if bit 0 (decimal value = 1) and bit 1 (decimal value = 2) are enabled, the query command will return "+3".

Examples

The following command enables bit 3 (decimal value = 8) in the enable register for Slot 4.

```
STAT:MOD:SLOT4:ENAB 8
```

The following query returns which bits are enabled in the register.

```
STAT:MOD:SLOT4:ENAB?
```

Typical Response: **+8**

See Also

[STATus:PRESet](#)

[STATus:MODule:ENABLE](#)

[STATus:MODule:SLOT\[n\]:CONDition?](#)

[STATus:MODule:SLOT\[n\]:EVENT?](#)

STATus:MODule:SLOT[n][:EVENT]?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

STATus:MODule:SLOT[n][:EVENT]?

Description

Most of the plug-in modules have their own set of Slot Event Registers (see [Plug-In Module Event Register Information](#)). This command queries the **event register** for the specified *Slot Event Register* group. This is a read-only register and the bits are cleared when you read the register.

NOTE

For more information on the SCPI Status System for the Keysight 34980A, see the [Status System Diagram](#).

Parameters

Name	Type	Range of Values	Default Value
<n>	Discrete	{1 2 3 4 5 6 7 8}	Slot 1

Remarks

- Once a bit is set, it remains set until cleared by reading the event register or the ***CLS** (clear status) command.

Return Format

The command reads the event register and returns a decimal value which corresponds to the binary-weighted sum of all bits set in the register. For example, if bit 1 (decimal value = 2) and bit 9 (decimal value = 512) are set, this command will return "+514".

Example

The following command reads the event register for Slot 3 (bit 11 is set).

```
STAT:MOD:SLOT3:EVEN?
```

Typical Response: +2048

See Also

[STATus:MODule:SLOT\[n\]:CONDition?](#)

[STATus:MODule:SLOT\[n\]:ENABLE](#)

STATus:OPERation:CONDition?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

STATus:OPERation:CONDition?

Description

This command queries the **condition register** for the *Standard Operation Register* group. This is a read-only register and the bits are not cleared when you read the register.

NOTE

For more information on the SCPI Status System for the Keysight 34980A, see the [Status System Diagram](#).

Used With:

- 34921A through 34925A Multiplexer Modules
- 34950A Digital I/O Module (digital input and counter channels only)
- 34952A Multifunction Module (digital input and totalizer channels only)

Remarks

- The following table lists the bit definitions for the Standard Operation Register.

Bit Number		Decimal Value	Definition
0	Calibration in Progress	1	Instrument is performing a calibration.
1-3	Not Used	Not Used	"0" is returned.
4	Measurement in Progress, or Measuring	16	Instrument is making a measurement as part of a scanning operation or as a standalone DMM measurement. The bit goes true when the INITiate operation begins, and goes false when the INITiate operation ends.
5	Waiting for Trigger	32	Instrument is waiting for an external trigger.
6-7	Not Used	Not Used	"0" is returned.
8	Configuration Change	256	This bit is set when anything related to a channel configuration or measurement is changed. This bit is cleared when a new measurement or digital read is initiated.
9	Memory Threshold	512	Programmed number of readings have been stored in reading memory (see DATA:POINts:EVENT:THR command).

10	Instrument Locked	1024	If a remote thread (GPIB, USB, or LAN) has a lock (see SYSTem:LOCK:REQuest? command), this bit will be set. When a remote thread releases the lock (see SYSTem:LOCK:RELease command), this bit will be cleared.
11-13	Not Used	Not Used	"0" is returned.
14	Sequence Running	16384	A sequence is currently running. The bit goes true at the beginning of the execution of the sequence, and goes false when the sequence has completed.
15	Not Used	Not Used	"0" is returned.

- A Factory Reset (***RST** command) will set the "Configuration Change" bit (bit 8) in the condition register.

Return Format

The command reads the condition register and returns a decimal value which corresponds to the binary-weighted sum of all bits set in the register (see table above). For example, if bit 4 (decimal value = 16) and bit 8 (decimal value = 256) are set, this command will return **" +272 "**.

Example

The following command reads the condition register (bit 4 is set).

```
STAT:OPER:COND?
```

Typical Response: **+16**

See Also

STATus:OPERation:ENABle

STATus:OPERation[:EVENT]?

STATus:OPERation:ENABle

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

STATus:OPERation:ENABle <enable_value>

STATus:OPERation:ENABle?

Description

This command enables bits in the **enable register** for the *Standard Operation Register* group. The selected bits are then reported to the Status Byte.

NOTE

For more information on the SCPI Status System for the Keysight 34980A, see the [Status System Diagram](#).

Used With:

- 34921A through 34925A Multiplexer Modules
- 34950A Digital I/O Module (digital input and counter channels only)
- 34952A Multifunction Module (digital input and totalizer channels only)

Parameters

Name	Type	Range of Values	Default Value
<enable_value>	Numeric	A decimal value which corresponds to the binary-weighted sum of the bits in the register (see table below).	This is a required parameter

Remarks

- The following table lists the bit definitions for the Standard Operation Register.

Bit Number		Decimal Value	Definition
0	Calibration in Progress	1	Instrument is performing a calibration.
1-3	Not Used	Not Used	"0" is returned.
4	Measurement in Progress, or Measuring	16	Instrument is making a measurement as part of a scanning operation or as a standalone DMM measurement. The bit goes true when the INITiate operation begins, and goes false when the INITiate operation ends.

5	Waiting for Trigger	32	Instrument is waiting for an external trigger.
6-7	Not Used	Not Used	"0" is returned.
8	Configuration Change	256	This bit is set when anything related to a channel configuration or measurement is changed. This bit is cleared when a new measurement or digital read is initiated.
9	Memory Threshold	512	Programmed number of readings have been stored in reading memory (see DATA:POINTS:EVENT:THR command).
10	Instrument Locked	1024	If a remote thread (GPIB, USB, or LAN) has a lock (see SYSTem:LOCK:REQuest? command), this bit will be set. When a remote thread releases the lock (see SYSTem:LOCK:RELease command), this bit will be cleared.
11-13	Not Used	Not Used	"0" is returned.
14	Sequence Running	16384	A sequence is currently running. The bit goes true at the beginning of the execution of the sequence, and goes false when the sequence has completed.
15	Not Used	Not Used	"0" is returned.

- Use the <enable_value> parameter to specify which bits will be reported to the Status Byte. The decimal value specified corresponds to the binary-weighted sum of the bits you wish to enable in the register. For example, to enable bit 4 (decimal value = 16), bit 8 (decimal value = 256), and bit 9 (decimal value = 512), the corresponding decimal value would be 784 (16 + 256 + 512).
- The ***CLS** (clear status) command will not clear the enable register but it does clear all bits in the **event register**.
- The **STATus:PRESet** command will clear all bits in the enable register.

Return Format

The query command reads the enable register and returns a decimal value which corresponds to the binary-weighted sum of all bits set in the register. For example, if bit 4 (decimal value = 16) and bit 8 (decimal value = 256) are enabled, the query command will return **" +272 "**.

Examples

The following command enables bit 8 (decimal value = 256) in the enable register.

```
STAT:OPER:ENAB 256
```

The following query returns which bits are enabled in the register.

```
STAT:OPER:ENAB?
```

Typical Response: **+256**

See Also

DATA:POINts:EVENT:THReshold

STATus:OPERation:CONDition?

STATus:OPERation[:EVENT]?

STATus:PRESet

STATus:OPERation[:EVENT]?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

STATus:OPERation[:EVENT]?

Description

This command queries the **event register** for the *Standard Operation Register* group.

NOTE

For more information on the SCPI Status System for the Keysight 34980A, see the [Status System Diagram](#).

Used With:

- 34921A through 34925A Multiplexer Modules
- 34950A Digital I/O Module (digital input and counter channels only)
- 34952A Multifunction Module (digital input and totalizer channels only)

Remarks

- The following table lists the bit definitions for the Standard Operation Register.

Bit Number		Decimal Value	Definition
0	Calibration in Progress	1	Instrument is performing a calibration.
1-3	Not Used	Not Used	"0" is returned.
4	Measurement in Progress, or Measuring	16	Instrument is making a measurement as part of a scanning operation or as a standalone DMM measurement. The bit goes true when the INITiate operation begins, and goes false when the INITiate operation ends.
5	Waiting for Trigger	32	Instrument is waiting for an external trigger.
6-7	Not Used	Not Used	"0" is returned.
8	Configuration Change	256	This bit is set when anything related to a channel configuration or measurement is changed. This bit is cleared when a new measurement or digital read is initiated.
9	Memory Threshold	512	Programmed number of readings have been stored in reading memory (see DATA:POINts:EVENT:THR command).

10	Instrument Locked	1024	If a remote thread (GPIB, USB, or LAN) has a lock (see SYSTem:LOCK:REQuest? command), this bit will be set. When a remote thread releases the lock (see SYSTem:LOCK:RELease command), this bit will be cleared.
11-13	Not Used	Not Used	"0" is returned.
14	Sequence Running	16384	A sequence is currently running. The bit goes true at the beginning of the execution of the sequence, and goes false when the sequence has completed.
15	Not Used	Not Used	"0" is returned.

- Once a bit is set, it remains set until cleared by reading the event register or the ***CLS** (clear status) command.

Return Format

The command reads the event register and returns a decimal value which corresponds to the binary-weighted sum of all bits set in the register. For example, if bit 4 (decimal value = 16) and bit 8 (decimal value = 256) are set, this command will return **"272"**.

Example

The following command reads the event register (bit 8 is set).

```
STAT:OPER?
```

Typical Response: **+256**

See Also

STATus:OPERation:CONDition?

STATus:OPERation:ENABle

STATus:PRESet

Syntax | **Description** | Parameters | Remarks | Return Format | **Example**

Syntax

STATus:PRESet

Description

This command clears all bits in the Questionable Data enable register, the Alarm enable register, and the Standard Operation enable register.

Used With:

- 34921A through 34925A Multiplexer Modules
- 34950A Digital I/O Module (digital input and counter channels only)
- 34952A Multifunction Module (digital input and totalizer channels only)

Example

The following command clears the enable register bits.

```
STAT:PRESet
```


STATus:QUEStionable:CONDition?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

STATus:QUEStionable:CONDition?

Description

This command queries the **condition register** for the *Questionable Data Register* group. This is a read-only register and the bits are not cleared when you read the register.

NOTE

For more information on the SCPI Status System for the Keysight 34980A, see the [Status System Diagram](#).

Used With:

- 34921A through 34925A Multiplexer Modules
- 34950A Digital I/O Module (digital input and counter channels only)
- 34952A Multifunction Module (digital input and totalizer channels only)

Remarks

- The following table lists the bit definitions for the Questionable Data Register.

Bit Number		Decimal Value	Definition
0-10	Not Used	Not Used	"0" is returned.
11	Totalizer Overflow	2048	Count overflow on a totalizer channel. The maximum count is 4,294,967,295 ($2^{32} - 1$). The count rolls over to "0" after reaching the maximum allowed value.
12	Memory Overflow	4096	Reading memory is full. One or more readings have been lost.
13-15	Not Used	Not Used	"0" is returned.

Return Format

The command reads the condition register and returns a decimal value which corresponds to the binary-weighted sum of all bits set in the register (see table above). For example, if bit 1 (decimal value = 2) and bit 9 (decimal value = 512) are set, this command will return "+514".

Example

The following command reads the condition register (bit 10 is set).

STAT:QUES:COND?

Typical Response: **+1024**

See Also

STATus:QUESTionable:ENABLE

STATus:QUESTionable[:EVENT]?

STATus:QUEStionable:ENABle

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

STATus:QUEStionable:ENABle <enable_value>

STATus:QUEStionable:ENABle?

Description

This command enables bits in the **enable register** for the *Questionable Data Register* group. The selected bits are then reported to the Status Byte.

NOTE

For more information on the SCPI Status System for the Keysight 34980A, see the [Status System Diagram](#).

Used With:

- 34921A through 34925A Multiplexer Modules
- 34937A through 34939A GP Switch Modules
- 34950A Digital I/O Module (digital input and counter channels only)
- 34952A Multifunction Module (digital input and totalizer channels only)

Parameters

Name	Type	Range of Values	Default Value
<enable_value>	Numeric	A decimal value which corresponds to the binary-weighted sum of the bits in the register (see table below).	This is a required parameter

Remarks

- The following table lists the bit definitions for the Questionable Data Register.

Bit Number		Decimal Value	Definition
0	Voltage Overload	1	Range overload on dc or ac volts.
1	Current Overload	2	Range overload on dc or ac current.
2-8	Not Used	Not Used	"0" is returned.
9	Resistance Overload	512	Range overload on 2- or 4-wire resistance.
10	Temperature Overload	1024	Range overload on temperature.

11	Totalizer Overflow	2048	Count overflow on a totalizer channel. The maximum count is 4,294,967,295 ($2^{32} - 1$). The count rolls over to "0" after reaching the maximum allowed value.
12	Memory Overflow	4096	Reading memory is full. One or more readings have been lost.
13-15	Not Used	Not Used	"0" is returned.

- Use the <enable_value> parameter to specify which bits will be reported to the Status Byte. The decimal value specified corresponds to the binary-weighted sum of the bits you wish to enable in the register. For example, to enable bit 0 (decimal value = 1), bit 1 (decimal value = 2), and bit 12 (decimal value = 4096), the corresponding decimal value would be 4099 ($1 + 2 + 4096$).
- The ***CLS** (clear status) command will not clear the enable register but it does clear all bits in the **event register**.
- The **STATus:PRESet** command will clear all bits in the enable register.

Return Format

The query command reads the enable register and returns a decimal value which corresponds to the binary-weighted sum of all bits set in the register. For example, if bit 0 (decimal value = 1) and bit 1 (decimal value = 2) are enabled, the query command will return **"+3"**.

Examples

The following command enables bit 9 (decimal value = 512) in the enable register.

```
STAT:QUES:ENAB 512
```

The following query returns which bits are enabled in the register.

```
STAT:QUES:ENAB?
```

Typical Response: **+512**

See Also

STATus:PRESet

STATus:QUESTionable:CONDition?

STATus:QUESTionable[:EVENT]?

STATus:QUEStionable[:EVENT]?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

STATus:QUEStionable[:EVENT]?

Description

This command queries the **event register** for the *Questionable Data Register* group.

NOTE

For more information on the SCPI Status System for the Keysight 34980A, see the [Status System Diagram](#).

Used With:

- 34921A through 34925A Multiplexer Modules
- 34937A through 34939A GP Switch Modules
- 34950A Digital I/O Module (digital input and counter channels only)
- 34952A Multifunction Module (digital input and totalizer channels only)

Remarks

- The following table lists the bit definitions for the Questionable Data Register.

Bit Number		Decimal Value	Definition
0	Voltage Overload	1	Range overload on dc or ac volts.
1	Current Overload	2	Range overload on dc or ac current.
2-8	Not Used	Not Used	"0" is returned.
9	Resistance Overload	512	Range overload on 2- or 4-wire resistance.
10	Temperature Overload	1024	Range overload on temperature.
11	Totalizer Overflow	2048	Count overflow on a totalizer channel. The maximum count is 4,294,967,295 ($2^{32} - 1$). The count rolls over to "0" after reaching the maximum allowed value.
12	Memory Overflow	4096	Reading memory is full. One or more readings have been lost.
13-15	Not Used	Not Used	"0" is returned.

- Once a bit is set, it remains set until cleared by reading the event register or the ***CLS** (clear status) command.

Return Format

The command reads the event register and returns a decimal value which corresponds to the binary-weighted sum of all bits set in the register. For example, if bit 1 (decimal value = 2) and bit 9 (decimal value = 512) are set, this command will return "+514".

Example

The following command reads the event register (bit 11 is set).

```
STAT:QUES?
```

Typical Response: **+2048**

See Also

STATus:QUESTionable:ENABle?

SWEEp Subsystem Introduction

Command Summary

NOTE

Hold the mouse cursor over a command to view the full syntax statement.

SWEEp:COUNT

SWEEp:COUNT?

SWEep:COUNT

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

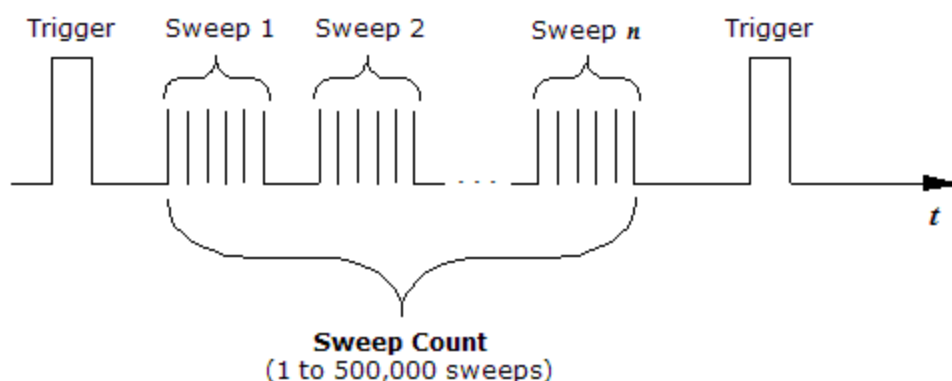
Syntax

SWEep:COUNT {<count>|MIN|MAX|DEF}

SWEep:COUNT? [{MIN|MAX}]

Description

This command selects the number of sweeps per trigger event during a scan (a *sweep* is one pass through the scan list). The front-panel sample annunciator ("*") turns on during each measurement.



Used With:

- 34921A through 34925A Multiplexer Modules
- 34950A Digital I/O Module (digital input and counter channels only)
- 34952A Multifunction Module (digital input and totalizer channels only)

Parameters

Name	Type	Range of Values	Default Value
<count>	Numeric	1 to 500,000 sweeps. MIN = 1 sweep, MAX = 500,000 reading sweeps	1 sweep through the present scan list

Remarks

- For the multiplexer modules, the internal DMM is required. An error is generated if the internal DMM is disabled (see [INSTrument:DMM\[:STATe\]](#) command) or not installed in the mainframe.

- After setting the sweep count, you must place the internal DMM in the "wait-for-trigger" state using the **INITiate** or **READ?** command. A trigger will not be accepted from the selected trigger source (see **TRIGger:SOURce** command) until the internal DMM is in the "wait-for-trigger" state.
- The sweep count is valid only while scanning (also valid with a temporary scan list; see **READ?** command). If no channels have been assigned to the scan list (see **ROUTe:SCAN** command), the specified sweep count is ignored (no error is generated).
- You can specify a sweep count in conjunction with a trigger count and a sample count. The three parameters operate independent of one another, and the total number of readings returned will be the product of the three parameters.
 - a. The *trigger count* selects the number of triggers to be accepted before returning to the "idle" trigger state (see **TRIGger:COUNt** command).
 - b. The *sample count* selects the number of auto-triggered samples per channel per trigger (see **SAMPLE:COUNT** command).
- You can store at least 500,000 readings in memory and all readings are automatically time stamped. If memory overflows, the new readings will overwrite the first (oldest) readings stored; the most recent readings are always preserved.
- The **CONFigure** and **MEASure?** commands automatically set the sweep count to 1 sweep.
- The instrument sets the sweep count to "1" after a Factory Reset (***RST** command). An Instrument Preset (**SYSTem:PRESet** command) or Card Reset (**SYSTem:CPON** command) does *not* change the setting.

Return Format

The query command returns the sweep count in the form "+1.00000000E+00".

Examples

The following command sets the sweep count to 3. When a trigger is received from the selected trigger source, the instrument will sweep through the channels in the scan list three times.

```
SWE:COUN 3
```

The following program segment configures two channels for dc voltage measurements, puts the channels in the scan list (the scan list is redefined), and sets the sweep count to 3. When a trigger is received from the selected trigger source, 3 readings will be returned for each channel in the scan list (6 readings total).

```
CONF:VOLT:DC 10,0.003, (@1003,1008)
ROUT:SCAN (@1003,1008)
SWE:COUN 3
INIT
```

The following query returns the present sweep count.

```
SWE:COUN?
```

Typical Response: +3.00000000E+00

See Also

[ROUTe:SCAN](#)

[SAMPle:COUNT](#)

[TRIGger:COUNT](#)

[TRIGger:SOURce](#)

SYSTem Subsystem Introduction

Command Summary

NOTE

Hold the mouse cursor over a command to view the full syntax statement.

General Commands

`SYSTem:ABUS:INterlock:SIMulate`
`SYSTem:ABUS:INterlock:SIMulate?`
`SYSTem:ALARm?`
`SYSTem:BEEPer`
`SYSTem:BEEPer:STATe`
`SYSTem:CDEscription?`
`SYSTem:CDEscription:RMOdule?`
`SYSTem:CPON`
`SYSTem:CTYPe?`
`SYSTem:CTYPe:RMOdule?`
`SYSTem:DATE`
`SYSTem:DATE?`
`SYSTem:DElay[:IMMediate]`
`SYSTem:ERRor?`
`SYSTem:MODule?`
`SYSTem:MODule:PFAil:JUMPer:AMP5?`
`SYSTem:MODule:TEMPerature?`
`SYSTem:MODule:WIRE:MODE`
`SYSTem:RMOdule:RESet`
`SYSTem:RMOdule:STATus?`
`SYSTem:PRESet`
`SYSTem:SECurity:IMMediate`
`SYSTem:TIME`
`SYSTem:TIME?`
`SYSTem:TIME:SCAN?`
`SYSTem:VERSion?`

Remote Interface Configuration Commands

`SYSTem:COMMunicate:ENABle`
`SYSTem:COMMunicate:ENABle?`
`SYSTem:COMMunicate:LAN:AUTOip`

SYSTem:COMMunicate:LAN:AUTOip?
SYSTem:COMMunicate:LAN:BStatus?
SYSTem:COMMunicate:LAN:CONTRol?
SYSTem:COMMunicate:LAN:DHCP
SYSTem:COMMunicate:LAN:DHCP?
SYSTem:COMMunicate:LAN:DNS
SYSTem:COMMunicate:LAN:DNS?
SYSTem:COMMunicate:LAN:DOMain
SYSTem:COMMunicate:LAN:DOMain?
SYSTem:COMMunicate:LAN:GATEway
SYSTem:COMMunicate:LAN:GATEway?
SYSTem:COMMunicate:LAN:HISTory?
SYSTem:COMMunicate:LAN:HISTory:CLEar
SYSTem:COMMunicate:LAN:HOSTname
SYSTem:COMMunicate:LAN:HOSTname?
SYSTem:COMMunicate:LAN:IPADdress
SYSTem:COMMunicate:LAN:IPADdress?
SYSTem:COMMunicate:LAN:KEEPlive
SYSTem:COMMunicate:LAN:KEEPlive?
SYSTem:COMMunicate:LAN:MAC?
SYSTem:COMMunicate:LAN:SMASk
SYSTem:COMMunicate:LAN:SMASk?
SYSTem:COMMunicate:LAN:TELNet:PROMpt
SYSTem:COMMunicate:LAN:TELNet:PROMpt?
SYSTem:COMMunicate:LAN:TELNet:WMESsage
SYSTem:COMMunicate:LAN:TELNet:WMESsage?
SYSTem:LOCK:OWNer?
SYSTem:LOCK:RELease
SYSTem:LOCK:REQuest?

SYSTem:COMMunicate:LAN:AUTOip

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

SYSTem:COMMunicate:LAN:AUTOip <mode>

SYSTem:COMMunicate:LAN:AUTOip?

Description

This command disables or enables use of the Auto-IP standard to automatically assign an IP address to the 34980A when on a network that does not have **DHCP** servers.

NOTE If you change the Auto-IP setting, you must cycle power on the 34980A to activate the new setting.

Parameters

Name	Type	Range of Values	Default Value
<mode>	Boolean	{OFF 0 ON 1}	This is a required parameter

Remarks

- Auto-IP allocates IP addresses from the link-local address range (169.254.xxx.xxx).
- From the factory, the Auto-IP setting is enabled.
- The Auto-IP setting is stored in **non-volatile** memory, and does not change when power has been off, after a Factory Reset (***RST** command), or after an Instrument Preset (SYSTem:PRESet command).

Return Format

The query command returns "0" (OFF) or "1" (ON).

Examples

The following command disables Auto-IP.

```
SYST:COMM:LAN:AUTOIP OFF
```

The following query returns the current Auto-IP setting.

```
SYST:COMM:LAN:AUTOIP?
```

Typical Response: 0

SYSTem:COMMunicate:LAN:BSTatus?

Syntax | **Description** | **Parameters** | **Remarks** | **Return Format** | **Example**

Syntax

SYSTem:COMMunicate:LAN:BSTatus?

Description

This command returns the instrument's LAN boot status.

Remarks

- This command is used primarily as a troubleshooting tool to determine whether the LAN interface started, and if so how.
- If the LAN interface is disabled (see **SYSTem:COMMunicate:ENABle** command), this command will return "LAN_NO_LINK" (see table below).

Return Format

The command reads the instrument's LAN boot status and returns one of the following strings.

String Returned	Description
LAN_NO_LINK	No link integrity found. The instrument cannot detect that a LAN cable is connected.
LAN_INIT	The network has not fully initialized. The instrument may be actively looking for an available DHCP server.
LAN_DUP_IP	The instrument attempted to boot using an IP address which is already in use on the network.
LAN_STATIC	The instrument booted with a static IP address.
LAN_DHCP	The instrument booted with a DHCP-assigned address.
LAN_ROLLOVER_STATIC	The instrument booted with DHCP ON, but no DHCP server could be found. Therefore, the instrument has rolled over to a static IP address.
LAN_AUTO_IP	The instrument booted with a local IP address.
LAN_DHCP_LEASE_ERROR	The instrument has lost its DHCP IP address.

Example

The following query returns the instrument's LAN boot status.

```
SYST:COMM:LAN:BST?
```

Typical Response: LAN_DHCP

SYSTem:COMMunicate:LAN:CONTrol?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

SYSTem:COMMunicate:LAN:CONTrol?

Description

This command reads the initial Control connection port number for Sockets communications. The initial connection is used to send and receive commands, queries, and query responses.

Remarks

- The Control socket connection is used to send a Device Clear to the instrument or to detect pending Service Request (SRQ) events.

Return Format

The command returns the Control connection port number. If "0" is returned, the instrument does not support a Socket Control connection.

Example

The following query returns the Control connection port number.

```
SYST:COMM:LAN:CONT?
```

Typical Response: **5000**

SYSTem:COMMunicate:LAN:DHCP

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

SYSTem:COMMunicate:LAN:DHCP <mode>

SYSTem:COMMunicate:LAN:DHCP?

Description

This command disables or enables use of the Dynamic Host Configuration Protocol (DHCP) for the 34980A.

When DHCP is enabled (factory setting), the 34980A will try to obtain an IP address from a DHCP server. If a DHCP server is found, it will assign a dynamic IP address, Subnet Mask, and Default Gateway to the instrument.

When DHCP is disabled or unavailable, the 34980A will use the static IP address, Subnet Mask, and Default Gateway during power-on.

NOTE

If you change the DHCP setting, you must cycle power on the 34980A to activate the new setting.

Parameters

Name	Type	Range of Values	Default Value
<mode>	Boolean	{OFF 0 ON 1}	This is a required parameter

Remarks

- Most Corporate LANs have a DHCP server.
- If a DHCP LAN address is not assigned by a DHCP server, then a static IP will be assumed after approximately 2 minutes. See the [SYSTem:COMMunicate:LAN:BSTatus?](#) command for more information on the instrument's boot status.
- The DHCP setting is stored in **non-volatile** memory, and does not change when power has been off, after a Factory Reset (***RST** command), or after an Instrument Preset (**SYSTem:PRESet** command).

Return Format

The query command returns "0" (OFF) or "1" (ON).

Examples

The following command disables DHCP.

```
SYST:COMM:LAN:DHCP OFF
```

The following query returns the current DHCP setting.

```
SYST:COMM:LAN:DHCP?
```

Typical Response: 0

See Also

[SYSTem:COMMunicate:LAN:BSTatus?](#)

[SYSTem:COMMunicate:LAN:GATEway](#)

[SYSTem:COMMunicate:LAN:IPADdress](#)

[SYSTem:COMMunicate:LAN:SMASk](#)

SYSTem:COMMunicate:LAN:DNS

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

SYSTem:COMMunicate:LAN:DNS <address>

SYSTem:COMMunicate:LAN:DNS?

Description

This command assigns the IP address of the Domain Name System (DNS) server. Contact your network administrator to determine if DNS is being used and for the correct address.

NOTE

If you change the DNS address, you must cycle power on the 34980A to activate the new setting.

Parameters

Name	Type	Range of Values	Default Value
<address>	Numeric	Specified in four-byte dot notation ("nnn.nnn.nnn.nnn"), where "nnn" in each case is a byte value in the range 0 through 255.	0.0.0.0

Remarks

- Dot-notation addresses ("nnn.nnn.nnn.nnn" where "nnn" is a byte value) must be expressed with care, as most web software on the PC will interpret byte values with leading zeros as *octal* numbers. For example, "255.255.020.011" is actually equivalent to decimal "255.255.16.9" not "255.255.20.11" because ".020" is interpreted as "16" expressed in octal, and ".011" as "9". To avoid confusion, use only decimal expressions of byte values (0 to 255), with **no leading zeros**.

For example, the 34980A assumes that all dot-notation addresses are expressed as decimal byte values and strips all leading zeros from these byte values. Thus, attempting to set an IP address of "255.255.020.011" will become "255.255.20.11" (a purely decimal expression). Be sure to enter the exact expression, "255.255.20.11", in your PC web software to address the instrument. Do not use "255.255.020.011" – the PC will interpret this address differently due to the leading zeros.

- The DNS address is stored in **non-volatile** memory, and does not change when power has been off, after a Factory Reset (***RST** command), or after an Instrument Preset (**SYSTem:PRESet** command).

Return Format

The query command returns the current DNS address in the form "nnn.nnn.nnn.nnn".

Examples

The following command sets the DNS address.

```
SYST:COMM:LAN:DNS 198.105.232.4
```

The following query returns the DNS address currently being used by the instrument (the quotes are also returned).

```
SYST:COMM:LAN:DNS?
```

Typical Response: "198.105.232.4"

See Also

SYSTem:COMMunicate:LAN:HOSTname

SYSTem:COMMunicate:LAN:DOMain

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

SYSTem:COMMunicate:LAN:DOMain "<name>"

SYSTem:COMMunicate:LAN:DOMain? [{CURRent|STATic}]

Description

This command assigns a Domain Name to the 34980A. The Domain Name is translated into an IP address.

NOTE

If you change the Domain Name, you must cycle power on the 34980A to activate the new setting.

Parameters

Name	Type	Range of Values	Default Value
<name>	Quoted ASCII String	A string of up to 63 characters. The first character must be a letter (A-Z), but the remaining 62 characters can be letters, numbers (0-9), dashes ("-"), or periods ("."). Blank spaces are not allowed.	No Domain Name assigned

Remarks

- If Dynamic Domain Name System (DNS) is available on your network and your instrument uses **DHCP**, the Domain Name is registered with the Dynamic DNS service at power-on.
- If DHCP is enabled (see **SYSTem:COMMunicate:LAN:DHCP** command), the DHCP server can change the specified Domain Name.
- The Domain Name is stored in **non-volatile** memory, and does not change when power has been off, after a Factory Reset (***RST** command), or after an Instrument Preset (**SYSTem:PRESet** command).

Return Format

The query command reads the Domain Name and returns an ASCII string enclosed in double quotes. If a Domain Name has not been assigned, a null string (" ") is returned.

Note that the query command has two optional parameters. Specify "CURRent" (default) to read the dynamic Domain Name currently being used by the instrument. Specify "STATic" to read the Domain Name currently

stored in **non-volatile** memory within the instrument (may not be the actual name used by the instrument if DHCP is enabled).

Examples

The following command defines a Domain Name.

```
SYST:COMM:LAN:DOM "www.example.com"
```

The following query returns the Domain Name currently being used by the instrument (the quotes are also returned).

```
SYST:COMM:LAN:DOM?
```

Typical Response: **"www.example.com"**

See Also

SYSTem:COMMunicate:LAN:DHCP

SYSTem:COMMunicate:LAN:HOSTname

SYSTem:COMMunicate:LAN:GATEway

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

SYSTem:COMMunicate:LAN:GATEway <address>

SYSTem:COMMunicate:LAN:GATEway? [{CURRENT|STATIC}]

Description

This command assigns a Default Gateway for the 34980A. The specified IP Address sets the Default Gateway which allows the instrument to communicate with systems that are not on the local subnet. Thus, this is the Default Gateway where packets are sent which are destined for a device not on the local subnet, as determined by the Subnet Mask setting. Contact your network administrator to determine if a gateway is being used and for the correct address.

NOTE

If you change the Default Gateway, you must cycle power on the 34980A to activate the new setting.

Parameters

Name	Type	Range of Values	Default Value
<address>	Numeric	Specified in four-byte dot notation ("nnn.nnn.nnn.nnn"), where "nnn" in each case is a byte value in the range 0 through 255.	0.0.0.0 (no Gateway)

Remarks

- If **DHCP** is enabled (see **SYSTem:COMMunicate:LAN:DHCP** command), the specified Default Gateway is not used. However, if the DHCP server fails to assign a valid IP address, the currently configured Default Gateway will be used.

- Dot-notation addresses ("nnn.nnn.nnn.nnn" where "nnn" is a byte value) must be expressed with care, as most web software on the PC will interpret byte values with leading zeros as *octal* numbers. For example, "255.255.020.011" is actually equivalent to decimal "255.255.16.9" not "255.255.20.11" because ".020" is interpreted as "16" expressed in octal, and ".011" as "9". To avoid confusion, use only decimal expressions of byte values (0 to 255), with **no leading zeros**.

For example, the 34980A assumes that all dot-notation addresses are expressed as decimal byte values and strips all leading zeros from these byte values. Thus, attempting to set a Default Gateway of "255.255.020.011" will become "255.255.20.11" (a purely decimal expression). Be sure to enter the exact expression, "255.255.20.11", in your PC web software to address the instrument. Do not use "255.255.020.011" – the PC will interpret this address differently due to the leading zeros.

- A value of "0.0.0.0" indicates that subnetting is not being used.
- The Default Gateway is stored in **non-volatile** memory, and does not change when power has been off, after a Factory Reset (***RST** command), or after an Instrument Preset (SYSTem:PRESet command).

Return Format

The query command returns the Default Gateway address in the form "nnn.nnn.nnn.nnn".

Note that the query command has two optional parameters. Specify "CURRent" (default) to read the dynamic Default Gateway currently being used by the instrument. Specify "STATic" to read the Default Gateway currently stored in **non-volatile** memory within the instrument (may not be the actual address used by the instrument if DHCP is enabled).

Examples

The following command sets the Default Gateway address.

```
SYST:COMM:LAN:GATEWAY 255.255.20.11
```

The following query returns the Default Gateway address currently being used by the instrument (the quotes are also returned).

```
SYST:COMM:LAN:GATEWAY? CURR or SYST:COMM:LAN:GATEWAY?
```

Typical Response: "0.0.0.0"

See Also

SYSTem:COMMunicate:LAN:DHCP

SYSTem:COMMunicate:LAN:IPADdress

SYSTem:COMMunicate:LAN:SMASk

SYSTem:COMMunicate:LAN:HISTory?

Syntax | Description | Parameters | Remarks | Return Format | Example

Syntax

SYSTem:COMMunicate:LAN:HISTory?

Description

This command returns a time-stamped record of all LAN session connections and disconnections.

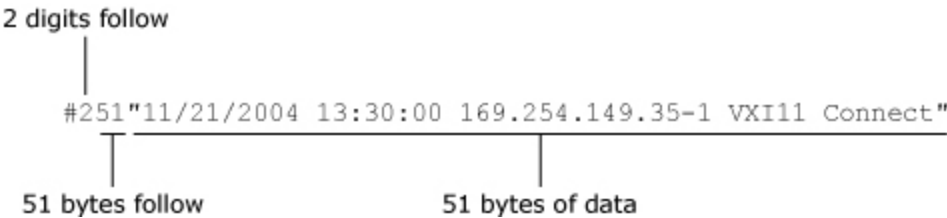
Remarks

- To clear the LAN connection history queue, use the SYSTem:COMMunicate:LAN:HISTory:CLEar command.

Return Format

The command returns the LAN connection history in **Definite-Length Block** format. The syntax is a pound sign (#) followed by a non-zero digit representing the number of digits in the decimal integer to follow. This digit is followed by a decimal integer indicating the number of 8-bit data bytes to follow. This is followed by a block of data containing the specified number of bytes.

For example:



Each connection record is enclosed in quotes and multiple responses are separated by commas. For example:



1 Date (November 21, 2004)	4 Session Number
2 Time of Day (1:30:00 PM)	5 Session Type (LAN, SOCKets, TELNet, VXI11, or WEB)
3 IP Address	6 Connect/Disconnect Status

If the connection history has been cleared, this command returns "#10".

Example

The following query returns the LAN connection history.

```
SYST:COMM:LAN:HIST?
```

Typical Response:

```
#3215"11/21/2004 13:30:00 169.254.149.35-1 VXI11 Connect","11/21/2004 13:35:24 169.254.149.35-2  
VXI11 Connect","11/21/2004 13:50:02 169.254.149.35-1 VXI11 Disconnect","11/21/2004 14:03:54  
169.254.149.35-2 VXI11 Disconnect"
```

See Also

SYSTem:COMMunicate:LAN:HISTory:CLEar

SYSTem:COMMunicate:LAN:HISTory:CLEar

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

SYSTem:COMMunicate:LAN:HISTory:CLEar

Description

This command clears the LAN connection history queue.

Example

The following command clears the LAN connection history queue.

```
SYST:COMM:LAN:HIST:CLE
```

See Also

[SYSTem:COMMunicate:LAN:HISTory?](#)

SYSTem:COMMunicate:LAN:HOSTname

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

SYSTem:COMMunicate:LAN:HOSTname "<name>"

SYSTem:COMMunicate:LAN:HOSTname? [{CURRent|STATic}]

Description

This command assigns a Host Name to the 34980A. The Host Name is the host portion of the domain name, which is translated into an IP address.

NOTE

If you change the Host Name, you must cycle power on the 34980A to activate the new setting.

Parameters

Name	Type	Range of Values	Default Value
<name>	Quoted ASCII String	A string of up to 15 characters. The first character must be a letter (A-Z), but the remaining 14 characters can be letters, numbers (0-9), or dashes ("-"). Blank spaces are not allowed.	A-34980A- <i>nnn</i> , where <i>nnn</i> is the instrument's serial number representation.

Remarks

- If Dynamic Domain Name System (DNS) is available on your network and your instrument uses **DHCP**, the Host Name is registered with the Dynamic DNS service at power-on.
- If DHCP is enabled (see **SYSTem:COMMunicate:LAN:DHCP** command), the DHCP server can change the specified Host Name.
- The Host Name is stored in **non-volatile** memory, and does not change when power has been off, after a Factory Reset (***RST** command), or after an Instrument Preset (SYSTem:PRESet command).

Return Format

The query command reads the Host Name and returns an ASCII string enclosed in double quotes. If a Host Name has not been assigned, a null string (" ") is returned.

Note that the query command has two optional parameters. Specify "CURRent" (default) to read the dynamic Host Name currently being used by the instrument. Specify "STATic" to read the Host Name currently stored in

non-volatile memory within the instrument (may not be the actual name used by the instrument if DHCP is enabled).

Examples

The following command defines a Host Name.

```
SYST:COMM:LAN:HOST "LAB1-34980A"
```

The following query returns the Host Name currently being used by the instrument (the quotes are also returned).

```
SYST:COMM:LAN:HOST? CURR or SYST:COMM:LAN:HOST?
```

Typical Response: "LAB1-34980A"

See Also

SYSTem:COMMunicate:LAN:DHCP

SYSTem:COMMunicate:LAN:DOMain

SYSTem:COMMunicate:LAN:IPADdress

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

SYSTem:COMMunicate:LAN:IPADdress <address>

SYSTem:COMMunicate:LAN:IPADdress? [{CURRENT|STATic}]

Description

This command assigns a static Internet Protocol (IP) Address for the 34980A. Contact your network administrator for a valid IP address to use for your instrument.

NOTE

If you change the IP address, you must cycle power on the 34980A to activate the new address.

Parameters

Name	Type	Range of Values	Default Value
<address>	Numeric	Specified in four-byte dot notation ("nnn.nnn.nnn.nnn"), where "nnn" in each case is a byte value in the range 0 through 255.	169.254.9.80

Remarks

- If **DHCP** is enabled (see **SYSTem:COMMunicate:LAN:DHCP** command), the specified static IP address is not used. However, if the DHCP server fails to assign a valid IP address, the currently configured static IP address will be used.
- Dot-notation addresses ("nnn.nnn.nnn.nnn" where "nnn" is a byte value) must be expressed with care, as most web software on the PC will interpret byte values with leading zeros as *octal* numbers. For example, "255.255.020.011" is actually equivalent to decimal "255.255.16.9" not "255.255.20.11" because ".020" is interpreted as "16" expressed in octal, and ".011" as "9". To avoid confusion, use only decimal expressions of byte values (0 to 255), with **no leading zeros**.

For example, the 34980A assumes that all dot-notation addresses are expressed as decimal byte values and strips all leading zeros from these byte values. Thus, attempting to set an IP address of "255.255.020.011" will become "255.255.20.11" (a purely decimal expression). Be sure to enter the exact expression, "255.255.20.11", in your PC web software to address the instrument. Do not use "255.255.020.011" – the PC will interpret this address differently due to the leading zeros.

- If you are planning to use a static IP address on a Corporate LAN, contact your network administrator to obtain a fixed IP address to be used exclusively for your instrument.
- The IP address is stored in **non-volatile** memory, and does not change when power has been off, after a Factory Reset (***RST** command), or after an Instrument Preset (**SYSTem:PRESet** command).

Return Format

The query command returns the IP address in the form "nnn.nnn.nnn.nnn".

Note that the query command has two optional parameters. Specify "CURRENT" (default) to read the dynamic IP address currently being used by the instrument. Specify "STATIC" to read the IP address currently stored in **non-volatile** memory within the instrument (may not be the actual address used by the instrument if DHCP is enabled).

Examples

The following command sets the IP address.

```
SYST:COMM:LAN:IPAD 255.255.25.14
```

The following query returns the IP address currently being used by the instrument (the quotes are also returned).

```
SYST:COMM:LAN:IPAD? CURR or SYST:COMM:LAN:IPAD?
```

Typical Response: "169.254.149.35"

See Also

SYSTem:COMMunicate:LAN:DHCP

SYSTem:COMMunicate:LAN:GATEway

SYSTem:COMMunicate:LAN:SMASk

SYSTem:COMMunicate:LAN:KEEPlive

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

SYSTem:COMMunicate:LAN:KEEPlive {<seconds>|MIN|MAX}

SYSTem:COMMunicate:LAN:KEEPlive? [{MIN|MAX}]

Description

This command sets the LAN keepalive timeout which specifies a number of seconds to keep a LAN socket active. If there has been no activity on the connection after the specified timeout, the instrument will send keepalive probes to the client to determine if it is still available. After the specified timeout, the connection will be marked as "down" or "dropped".

NOTE

If you specify a timeout value, it is recommended that you use the largest value that still meets the application's need for unreachable client detection. Smaller timeout values will generate more keepalive probes thus using more of the available network bandwidth.

Parameters

Name	Type	Range of Values	Default Value
<seconds>	Numeric	Desired timeout in seconds between 600 seconds and 32,000,000 seconds, or 0 (no timeout). MIN = 600 seconds MAX = 32,000,000 seconds	1,800 seconds (30 minutes)

Remarks

- If you specify a value of "0", no timeout is set; the instrument will wait indefinitely and will not send any keepalive probes to the client.
- For the <seconds> parameter, you can substitute MIN or MAX for a numeric value. MIN selects the smallest value accepted; MAX selects the largest value accepted.
- The timeout is stored in **non-volatile** memory, and does not change when power has been off, after a Factory Reset (***RST** command), or after an Instrument Preset (SYSTem:PRESet command).

Return Format

The query command returns the current timeout in seconds.

Examples

The following command sets the timeout to 2,700 seconds (45 minutes).

```
SYST:COMM:LAN:KEEP 2.7E+03
```

The following query returns the timeout currently being used.

```
SYST:COMM:LAN:KEEP?
```

Typical Response: **+2.70000000E+03**

SYSTem:COMMunicate:LAN:MAC?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

SYSTem:COMMunicate:LAN:MAC?

Description

This command reads the 34980A's Media Access Control (MAC) address, also known as the link-level address, the Ethernet (station) address, LANIC ID, or Hardware Address. This is an unchangeable 48-bit address assigned by the manufacturer to each unique Internet device.

NOTE

Your network administrator may need the MAC address if they are assigning a static IP address for this device.

Remarks

- The instrument's MAC address is set at the factory and cannot be changed.
- The MAC address is stored in **non-volatile** memory, and does not change when power has been off, after a Factory Reset (***RST** command), or after an Instrument Preset (**SYSTem:PRESet** command).

Return Format

The command reads the MAC address and returns an ASCII string enclosed in double quotes. The MAC address is represented as 12 hexadecimal characters divided into groups of two and separated by dashes (e.g., "XX-XX-XX-XX-XX-XX").

Example

The following query returns the MAC address (the quotes are also returned).

```
SYST:COMM:LAN:MAC?
```

Typical Response: "00-30-D3-00-10-41"

SYSTem:COMMunicate:LAN:SMASk

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

SYSTem:COMMunicate:LAN:SMASk <mask>

SYSTem:COMMunicate:LAN:SMASk? [{CURRent|STATic}]

Description

This command assigns a Subnet Mask for the 34980A. The instrument uses the Subnet Mask to determine if a client IP address is on the same local subnet. When a client IP address is on a different subnet, all packets must be sent to the Default Gateway. Contact your network administrator to determine if subnetting is being used and for the correct Subnet Mask.

NOTE

If you change the Subnet Mask, you must cycle power on the 34980A to activate the setting.

Parameters

Name	Type	Range of Values	Default Value
<mask>	Numeric	Specified in four-byte dot notation ("nnn.nnn.nnn.nnn"), where "nnn" in each case is a byte value in the range 0 through 255.	255.255.0.0

Remarks

- If **DHCP** is enabled (see **SYSTem:COMMunicate:LAN:DHCP** command), the specified Subnet Mask is not used. However, if the DHCP server fails to assign a valid IP address, the currently configured Subnet Mask will be used.

- Dot-notation addresses ("nnn.nnn.nnn.nnn" where "nnn" is a byte value) must be expressed with care, as most web software on the PC will interpret byte values with leading zeros as *octal* numbers. For example, "255.255.020.011" is actually equivalent to decimal "255.255.16.9" not "255.255.20.11" because ".020" is interpreted as "16" expressed in octal, and ".011" as "9". To avoid confusion, use only decimal expressions of byte values (0 to 255), with **no leading zeros**.

For example, the 34980A assumes that all dot-notation addresses are expressed as decimal byte values and strips all leading zeros from these byte values. Thus, attempting to set a Subnet Mask of "255.255.020.011" will become "255.255.20.11" (a purely decimal expression). Be sure to enter the exact expression, "255.255.20.11", in your PC web software to address the instrument. Do not use "255.255.020.011" – the PC will interpret this address differently due to the leading zeros.

- A value of "0.0.0.0" or "255.255.255.255" indicates that subnetting is not being used.
- The Subnet Mask is stored in **non-volatile** memory, and does not change when power has been off, after a Factory Reset (***RST** command), or after an Instrument Preset (**SYSTem:PRESet** command).

Return Format

The query command returns the Subnet Mask in the form "nnn.nnn.nnn.nnn".

Note that the query command has two optional parameters. Specify "CURRent" (default) to read the dynamic Subnet Mask currently being used by the instrument. Specify "STATic" to read the Subnet Mask currently stored in **non-volatile** memory within the instrument (may not be the actual mask used by the instrument if DHCP is enabled).

Examples

The following command sets the Subnet Mask.

```
SYST:COMM:LAN:SMAS 255.255.20.11
```

The following query returns the Subnet Mask currently being used by the instrument (the quotes are also returned).

```
SYST:COMM:LAN:SMAS? CURR or SYST:COMM:LAN:SMAS?
```

Typical Response: "255.255.0.0"

See Also

SYSTem:COMMunicate:LAN:DHCP

SYSTem:COMMunicate:LAN:GATEway

SYSTem:COMMunicate:LAN:IPADdress

SYSTem:COMMunicate:LAN:TELNet:PROMpt

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

SYSTem:COMMunicate:LAN:TELNet:PROMpt "<string>"

SYSTem:COMMunicate:LAN:TELNet:PROMpt?

Description

This command sets the command prompt seen when using a Telnet session to communicate with the 34980A.

Parameters

Name	Type	Range of Values	Default Value
<string>	Quoted ASCII String	A string of up to 15 characters.	"34980A>"

Remarks

- For all Keysight products, the Telnet port number is 5024.
- Telnet session can typically be started as follows from a host computer shell:

```
telnet <IP_address> <port>
```

For example:

```
telnet 169.254.9.80 5024
```

To exit a Telnet session, press <Ctrl-D>.

- The command prompt is stored in **non-volatile** memory, and does not change when power has been off, after a Factory Reset (***RST** command), or after an Instrument Preset (SYSTem:PRESet command).

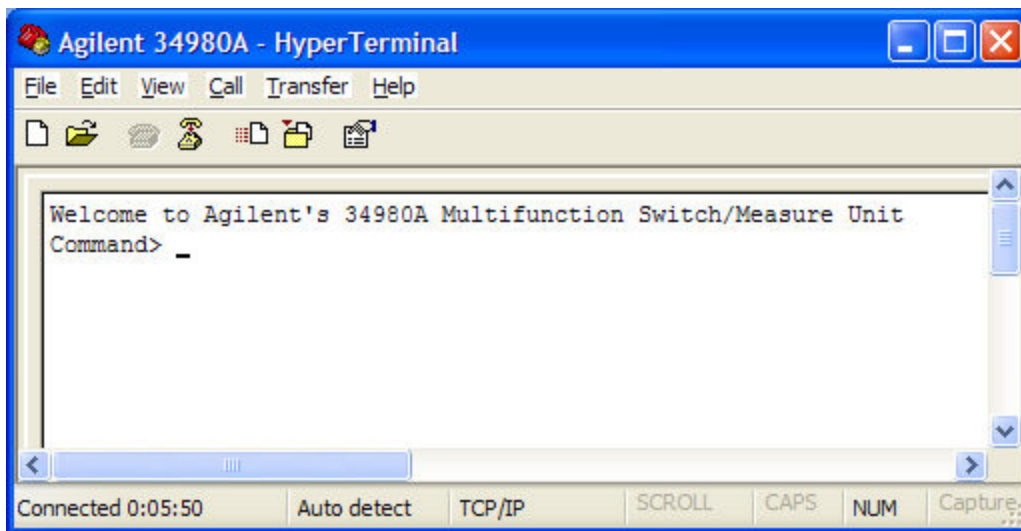
Return Format

The query command reads the command prompt and returns an ASCII string enclosed in double quotes.

Examples

The following command defines the command prompt.

```
SYST:COMM:LAN:TELN:PROM "Command> "
```



The following query returns the command prompt currently being used (the quotes are also returned).

```
SYST:COMM:LAN:TELN:PROM?
```

Typical Response: "Command> "

See Also

[SYSTem:COMMunicate:LAN:TELNet:WMESsage](#)

SYSTem:COMMunicate:LAN:TELNet:WMESsage

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

SYSTem:COMMunicate:LAN:TELNet:WMESsage "<string>"

SYSTem:COMMunicate:LAN:TELNet:WMESsage?

Description

This command sets the welcome message seen when using a Telnet session to communicate with the 34980A.

Parameters

Name	Type	Range of Values	Default Value
<string>	Quoted ASCII String	A string of up to 63 characters.	"Welcome to Keysight's 34980A Multifunction Switch/Measure Unit"

Remarks

- For all Keysight products, the Telnet port number is 5024.
- The welcome message is stored in **non-volatile** memory, and does not change when power has been off, after a Factory Reset (***RST** command), or after an Instrument Preset (SYSTem:PRESet command).

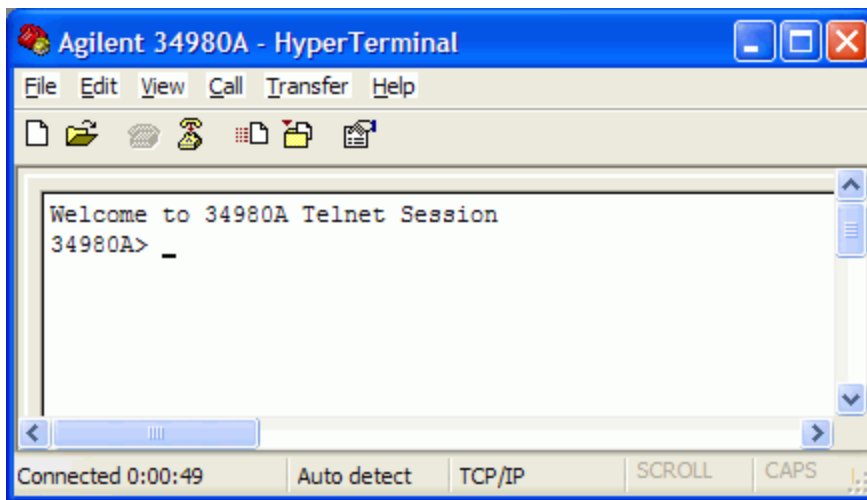
Return Format

The query command reads the welcome message and returns an ASCII string enclosed in double quotes.

Examples

The following command defines the welcome message.

```
SYST:COMM:LAN:TELN:WMES "Welcome to 34980A Telnet Session"
```

The following query returns the welcome message currently being used (the quotes are also returned).

```
SYST:COMM:LAN:TELN:WMES?
```

Typical Response: **"Welcome to 34980A Telnet Session"**

See Also

SYSTem:COMMunicate:LAN:TELNet:PROMpt

SYSTem:ABUS:INTERlock:SIMulate

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

SYSTem:ABUS:INTERlock:SIMulate <mode>

SYSTem:ABUS:INTERlock:SIMulate?

Description

The *Safety Interlock* feature prevents connections to the Analog Buses if no terminal block or properly-wired cable is connected to the module. Normally, if you attempt to connect to the Analog Buses without a terminal block or properly-wired cable connected, an error is generated. This command allows you to *temporarily* disable errors generated by the Safety Interlock feature. This may be useful during test system development when you may not have connected any terminal blocks or cables to your module.

NOTE

The Safety Interlock feature is implemented in hardware on the modules and cannot be circumvented. Regardless of whether the simulation mode is enabled or disabled, all Analog Bus connections are disabled as long as no terminal block or properly-wired cable is connected to the module.

Used With:

- 34921A through 34925A Multiplexer Modules
- 34931A through 34933A Matrix Modules (*this command does not apply to the 34934A*)

Parameters

Name	Type	Range of Values	Default Value
<mode>	Boolean	{OFF 0 ON 1}	OFF

Remarks

- This command applies to the entire mainframe and cannot be selectively used on individual modules.
- When the simulation mode is enabled, the Analog Bus relays will *appear* to close and open as directed. For example, no errors are generated if you close an Analog Bus relay from the front panel, remote interface, or Web Interface. However, remember that the Safety Interlock feature prevents the actual hardware state of the Analog Bus relays from being changed. Note, however, that when you connect a terminal block or cable to the module, the Analog Bus relays will be closed.
- The simulation setting is stored in **volatile** memory and will be disabled (OFF) when power is turned off or after a Factory Reset (***RST** command). The simulation setting will also be disabled (OFF) when a stored state is recalled (***RCL** command). To re-enable the simulation mode, send SYSTem:ABUS:INTERlock:SIMulate ON.

Return Format

The query command returns "0" (OFF) or "1" (ON).

Examples

The following command enables the Safety Interlock simulation mode. Although Safety Interlock errors are suppressed in this mode, all Analog Bus connections are prohibited as long as no terminal block or cable is connected to the module.

```
SYST:ABUS:INT:SIM ON
```

The following query returns the setting of the Safety Interlock simulation mode.

```
SYST:ABUS:INT:SIM?
```

Typical Response: **1**

SYSTem:ALARm?

Syntax | Description | Parameters | Remarks | Return Format | Example

Syntax

SYSTem:ALARm?

Description

This command reads the alarm data from the alarm queue (one message is read and deleted from the queue each time this command is executed). A record of up to 20 alarms can be stored in the instrument's alarm queue.

Used With:

- 34921A through 34925A Multiplexer Modules
- 34950A Digital I/O Module (digital input and counter channels only)
- 34952A Multifunction Module (digital input and totalizer channels only)

Remarks

- Each time you start a new scan, the instrument clears all readings (and the alarm queue) stored in reading memory from the previous scan. Therefore, the contents of memory are always from the most recent scan.
- Alarm data is retrieved in first-in-first-out (FIFO) order. The first alarm returned is the first alarm that was stored.
- Up to 20 alarms can be logged in the alarm queue. If more than 20 alarms are generated, they will be lost (only the first 20 alarms are saved).
- To retrieve scanned readings and alarm data from reading memory without clearing the information, use the **FETCh?** command.
- The alarm queue is cleared by the ***CLS** (clear status) command, when power is cycled, and by reading all of the entries. A Factory Reset (***RST** command) or Instrument Preset (**SYSTem:PRESet** command) does *not* clear the alarm queue.

Return Format

One string is returned each time this command is executed. The command reads the alarm data and clears one alarm event from the alarm queue. If readings are acquired using the internal DMM independently (without a multiplexer scan), the channel number will be logged as channel "0".

The command returns a string in the form shown below (independent of **FORMat:READIng** commands):

2.61950000E+01 C,2004,11,21,15,30,23.000,1003,2,4

1 Reading with Units (26.195 °C)	4 Channel Number
2 Date (November 21, 2004)	5 Alarm Limit Threshold Crossed (0 = No Alarm, 1 = LO, 2 = HI)
3 Time of Day (3:30:23.000 PM)	6 Alarm Number (1 - 4)

Example

The following command reads one message from the alarm queue and removes that message from the queue.

```
SYST:ALAR?
```

Typical Response: -1.17616000E-04 VDC,2004,11,21,15,54,50.184,1003,1,3

SYSTem:BEEPer

Syntax | **Description** | Parameters | Remarks | Return Format | **Example**

Syntax

SYSTem:BEEPer

Description

This command issues a single beep immediately from the instrument. This may be useful for program development and troubleshooting.

Example

The following command issues a single beep from the instrument.

```
SYST:BEEP
```

SYSTem:BEEPer:STATe

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

SYSTem:BEEPer:STATe <mode>

SYSTem:BEEPer:STATe?

Description

This command disables or enables the tone heard when an error is generated from the front panel or over the remote interface.

Parameters

Name	Type	Range of Values	Default Value
<mode>	Boolean	{OFF 0 ON 1}	This is a required parameter

Remarks

- Turning off the beeper does *not* disable the key click generated when you press a front-panel key or turn the knob.
- The beeper setting is stored in **non-volatile** memory, and does not change when power has been off, after a Factory Reset (***RST** command), or after an Instrument Preset (**SYSTem:PRESet** command).

Return Format

The query command returns "0" (OFF) or "1" (ON).

Examples

The following command disables the beeper state.

```
SYST:BEEP:STAT OFF
```

The following query returns the beeper state.

```
SYST:BEEP:STAT?
```

Typical Response: 0

See Also

SYSTem:BEEPer

SYSTem:CDEscription?

Syntax | **Description** | **Parameters** | **Remarks** | **Return Format** | **Example**

Syntax

SYSTem:CDEscription? <slot>

Description

This command returns a string containing a description of the plug-in module in the specified slot. The table below shows the strings returned by the plug-in modules available for the Keysight 34980A.

Model Number	String Returned
34921A	40-Channel Armature Multiplexer with Low Thermal Offset
34922A	70-Channel Armature Multiplexer
34923A	40-Channel Reed Multiplexer
34923A-1W	80-Channel Reed Multiplexer (1-Wire Mode)
34924A	70-Channel Reed Multiplexer
34925A	40-Channel Optically-Isolated FET Multiplexer
34925A-1W	80-Channel Optically-Isolated FET Multiplexer (1-Wire Mode)
34931A	Dual 4x8 Armature Matrix
34932A	Dual 4x16 Armature Matrix
34933A	Dual 4x8 Reed Matrix
34933A-1W	Quad 4x8 Reed Matrix (1-Wire Mode)
34934A	4x32: Quad 4x32 High Density Reed Matrix 4x64: Dual 4x64 High Density Reed Matrix 4x128: Single 4x128 High Density Reed Matrix 8x32: Dual 8x32 High Density Reed Matrix 8x64: Single 8x64 High Density Reed Matrix 16x32: Single 16x32 High Density Reed Matrix
34937A	32-Channel Form C/Form A General-Purpose Switch
34938A	20-Channel 5A Form A Switch
34939A	64-Channel Form A General-Purpose Switch
34941A	Quad 1x4 50-Ohm 3 GHz RF Multiplexer
34942A	Quad 1x4 75-Ohm 1.5 GHz RF Multiplexer
34945A	Microwave Switch/Attenuator Driver Interface
34946A	Dual 1x2 SPDT Terminated Microwave Switch
34947A	Triple 1x2 SPDT Unterminated Microwave Switch
34950A	64-Bit Digital I/O Module with Memory and Counter

34951A	4-Channel Isolated D/A Converter with Waveform Memory
34952A	Multifunction Module with DIO, DAC, and Totalizer
34959A	Breadboard Module
Empty Slot	Slot empty (or card unresponsive)

Parameters

Name	Type	Range of Values	Default Value
<slot>	Discrete	{1 2 3 4 5 6 7 8}	This is a required parameter

Return Format

- The command returns an ASCII string enclosed in double quotes as shown in the table above. To read the string into your computer, be sure to dimension a string variable with at least 60 characters.
- If a module is installed in the specified slot but cannot be properly identified, the command responds with an "Card not supported by mainframe" string. An error is also generated and reported to all I/O sessions.
- If a module is installed in the specified slot but a firmware incompatibility exists, the command responds with a "Card FW incompatible with mainframe" string. An error is also generated and reported to all I/O sessions.
- If a module is installed in the specified slot but a self-test error has occurred, the command responds with a "Fatal boot self-test failure" string. An error is also generated and reported to all I/O sessions.

Example

The following command returns the description of the module in slot 3 (the quotes are also returned).

```
SYST:CDES? 3
```

Typical Response: **"40-Channel Armature Multiplexer with Low Thermal Offset"**

See Also

SYSTem:CDEscription:RMOdule? (34945A only)

SYSTem:CTYPE?

***IDN?**

SYSTem:CDEscription:RMOdule?

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

SYSTem:CDEscription:RMOdule? (@<rem_ch>) [,<dist_board>]

Description

This command returns a string containing a description of the specified 34945EXT remote module connected to the 34945A Microwave Switch/Attenuator Driver. By specifying the optional <dist_board> parameter, you can query the description of one of four Distribution Boards connected to the specified 34945EXT remote module.

Used With:

- 34945A Microwave Switch/Attenuator Driver

Parameters

Name	Type	Range of Values	Default Value
<rem_ch>	Numeric	One 34945EXT remote module identifier in the form (@sr00). Select from s100 through s800.	This is a required parameter
<dist_board>	Discrete	{DISTribution1-DISTribution4} The numbering of each Distribution Board corresponds to the <i>bank</i> position in which it is installed on the 34945EXT remote module (banks are numbered 1 through 4).	If omitted, the identity of the specified 34945EXT remote module is returned.

Return Format

- If you omit the <dist_board> parameter, the command returns a string containing a description of the specified 34945EXT remote module (the string is enclosed in double quotes). To read the string into your computer, be sure to dimension a string variable with at least 60 characters.

Microwave Switch/Attenuator Driver Extender

- If you specify the <dist_board> parameter, the command returns a string containing a description of the specified Distribution Board (the string is enclosed in double quotes). To read the string into your computer, be sure to dimension a string variable with at least 60 characters. The table below shows the strings returned by the available Distribution Boards.

Distribution Board	String Returned
Y1150A	Distribution Board for N181x Switches
Y1151A	Distribution Board for 87104x/106x or 87406B Switches
Y1152A	Distribution Board for 87204x/206x/606B and N181x Switches
Y1153A	Distribution Board for 84904/5/8x and 8494/5/6 Attenuators
Y1154A	Distribution Board for 87222 and N181x Switches
Y1155A	Distribution Board for - Screw Terminals
None	Unrecognized/Missing distribution board

- If a 34945EXT module is present but is not properly powered, the command responds with a "34945EXT unpowered" string. An error is also generated and reported to all I/O sessions.
- If a 34945EXT module is present but a firmware incompatibility exists or a self-test error has occurred, the command responds with a "34945EXT boot error" string. An error is also generated and reported to all I/O sessions.

Examples

The following command returns the description of 34945EXT remote module #2 connected to slot 3 (the quotes are also returned).

```
SYST:CDES:RMOD? (@3200)
```

Typical Response: **"Microwave Switch/Attenuator Driver Extender"**

The following command returns the description of Distribution Board #4 on 34945EXT remote module #2 connected to slot 3 (the quotes are also returned).

```
SYST:CDES:RMOD? (@3200),DIST4
```

Typical Response: **"Distribution Board for N181x Switches"**

See Also

[SYSTem:CDEScriptio?](#)

[SYSTem:CTYPe:RMOdule?](#)

[SYSTem:CTYPe?](#)

[*IDN?](#)

SYSTem:COMMunicate:ENABle

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

SYSTem:COMMunicate:ENABle <mode>, <interface>

SYSTem:COMMunicate:ENABle? <interface>

Description

This command disables or enables the GPIB, USB, or LAN remote interface. In addition, this command disables or enables the available remote services such as Sockets, Telnet, VXI11, and the 34980A's built-in Web Interface.

NOTE

If you change the LAN setting, you must cycle power on the 34980A to activate the new setting.

Parameters

Name	Type	Range of Values	Default Value
<mode>	Boolean	{OFF 0 ON 1}	This is a required parameter
<interface>	Discrete	{GPIB USB LAN SOCKets TELNet VXI11 WEB}	This is a required parameter

Remarks

- If you disable the LAN interface, all associated LAN services will not be started when you power on the 34980A.
- The interface setting is stored in **non-volatile** memory, and does not change when power has been off, after a Factory Reset (***RST** command), or after an Instrument Preset (**SYSTem:PRESet** command).

Return Format

The query command returns "0" (OFF) or "1" (ON) for the specified interface.

Examples

The following command disables the USB interface.

```
SYST:COMM:ENAB OFF,USB
```

The following query returns the state of the USB interface.

```
SYST:COMM:ENAB? USB
```

Typical Response: **0**

SYSTem:COMMunicate:GPIB:ADDRess

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

SYSTem:COMMunicate:GPIB:ADDRess <address>

SYSTem:COMMunicate:GPIB:ADDRess?

Description

This command assigns the instrument's GPIB (IEEE-488) address. Each device on the GPIB interface must have a unique address.

Parameters

Name	Type	Range of Values	Default Value
<address>	Numeric	Any value between 0 and 30.	9

Remarks

- Your computer's GPIB interface card has its own address. Be sure to avoid using the computer's address for any instrument on the interface bus.
- The GPIB address is stored in **non-volatile** memory, and does not change when power has been off, after a Factory Reset (***RST** command), or after an Instrument Preset (**SYSTem:PRESet** command).

Return Format

The query command returns the GPIB address in the form "+9".

Examples

The following command sets the GPIB address.

```
SYST:COMM:GPIB:ADDR 15
```

The following query returns the GPIB address currently being used by the instrument.

```
SYST:COMM:GPIB:ADDR?
```

Typical Response: **+15**

SYSTem:CPON

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

SYSTem:CPON <slot>

Description

This command resets the module in the specified slot to its factory configuration (CPON means "card power on"). See [Factory Reset State](#) for a complete listing of the instrument's Factory configuration.

Parameters

Name	Type	Range of Values	Default Value
<slot>	Discrete	{1 2 3 4 5 6 7 8}	This is a required parameter

Remarks

- This command does not reset the internal DMM.
- To reset all eight slots in the instrument, send the ***RST** command.
- This command may be used to restore normal operation to a 34925A FET Multiplexer that is in the over-voltage state.
- On the 34945A Microwave Switch/Attenuator Driver, this command resets all channels on a remote module to their default states as specified by the **ROUTe:CHANnel:DRIVE:OPEN:DEFault** command and sets all channel drives to the specified boot state (see **ROUTe:RMOdule:DRIVE:SOURce:BOOT** command). When the SYSTem:CPON command is executed, the 34945A does *not* re-evaluate the external remote module connections (unlike the ***RST** command which does a re-evaluation).
- On the 34945A Microwave Switch/Attenuator Driver, the time required to complete a reset may be significant depending on the specified pulse width (see **ROUTe:CHANnel:DRIVE:PULSe:WIDTh** command) and power supply recovery time (see **ROUTe:CHANnel:DRIVE:TIME:RECOvery** command). If both values are set to their upper limits (255 ms each) for all channels, the time required to reset (or boot) the module may exceed 30 seconds:

$$64 \text{ Channels} \times (255 \text{ ms Pulse Width} + 255 \text{ ms Recovery Time}) = \sim 33 \text{ seconds}$$

Example

The following command resets the module installed in slot 3.

```
SYST:CPON 3
```


See Also

***RST**

ROUTe:CHANnel:DRIVe:PULSe:WIDTh (34945A *only*)

ROUTe:CHANnel:DRIVe:TIME:RECoverY (34945A *only*)

SYSTem:PRESet

SYSTem:CTYPe?

Syntax | **Description** | **Parameters** | **Remarks** | **Return Format** | **Example**

Syntax

SYSTem:CTYPe? <slot>

Description

This command returns the identity of the plug-in module in the specified slot. The table below shows the plug-in modules available for the Keysight 34980A.

Model Number	Module Description
34921A	40-Channel Armature Multiplexer with Low Thermal Offset
34922A	70-Channel Armature Multiplexer
34923A	40-Channel Reed Multiplexer
34923A-1W	80-Channel Reed Multiplexer (1-Wire Mode)
34924A	70-Channel Reed Multiplexer
34925A	40-Channel Optically-Isolated FET Multiplexer
34925A-1W	80-Channel Optically-Isolated FET Multiplexer (1-Wire Mode)
34931A	Dual 4x8 Armature Matrix
34932A	Dual 4x16 Armature Matrix
34933A	Dual 4x8 Reed Matrix
34933A-1W	Quad 4x8 Reed Matrix (1-Wire Mode)
34934A	-4x32: High Density Matrix Module -4x64: High Density Matrix Module -4x128: High Density Matrix Module -8x32: High Density Matrix Module -8x64: High Density Matrix Module -16x32: High Density Matrix Module
34937A	32-Channel Form C/Form A General-Purpose Switch
34938A	20-Channel 5A Form A Switch
34939A	64-Channel 1A Form A Switch
34941A	Quad 1x4 50-Ohm 3 GHz RF Multiplexer
34942A	Quad 1x4 75-Ohm 1.5 GHz RF Multiplexer
34945A	Microwave Switch/Attenuator Driver Interface
34946A	Dual 1x2 SPDT Terminated Microwave Switch
34947A	Triple 1x2 SPDT Unterminated Microwave Switch
34950A	64-Bit Digital I/O Module with Memory and Counter
34951A	4-Channel Isolated D/A Converter with Waveform Memory

34952A	Multifunction Module with DIO, DAC, and Totalizer
34959A	Breadboard Module

Parameters

Name	Type	Range of Values	Default Value
<slot>	Discrete	{1 2 3 4 5 6 7 8}	This is a required parameter

Return Format

- The command returns an ASCII string with the following format (the string is enclosed in double quotes). To read the string into your computer, be sure to dimension a string variable with at least 73 characters.

Keysight Technologies,<Model Number>,<Serial Number>,<Firmware Rev>

A 10-digit string is returned for the Serial Number field. The Firmware Revision has the form **R.RR** and indicates the revision of firmware currently in use on the specified module.

- For the 34923A, 34925A, and 34933A modules, the Model Number may include a suffix to indicate a single-ended (1-wire) configuration. For example, the response for the 34923A will be either "34923A" (differential mode) or "34923A-1W" (single-ended mode).
- For the 34951A module, the command also returns the FPGA revision number:

Keysight Technologies,<Model Number>,<Serial Number>,<Firmware Rev>-<FPGA Rev>

- If the specified slot is empty, the command responds with "Keysight Technologies,0,0,0".
- If a module is installed in the specified slot but cannot be properly identified, the command responds with an "Unknown Card ID" string. An error is also generated and reported to all I/O sessions.
- If a module is installed in the specified slot but a firmware incompatibility exists or a self-test error has occurred, the command responds with a "Boot Error" string. An error is also generated and reported to all I/O sessions.

Example

The following command returns the identity of the module in slot 3 (the quotes are also returned).

```
SYST:CTYP? 3
```

Typical Response: "Keysight Technologies,34921A,MY12345678,1.00"

See Also

***IDN?**

SYSTem:CDEscription?

SYSTem:CTYPe:RMOdule? (34945A only)

SYSTem:MODule:TERMinal:TYPE? (34934A only)

SYSTem:CTYPe:RMODule?

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

SYSTem:CTYPe:RMODule? (@<rem_ch>) [,<dist_board>]

Description

This command returns the identity of the specified 34945EXT remote module connected to the 34945A Microwave Switch/Attenuator Driver. By specifying the optional <dist_board> parameter, you can query the identify of one of four Distribution Boards connected to the specified 34945EXT remote module.

Used With:

- 34945A Microwave Switch/Attenuator Driver

Parameters

Name	Type	Range of Values	Default Value
<rem_ch>	Numeric	One 34945EXT remote module identifier in the form (@sr00). Select from s100 through s800.	This is a required parameter
<dist_board>	Discrete	{DISTribution1-DISTribution4} The numbering of each Distribution Board corresponds to the <i>bank</i> position in which it is installed on the 34945EXT remote module (banks are numbered 1 through 4).	If omitted, the identity of the specified 34945EXT remote module is returned.

Return Format

- If you omit the <dist_board> parameter, the command returns an ASCII string with the following format (the string is enclosed in double quotes). To read the string into your computer, be sure to dimension a string variable with at least 73 characters.

Keysight Technologies,34945EXT,<Serial Number>,<Firmware Rev>

A 10-digit string is returned for the Serial Number field (this is the serial number for the specified 34945EXT remote module). The Firmware Revision has the form **R.RR** and indicates the revision of firmware currently in use on the specified 34945EXT remote module.

- If you specify the `<dist_board>` parameter, the command returns an ASCII string with the following format (the string is enclosed in double quotes). To read the string into your computer, be sure to dimension a string variable with at least 73 characters.

Keysight Technologies,Y115xA,<Serial Number>,<Firmware Rev>

"0" is always returned for the Serial Number field (the Distribution Boards do not have readable serial numbers). "0" is always returned for the Firmware Revision field (the Distribution Boards do not have firmware).

- If a 34945EXT remote module is present but is not properly powered, the command responds with a "34945EXT unpowered" string. An error is also generated and reported to all I/O sessions.
- If a 34945EXT module is present but a firmware incompatibility exists or a self-test error has occurred, the command responds with a "34945EXT boot error" string. An error is also generated and reported to all I/O sessions.

Examples

The following command returns the identity of 34945EXT remote module #2 connected to slot 3 (the quotes are also returned).

```
SYST:CTYP:RMOD? (@3200)
```

Typical Response: **"Keysight Technologies,34945EXT,MY12345678,1.00"**

The following command returns the identity of Distribution Board #4 on 34945EXT remote module #2 connected to slot 3 (the quotes are also returned).

```
SYST:CTYP:RMOD? (@3200),DIST4
```

Typical Response: **"Keysight Technologies,Y1150A,0,0"**

See Also

[SYSTem:CDEscription?](#)

[SYSTem:CDEscription:RMOdule?](#)

[SYSTem:CTYPe?](#)

[*IDN?](#)

SYSTem:DATE

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

SYSTem:DATE <yyyy>,<mm>,<dd>

SYSTem:DATE?

Description

During a scan, the instrument stores all readings and alarms with the current time and date. This command sets the instrument calendar.

Parameters

Name	Type	Range of Values	Default Value
<yyyy>	Numeric	The current year	This is a required parameter
<mm>	Numeric	The current month	This is a required parameter
<dd>	Numeric	The day of the current month	This is a required parameter

Remarks

- When shipped from the factory, the instrument is set to the current time and date for Greenwich Mean Time (GMT).
- The calendar setting is stored in **non-volatile** memory, and does not change when power has been off, after a Factory Reset (***RST** command), or after an Instrument Preset (**SYSTem:PRESet** command).

Return Format

The query command returns three comma-separated values in the form "yyyy,mm,dd".

Examples

The following command sets the calendar to November 21, 2004.

```
SYST:DATE 2004,11,21
```

The following query returns the date.

```
SYST:DATE?
```

Typical Response: 2004,11,21

See Also

SYSTem:TIME

SYSTem:DElay[:IMMediate]

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

SYSTem:DElay[:IMMediate] *<time>*

Description

This command inserts a programmatic delay, during which all other operations are suspended. This command is intended for **sequence** operations, but can be used whenever a programmatic delay is needed.

Parameters

Name	Type	Range of Values	Default Value
<i><time></i>	Numeric	0 to 100 seconds, with 1 ms resolution.	This is a required parameter

Remarks

- To abort a delay operation, use the **ABORt** command or a Device Clear.

Example

The following command defines a sequence named "MYSEQ_1", which closes several channels on the module in slot 1, waits 100 ms for the relays to settle, and then opens a single channel on the module in slot 2.

```
ROUT:SEQ:DEF MYSEQ_1,"ROUT:CLOS (@1001:1009); :SYSTem:DEL 100E-3 ;:ROUT:OPEN (@2001) "
```

See Also

ABORt

ROUTe:SEquence:DEFine

ROUTe:SEquence:TRIGger:SOURce

SYSTem:ERRor?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

SYSTem:ERRor?

Description

This command reads and clears one error from the instrument's *error queue*. A record of up to 20 errors can be stored in the instrument's error queue. Each remote interface I/O session (i.e., GPIB, USB, LAN, etc.) has its own interface-specific error queue. Errors appear in the error queue of the I/O session that caused the error. For example, if an error was generated by a command sent over the GPIB interface, send this command from GPIB to read the error queue.

For a complete listing of the Keysight 34980A's error messages, see [SCPI Error Messages](#).

Remarks

- The instrument beeps once each time a command syntax or hardware error is generated. The front-panel ERROR annunciator turns on when one or more errors are currently stored in the error queue.
- A special *global* error queue holds all power-on and hardware-related errors (e.g., over-temperature, Safety Interlock, etc.).
- Errors are retrieved in first-in-first-out (FIFO) order. The first error returned is the first error that was stored. Once you have read all of the interface-specific errors, the errors in the global error queue are retrieved.
- Errors are cleared as you read them. When you have read all errors from the interface-specific and global error queues, the ERROR annunciator turns off and the errors are cleared.
- If more than 20 errors have occurred, the last error stored in the queue (the most recent error) is replaced with **-350,"Error queue overflow"**. No additional errors are stored until you remove errors from the queue. If no errors have occurred when you read the error queue, the instrument responds with **+0,"No error"**.
- The front panel reports errors from all I/O sessions as well as the global error queue. To read the error queue from the front panel, use the View key.
- Error conditions are also summarized in the Status Byte Register. For more information on the SCPI Status System for the Keysight 34980A, see [Status System Introduction](#).
- The interface-specific and global error queues are cleared by the ***CLS** (Clear Status) command and when power is cycled. The errors are also cleared when you read the error queue. The error queue is not cleared by a Factory Reset (***RST** command) or an Instrument Preset (**SYSTem:PRESet** command).

Return Format

The command reads and clears one error string from the error queue. The error string may contain up to 160 characters and consists of an error number and an error string enclosed in double quotes. For example:

-113,"Undefined header"

Example

The following query reads and clears one error.

```
SYST:ERR?
```

Typical Response: -101,"Invalid character"

See Also

***SRE**

SYSTem:LOCK:OWNer?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

SYSTem:LOCK:OWNer?

Description

This command returns the I/O interface that currently has a lock.

Remarks

- When a lock is active, Bit 10 in the Standard Operation Register will be set (see [STATus:OPERa-tion:CONDition?](#) command). When the lock is released on all I/O interfaces, this bit will be cleared.

Return Format

The command returns "GPIB", "USB", "VXI11", or "LAN<IP Address>" indicating the I/O interface which currently has a lock. If no interfaces have a lock, "NONE" is returned.

Example

The following command queries which I/O interface currently has a lock.

```
SYST:LOCK:OWN?
```

Typical Response: **LAN169.254.149.35**

See Also

[SYSTem:LOCK:RELease](#)

[SYSTem:LOCK:REQuest?](#)

SYSTem:LOCK:RELease

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

SYSTem:LOCK:RELease

Description

This command decrements the lock count by one and releases the I/O interface from which the command is executed.

Remarks

- When a lock is active, Bit 10 in the Standard Operation Register will be set (see [STATus:OPERa-tion:CONDition?](#) command). When the lock is released on all I/O interfaces, this bit will be cleared.

Example

The following command decreases the lock count by one.

```
SYST:LOCK:REL
```

See Also

[SYSTem:LOCK:OWNer?](#)

[SYSTem:LOCK:REQuest?](#)

SYSTem:LOCK:REQuest?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

SYSTem:LOCK:REQuest?

Description

This command requests a lock of the current I/O interface. This provides a mechanism by which you can lock the instrument's configuration or cooperatively share the instrument with other computers.

Remarks

- Lock requests can be nested and each request will increase the lock count by 1. For every request, you will need to do a release (see **SYSTem:LOCK:RELease** command).
- Instrument locks are handled at the I/O interface level (GPIB, USB, LAN, etc.) and you are responsible for all coordination between threads and/or programs on that interface.
- When a request is granted, only I/O sessions from the present interface will be allowed to change the state of the instrument. From the other I/O interfaces, you can query the state of the instrument but no other configuration changes or measurements are allowed.
- Locks from LAN sessions are granted by the IP address.
- Locks from LAN sessions will be automatically released when a LAN disconnect is detected.
- When a lock is granted, Bit 10 in the Standard Operation Register will be set (see **STATus:OPERa-tion:CONDition?** command). In addition, the entire instrument front panel, including the **LOCAL** key, will be locked out while a lock is in place ("KEYBOARD LOCKED" is displayed).

Return Format

The command returns "+1" if the lock request is granted or "+0" if denied.

Example

The following command requests a lock of the current I/O interface.

```
SYST:LOCK:REQ?
```

Typical Response: +1

See Also

SYSTem:LOCK:OWNer?

SYSTem:LOCK:RELease

SYSTem:MODule?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

SYSTem:MODule?

Description

This command reads and clears one event from the instrument's *Module Event queue*. A record of up to 20 events can be stored in the event queue.

NOTE

For more information on the SCPI Status System for the Keysight 34980A, see [Status System Introduction](#).

Remarks

- Module events are retrieved in first-in-first-out (FIFO) order and are cleared when you read them. The first event returned is the first event that was stored.
- Up to 20 events can be logged in the module event queue. If more than 20 events are detected, they will be lost (only the first 20 events are saved).
- Most of the plug-in modules have defined events that are logged in the event queue. For module-specific event definitions, see [Plug-In Module Event Register Information](#).
- The module event queue is cleared by the ***CLS** (Clear Status) command and when power is cycled. The events are also cleared when you read the module event queue. The module event queue is not cleared by a Factory Reset (***RST** command) or an Instrument Preset (**SYSTem:PRESet** command).

Return Format

This command returns an ASCII string enclosed in double quotes. One string is returned each time this command is executed. If no events have been detected, a null string (" ") is returned. The command reads the event data and clears one event from the queue.

For example:

```
"DisconnectBank1,3,Interlock disconnect on Bank 1,2004,11,21,15,30,23.000"
```

1

2

3

4

5

1 Event Description (Short Form)

2 Mainframe Slot Number

3 Event Description (Long Form)

4 Date (November 21, 2004)

5 Time of Day (3:30:23.000 PM)

Example

The following query reads and clears one event (the quotes are also returned).

```
SYST:MOD?
```

Typical Response: "OverVoltage,6,Over-voltage detected,2004,11,21,15,54,50.184"

See Also

STATus:MODule[:EVENT]?

SYSTem:MODule:PFail:JUMPer:AMP5?

Syntax | Description | Parameters | Remarks | Return Format | Example

Syntax

SYSTem:MODule:PFail:JUMPer:AMP5? <slot>

Description

The 34937A and 34938A General-Purpose Switch Modules implement a hardware jumper which allows you to define the power-fail state of the **5 Amp** Form A latching relays on the module (relays maintain their present state versus all relays open). This command queries the position of the power-fail jumper on the module in the specified slot.

NOTE

As shipped from the factory, the power-fail jumper is in the "MAINTAIN" position (i.e., all 5 Amp relays maintain their present state when power fails). To change the position of the jumper, you must remove the sheet metal covers from the module and move the position of the jumper mounted on the circuit board. See the Keysight 34980A *User's Guide* for more information.

Used With:

- 34937A 32-Channel General-Purpose Switch (channels 29 through 32 only)
- 34938A 20-Channel 5A Switch (all channels)

Parameters

Name	Type	Range of Values	Default Value
<slot>	Discrete	{1 2 3 4 5 6 7 8}	This is a required parameter

Remarks

- In the "MAINTAIN" position, all 5 Amp relays maintain their present state when power fails (does *not* apply to the 1 Amp relays on the 34937A module). When power is restored, all relays return to their normal power-on state. If a power-on recall of a stored instrument state is specified (see **MEMory:STATe:RECall:AUTO** command), all relays are returned to the specified state when power is restored.
- In the "OPEN" position, all 5 Amp relays are opened when power fails (does *not* apply to the 1 Amp relays on the 34937A module). When power is restored, all 5 Amp relays remain open. Even if a power-on recall of a stored instrument state is specified (see **MEMory:STATe:RECall:AUTO** command) that would normally close one or more 5 Amp relays when power is restored, the relays remain open. All of the 1 Amp relays (34937A only), however, are set to the state specified by the power-on recall operation.

- If the power-fail jumper is missing and is not installed on the circuit board, the instrument will use the default "MAINTAIN" mode.

Return Format

The command returns "MAIN" (all 5 Amp relays maintain their present state when power fails) or "OPEN" (all 5 Amp relays open when power fails). If you send this command to a module other than the 34937A or 34938A, "NONE" is returned and no error is generated.

Example

The following command queries the position of the power-fail jumper on the module in slot 3.

```
SYST:MOD:PFA:JUMP:AMP5? 3
```

Typical Response: **OPEN**

See Also

MEMory:STATe:RECall:AUTO

SYSTem:MODule:ROW:PROTection

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

SYSTem:MODule:ROW:PROTection <slot>, <mode>

SYSTem:MODule:ROW:PROTection? <slot>

or

SYSTem:MODule:ROW:PROTection DEFault, <mode>

SYSTem:MODule:ROW:PROTection? DEFault

Description

These commands set the slot row protection mode and default row protection mode for the 34934A. The row protection circuitry protects the reed relays from in-rush currents.

Used With:

- 34934A High-Density Matrix Module

Parameters

Name	Type	Range of Values	Default Value
<slot>	Discrete	{1 2 3 4 5 6 7 8}	none
or		selected mode applies to all 34934A rows in the specified slot. The mode is set upon execution of the command.	
DEFault		selected mode is the default mode set following power-on, *RST, SYSTem:PRESet, or SYSTem:CPON.	none

<mode>	Discrete	FIXed - closes the row protection relays which places 100Ω protection resistors in the signal paths of all rows. ISolated - opens the row protection relays and bypass relays of all rows. This isolates the 32-column banks from all other banks. This mode is valid for the 4x32, 8x32, and 16x32 configurations <i>only</i>. AUTO100 - closing any channel in a given 32-column bank closes the corresponding row protection relay which places a 100Ω protection resistor in the signal path. The row protection relay remains closed as long as any channel in the same 32-column bank connected to that row is closed. AUTO0 - closing any channel in a given 32-column bank closes the row protection relay, <i>momentarily</i> placing a 100Ω protection resistor in the signal path. The bypass relay is then closed and the protection relay is opened (see "Remarks" for more information on AUTO0 mode).	AUTO100

Remarks

- A row protection relay (resistor) and bypass relay are located on each row accessed by each 32-column bank within the different matrix configurations (4x32, 4x64, 4x128, 8x32, 8x64, 16x32). Depending on the row protection mode, there may be a maximum of 200Ω of resistance for a 1-wire connection between any two column banks.
- The fastest switching speeds for relays in a given signal path are achieved using the FIXed or ISolated modes, followed by the AUTO100 and AUTO0 modes. When using the AUTO100 or AUTO0 mode, specifying more than one channel rather than a single channel in the channel list will improve cumulative switching speed.
- In AUTO0 mode, the row protection relays are operated based on the channel list specified in the ROUTe:CLOSE or ROUTe:CLOSE:PAIR command. Upon receiving the command, the relay sequence is as follows:
 1. row protection relay(s) for the corresponding 32-bank(s) is/are closed
 2. column (crosspoint) relay(s) is/are closed
 3. bypass relay(s) is/are closed
 4. row protection relay(s) is/are opened

For multiple channels in the channel list, steps 1, 3, and 4 are performed for **each** channel simultaneously - thus increasing cumulative switching speed.
- Recalling (*RCL) the matrix module configuration from a saved (*SAV) state will restore the row protection mode set for that slot at the time the state was saved.

- Power-on, *RST, SYSTem:PRESet, or SYSTem:CPON restores the row protection mode last specified as the DEFault mode. Following any of these actions, if the default mode is ISOLated an error occurs on 34934A modules not configured as a 4x32, 8x32, or 16x32 in the 34980A mainframe.

Return Format

The query form of these commands return the current discrete mode settings.

Examples

This example sets the row protection mode to FIXed which closes the row protection relays of all rows in slot 1. Note that the row relays are closed upon execution of this command.

```
SYST:MOD:ROW:PROT 1, FIX
```

This example sets the row protection mode to AUTO0 for all rows in slot 1.

```
SYST:MOD:ROW:PROT 1, AUTO0
```

This example sets the default row protection mode to ISOLated. This mode is restored for all rows on all 34934A matrix modules in the 34980A at power-on or following *RST, SYSTem:PRESet, or SYSTem:CPON.

```
SYST:MOD:ROW:PROT DEF, ISO
```

These examples query the current row protection mode for the module in slot 1 and the default mode for all 34934A modules in the 34980A mainframe.

```
SYST:MOD:ROW:PROT? 1
```

Typical Response: AUTO0

```
SYST:MOD:ROW:PROT? DEF
```

Typical Response: ISO

See Also

[ROUTE:CLOSe](#)

[ROUTE:CLOSe:PAIR](#)

SYSTem:MODule:TEMPerature?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

SYSTem:MODule:TEMPerature? [<mode>], <slot>

Description

Operating the 34937A, 34938A and 34939A General-Purpose Switch Modules at their maximum rated current on all channels can cause them to overheat. A temperature transducer has been implemented on these modules to alert you to pending over-temperature conditions. This command reads the present temperature on the temperature transducer ("TRANsducer") or the factory-set temperature threshold ("TTHReshold") for the module in the specified slot.

NOTE

No relays will be automatically opened as a result of an over-temperature condition on these modules. If you are planning to use these modules at or near their operating limits, be sure to implement the necessary procedures in your programming application to address the event of an over-temperature condition.

Used With:

- 34937A 32-Channel General-Purpose Switch
- 34938A 20-Channel 5A Switch
- 34939A 64-Channel 1A Switch

Parameters

Name	Type	Range of Values	Default Value
<mode>	Discrete	{TRANsducer TTHReshold}	TRANsducer (read the present temperature on the temperature transducer)
<slot>	Discrete	{1 2 3 4 5 6 7 8}	This is a required parameter

Remarks

- This command applies only to those modules listed above. An error will be generated if you send this command to a slot that doesn't contain one of these modules.
- The factory-set temperature threshold for these modules is 70 °C (the threshold cannot be modified).

- You can configure the modules to generate a Service Request (SRQ) when an over-temperature condition exists. One over-temperature SRQ event is logged each time the temperature threshold is exceeded. See [Keysight 34937A Event Registers](#) or [Keysight 34938A Event Registers](#) for more information on configuring the Status Registers for these modules.
- The front-panel "HOT" annunciator turns on when an over-temperature condition exists on one or more modules in the mainframe. The annunciator will remain on until the module temperature drops below the threshold.

Return Format

The command returns the present temperature on the temperature transducer ("TRANsducer") or the factory-set temperature threshold ("TTHReshold") on the module in the specified slot. The value is returned in °C.

Examples

The following command reads the present temperature on the module in slot 2. The transducer temperature is returned in °C.

```
SYST:MOD:TEMP? TRAN,2
```

Typical Response: **+3.65640000E+01**

The following command reads the factory-set temperature threshold (always 70 °C) on the module in slot 2.

```
SYST:MOD:TEMP? TTHR,2
```

Typical Response: **+7.00000000E+01**

See Also

[STATus:MODule:SLOT\[n\]:ENABLE](#)

SYSTem:MODule:TERMinal:TYPE?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

SYSTem:MODule:TERMinal:TYPE? <slot>

Description

This command returns the current configuration of the 34934A High Density Matrix module.

Used With:

- 34934A High-Density Matrix Module

Parameters

Name	Type	Range of Values	Default Value
<slot>	Discrete	{1 2 3 4 5 6 7 8}	This is a required parameter

Remarks

- The configuration returned includes information on the terminal block type and whether the terminal block safety interlock is active.

Return Format

The data returned by the command is summarized in the following table.

Return String	Description
R4_C32	4x32: 4 row / 32 column configuration (4 matrices)
R4_C64	4x64: 4 row / 64 column configuration (2 matrices)
R4_C128	4x128: 4 row / 128 column configuration (1 matrix)
R8_C32	8x32: 8 row / 32 column configuration (2 matrices)
R8_C64	8:64: 8 row / 64 column configuration (1 matrix)
R16_C32	16x32: 16 row / 32 column configuration (1 matrix)
NONE	No terminal or configuration module connected; or safety interlock jumper removed

Examples

The following examples read the configuration of the 34934A modules in slots 1 and 2.

```
SYST:MOD:TERM:TYPE? 1
```


Typical Response: **R4_C64**

```
SYST:MOD:TERM:TYPE? 2
```

Typical Response: **R8_C32**

See Also

SYSTem:CTYPe?

SYSTem:MODule:WIRE:MODE

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

SYSTem:MODule:WIRE:MODE *<mode>*, *<slot>*

Description

This command configures the module in the specified slot for 2-wire (differential) or 1-wire (single ended) measurements.

NOTE

If you change the module configuration, you must cycle power on the 34980A to activate the new setting.

Used With:

- 34923A Reed Multiplexer
- 34925A FET Multiplexer
- 34933A Dual 4x8 Reed Matrix

Parameters

Name	Type	Range of Values	Default Value
<i><mode></i>	Discrete	{WIRE1 WIRE2}	This is a required parameter
<i><slot></i>	Discrete	{1 2 3 4 5 6 7 8}	This is a required parameter

Remarks

- This command applies only to those modules listed above. An error will be generated if you send this command to a slot that doesn't contain one of these modules.
- This command does not have a query form. To determine whether the module is in the 2-wire or 1-wire configuration, send the **SYSTem:CTYPE?** or **SYSTem:CDEscription?** command after cycling power to the 34980A. For example, the SYSTem:CTYPE? response for the 34923A will be either "34923A" (differential mode) or "34923A-1W" (single-ended mode).

- If you are using terminal blocks with these modules, be sure to use the corresponding 2-wire or 1-wire terminal block.

Terminal Block Option	Description
34923T – Option 001	40-Channel Reed Multiplexer (2-Wire Mode)
34923T – Option 002	80-Channel Reed Multiplexer (1-Wire Mode)
34925T – Option 001	40-Channel FET Multiplexer (2-Wire Mode)
34925T – Option 002	80-Channel FET Multiplexer (1-Wire Mode)
34933T – Option 001	Dual 4x8 Reed Matrix (2-Wire Mode)
34933T – Option 002	Quad 4x8 Reed Matrix (1-Wire Mode)

- The module configuration is stored in **non-volatile** memory on the module and does not change when you remove the module from the mainframe, after a Factory Reset (***RST** command), or after an Instrument Pre-set (**SYSTem:PRESet** command).

Example

The following command selects the 1-wire configuration on the module in slot 3. Remember, the new configuration will not take effect until you cycle power on the 34980A.

```
SYST:MOD:WIRE:MODE WIRE1,3 !Cycle mainframe power to activate new setting
```

See Also

SYSTem:CDEscription?

SYSTem:CTYPe?

SYSTem:PRESet

Syntax | Description | Parameters | Remarks | Return Format | Example

Syntax

SYSTem:PRESet

Description

This command presets the mainframe and all installed modules to a known configuration. See **Instrument Preset State** for a complete listing of the instrument's Preset configuration.

Remarks

- On the 34945A Microwave Switch/Attenuator Driver, this command resets all channels on a remote module to their default states as specified by the **ROUTe:CHANnel:DRIVE:OPEN:DEFault** command and sets all channel drives to the specified boot state (see **ROUTe:RMOdule:DRIVE:SOURce:BOOT** command). In addition, when the *RST command is executed, the 34945A automatically re-evaluates all external remote module connections to determine what is connected, what is powered, etc. No other settings are changed.
- On the 34945A Microwave Switch/Attenuator Driver, the time required to complete a preset may be significant depending on the specified pulse width (see **ROUTe:CHANnel:DRIVE:PULSe:WIDTh** command) and power supply recovery time (see **ROUTe:CHANnel:DRIVE:TIME:RECoverY** command). If both values are set to their upper limits (255 ms each) for all channels, the time required to preset (or boot) the module may exceed 30 seconds:

$$64 \text{ Channels} \times (255 \text{ ms Pulse Width} + 255 \text{ ms Recovery Time}) = \sim 33 \text{ seconds}$$

Example

The following command presets the instrument.

```
SYST:PRESet
```

See Also

***RST**

ROUTe:CHANnel:DRIVE:PULSe:WIDTh (34945A only)

ROUTe:CHANnel:DRIVE:TIME:RECoverY (34945A only)

SYSTem:CPON

SYSTem:RMOdule:RESet

Syntax | **Description** | **Parameters** | **Remarks** | **Return Format** | **Example**

Syntax

SYSTem:RMOdule:RESet <slot>

Description

This command resets all 34945EXT remote modules connected to the 34945A Microwave Switch/Attenuator Driver in the specified slot. This command provides the only way to reset all 34945EXT remote modules in a given slot to a factory default state. The following table shows the reset state.

Attribute	Reset State
At the 34945EXT Level:	
ROUTe:RMOdule:DRIVe:SOURce[:IMMediate]	OFF
ROUTe:RMOdule:DRIVe:SOURce:BOOT	OFF
ROUTe:RMOdule:DRIVe:LIMit	1
At the Bank Level:	
ROUTe:RMOdule:BANK:DRIVe[:MODE]	OCOLlector
ROUTe:RMOdule:BANK:LED:DRIVe[:ENABle]	ON
ROUTe:RMOdule:BANK:LED:DRIVe:LEVel	5 mA
All Channels:	
ROUTe:CHANnel:DRIVe:PAIRed[:MODE]	OFF
ROUTe:CHANnel:DRIVe:PULSe[:MODE]	ON
ROUTe:CHANnel:DRIVe:PULSe:WIDTh	15 ms
ROUTe:CHANnel:DRIVe:TIME:RECOvery	0.0 seconds
ROUTe:CHANnel:DRIVe:TIME:SETTle	0.0 seconds
ROUTe:CHANnel:DRIVe:OPEN:DEFault	OPEN selected
ROUTe:CHANnel:VERify[:ENABle]	OFF
ROUTe:CHANnel:VERify:POLarity	NORMal

Used With:

- 34945A Microwave Switch/Attenuator Driver

Parameters

Name	Type	Range of Values	Default Value

<slot>	Discrete	{1 2 3 4 5 6 7 8}	This is a required parameter

Remarks

- Since this command disables both the channel drive source and channel drive boot state, the channels will remain inoperable until you re-enable the channel drive source using the **ROUTe:RMOdule:DRIVE:SOURce[:IMMediate]** command (select the INTERNAL or EXTERNAL source).
- With the SYSTem:RMOdule:RESet command, the bank-level attributes are reset without regard to which distribution boards are installed. To reset the bank-level attributes on a specific 34945EXT remote module, see the **ROUTe:RMOdule:BANK:PRESet** command; with this command, the bank-level attributes vary according to which distribution boards are installed.
- The ***RST** and **SYSTem:PRESet** commands reset all channels on a remote module to their default states as specified by the **ROUTe:CHANnel:DRIVE:OPEN:DEFault** command and set all channel drives to the specified boot state (see **ROUTe:RMOdule:DRIVE:SOURce:BOOT** command). In addition, when the ***RST** and SYSTem:PRESet commands are executed, the 34945A automatically re-evaluates all external remote module connections to determine what is connected, what is powered, etc. No other settings are changed.
- The **SYSTem:CPON** command has nearly the same effect as the ***RST** and **SYSTem:PRESet** commands (see above). However, when the SYSTem:CPON command is executed, the 34945A does *not* re-evaluate the external remote module connections.
- The SYSTem:RMOdule:RESet command does *not* clear the relay cycle count on the specified slot (see **DIAGnostic:RELAy:CYCLes?** command).

Example

The following command resets all 34945EXT remote modules connected to slot 3 to their factory default state. The bank-level attributes are reset without regard to which distribution boards are installed.

```
SYST:RMOD:RESET 3
```

See Also

***RST**

DIAGnostic:RELAy:CYCLes?

ROUTe:RMOdule:BANK:PRESet

SYSTem:CPON

SYSTem:PRESet

SYSTem:RMOdule:STATus?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

SYSTem:RMOdule:STATus? <slot>

Description

This command returns the hardware state of the 34945EXT remote modules connected to the 34945A Microwave Switch/Attenuator Driver in the specified slot. Two decimal values are returned indicating which 34945EXT remote modules are properly booted, currently present, and under 34980A control.

Used With:

- 34945A Microwave Switch/Attenuator Driver

Parameters

Name	Type	Range of Values	Default Value
<slot>	Discrete	{1 2 3 4 5 6 7 8}	This is a required parameter

Remarks

- A 34945EXT Master module always boots as long as it is properly connected to the 34945A and the 349480A mainframe is running (the master is powered internally by the mainframe). In order for a 34945EXT Slave module to properly boot, it must be properly connected (to the master module or another slave module) and external power must be applied.
- Any 34945EXT Slave modules that are attached will be reported in the hardware configuration, even if they are not powered.
- If the values returned do not accurately reflect the expected state of the hardware, send a Factory Reset (*RST command) or Card Reset (SYSTem:CPON command) to refresh the configuration.
- A response of "0,0" indicates that the 34945A is installed but no 34945EXT remote module (master) is attached or has failed to properly boot.
- You can also use this command in conjunction with 34945A's status event register, which detects configuration changes on the 34945EXT remote modules. For more information, see [Keysight 34945A Event Registers](#).

Return Format

The command returns two comma-separated decimal values representing the state of two registers on the 34945A. The first register, the *Booted Register*, indicates which 34945EXT remote modules are in active operation (i.e., the module is both present and properly booted). The second register, the *Attached Register*, indicates which 34945EXT remote modules are present but they may or may not be properly booted.

The command returns the state of each register in the following format:

<*Booted Register*>,<*Attached Register*>

Each value corresponds to the binary-weighted sum of all bits set in the corresponding register. For example, if bit 0 (decimal value = 1) and bit 3 (decimal value = 8) are set, "9" would be returned for that register. The following tables list the bit definitions for each register.

34945A Booted Register: Indicates which 34945EXT remote modules are in active operation (i.e., the module is both present and properly booted).

Bit	Decimal Value	Definition
0	1	34945EXT Remote Module #1 (Master) is booted
1	2	34945EXT Remote Module #2 is booted
2	4	34945EXT Remote Module #3 is booted
3	8	34945EXT Remote Module #4 is booted
4	16	34945EXT Remote Module #5 is booted
5	32	34945EXT Remote Module #6 is booted
6	64	34945EXT Remote Module #7 is booted
7	128	34945EXT Remote Module #8 is booted

34945A Attached Register: Indicates which 34945EXT remote modules are present but they may or may not be properly booted.

Bit	Decimal Value	Definition
0	1	34945EXT Remote Module #1 (Master) is attached
1	2	34945EXT Remote Module #2 is attached
2	4	34945EXT Remote Module #3 is attached
3	8	34945EXT Remote Module #4 is attached
4	16	34945EXT Remote Module #5 is attached
5	32	34945EXT Remote Module #6 is attached
6	64	34945EXT Remote Module #7 is attached
7	128	34945EXT Remote Module #8 is attached

Example

The following command returns the state of the 34945EXT remote modules connected to slot 3.

```
SYST:RMOD:STAT? 3
```

Typical Response: **5,7**

The values returned indicate the following state:

5 (Booted Register):	Remote modules #1 and #3 are booted
7 (Attached Register):	Remote Modules #1, #2, and #3 are attached

See Also

STATus:MODule:SLOT[n]:CONDition?

STATus:MODule:SLOT[n]:ENABLe

SYSTem:SECurity:IMMediate

Syntax | Description | Parameters | Remarks | Return Format | Example

Syntax

SYSTem:SECurity:IMMediate

Description

This command clears all instrument memory (except calibration parameters, I/O hardware addresses, and boot parameters) and then cycles power to the instrument. This command is typically used to clear all memory before removing the instrument from a secured area.

CAUTION

This command is *not* recommended for use in routine applications because of the possibility of unintended loss of data.

Remarks

- This command initializes all instrument and module settings to their Factory Reset (***RST** command) values.
- This command deletes all user-defined state information, channel labels, and I/O settings such as the GPIB and LAN address information.
- The only non-volatile settings that are *not* deleted are the calibration parameters (calibration string, secure code, etc.), I/O hardware address information (Ethernet MAC address and instrument serial number), and the instrument's boot parameters.

Example

The following command clears all instrument memory.

```
SYST:SEC:IMM
```

SYSTem:TIME

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

SYSTem:TIME <hh>,<mm>,<ss.sss>

SYSTem:TIME?

Description

During a scan, the instrument stores all readings and alarms with the current time and date. This command sets the instrument clock (based on a 24-hour clock).

Parameters

Name	Type	Range of Values	Default Value
<hh>	Numeric	The hour in 24-hour clock format	This is a required parameter
<mm>	Numeric	The minutes	This is a required parameter
<ss.sss>	Numeric	The seconds, with 1 ms resolution	This is a required parameter

Remarks

- When shipped from the factory, the instrument is set to the current time and date for Greenwich Mean Time (GMT).
- The clock setting is stored in **non-volatile** memory, and does not change when power has been off, after a Factory Reset (***RST** command), or after an Instrument Preset (**SYSTem:PRESet** command).

Return Format

The query command returns three comma-separated values in the form "hh,mm,sss.ss".

Examples

The following command sets the clock to 3:30:23.000 PM.

```
SYST:TIME 15,30,23.000
```

The following query returns the current time.

```
SYST:TIME?
```

Typical Response: 15,30,23.000

See Also

SYSTem:DATE

SYSTem:TIME:SCAN?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

SYSTem:TIME:SCAN?

Description

This command returns the time at the start of the scan.

Used With:

- 34921A through 34925A Multiplexer Modules
- 34950A Digital I/O Module (digital input and counter channels only)
- 34952A Multifunction Module (digital input and totalizer channels only)

Remarks

- You can read the time at any time, even during a scan.
- This command is not affected by the **FORMat:READIng:TIME:TYPE** command which selects the time format for storing scanned data in memory (absolute time versus relative time).
- This command is not affected by the **CALCulate:AVERage:CLEar** command which clears all values from the statistics registers.
- The instrument clears all stored data on all channels when a new scan is started, after a Factory Reset (***RST** command), or after an Instrument Preset (**SYSTem:PRESet** command).

Return Format

The command returns a string indicating the time and date at the start of the most recent scan.

The string returned has the form **yyyy,mm,dd,hh,mm,ss.sss**:

yyyy	is the year
mm	is the month
dd	is the day of the month
hh	is the hour in 24-hour format
mm	is the minutes
ss.sss	is the seconds (with 1 ms resolution)

For example:

2004,11,21,10,07,11.364
November 21, 2004 10:07:11.364 AM

Example

The following query returns the time and date at the start of the most recent scan.

```
SYST:TIME:SCAN?
```

Typical Response: 2004,11,21,10,03,10.314

See Also

[SYSTem:DATE](#)

[SYSTem:TIME](#)

SYSTem:VERSion?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

SYSTem:VERSion?

Description

This command returns the version of the SCPI (Standard Commands for Programmable Instruments) standard with which the instrument is in compliance. The instrument complies with the rules and conventions of the indicated version of the SCPI standard.

NOTE

You cannot query the SCPI version from the front panel.

Return Format

The command returns a string in the form "YYYY.V", where "YYYY" represents the year of the version and "V" represents a version for that year (e.g., 1994.0).

Example

The following query returns the SCPI version.

```
SYST:VERS?
```

Typical Response: **1994.0**

TRACe Subsystem Introduction

Command Summary

NOTE

Hold the mouse cursor over a command to view the full syntax statement.

TRACe:CATalog?

TRACe[:DATA]

TRACe[:DATA]:DAC

TRACe[:DATA]:DIGital[:<width>]

TRACe[:DATA]:DIGital:FUNCTion

TRACe[:DATA]:FUNCTion

TRACe:DELeTe:ALL

TRACe:DELeTe[:NAME]

TRACe:FREE?

TRACe:POINts?

TRACe:CATalog?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

TRACe:CATalog? {(@<channel>)|<slot>}

Description

This command returns a list of trace names currently downloaded to **volatile** memory.

Used With:

- 34950A Digital I/O Module (digital output channels only)
- 34951A Isolated DAC Module

Parameters

Name	Type	Range of Values	Default Value
<channel> 34950A Only	Numeric	One channel in the form (@sccc). Select from s101 through s104, s201 through s204.	This is a required parameter
<slot> 34951A Only	Discrete	{1 2 3 4 5 6 7 8}	This is a required parameter

Remarks

- Use the **TRACe:DELeTe[:NAME]** command to delete traces from memory.
- Use the **TRACe:POINts?** command to determine the number of points used by a specific trace name.
- Each bank on the 34950A has its own memory (64K bytes each) for use in buffered output transfers. You can download up to 32 traces into each bank.
- You can store up to 512,000 trace points per 34951A module.
- For the 34950A, if you change the width of a bank (see **CONFigure:DIGital:WIDTh** command), all traces in memory are cleared.
- A Factory Reset (***RST** command), Instrument Preset (**SYSTem:PRESet** command), and Card Reset (**SYSTem:CPON** command) deletes the trace from memory and removes all trace name associations. In addition, storing the instrument state (***SAV** command) will delete the trace from memory and remove all trace name associations.

Return Format

This command reads the trace names currently assigned and returns a comma-separated list. If the specified slot has no trace names assigned, a null string (" ") is returned

Examples

The following command returns a list of trace names downloaded to channel 101 on the **34950A** in slot 3.

```
TRAC:CAT? (@3101)
```

Typical Response: **PATTERN_1,DOUT1**

The following command returns a list of trace names downloaded to the **34951A** in slot 4 (the quotes are also returned).

```
TRAC:CAT? 4
```

Typical Response: **"SIN","SQU","TEST_WFORM"**

See Also

[\[SENSe:\]DIGital:MEMory:ENABLE](#)

[TRACe:POINts?](#)

[TRACe:DELeTe\[:NAME\]](#)

TRACe[:DATA]

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

```
TRACe[:DATA] <slot>, <name>, {<binary_block>|<value>, <value> [,<value>, ...]}
```

Description

This command downloads 32-bit *floating-point* values between -1 and +1 into **volatile** memory on the 34951A Isolated DAC Module in the specified slot. You can download between 2 and 512,000 points as IEEE-488.2 Binary Block data or as a comma-separated list of real numbers. Once you have downloaded the points to memory, you can adjust the amplitude and offset of the output to the desired levels.

NOTE

Downloading floating-point values using TRACe[:DATA] is generally slower than downloading signed integer values (see **TRACe[:DATA]:DAC** command); however, floating-point values are more convenient, for example, when using trigonometric functions which return values between -1 and +1.

Parameters

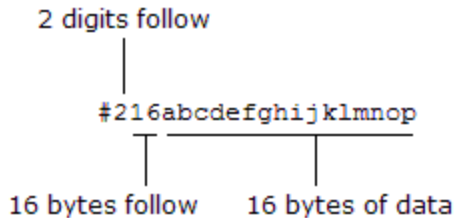
Name	Type	Range of Values	Default Value
<slot>	Discrete	{1 2 3 4 5 6 7 8}	This is a required parameter
<name>	ASCII String	A trace name consisting of up to 12 characters. The first character must be a letter (A-Z), but the remaining 11 characters can be letters, numbers (0-9), or an underscore (_). Blank spaces are not allowed.	This is a required parameter
<binary_block>	Numeric	Peak-to-peak trace values between -1 and +1 represented as floating-point numbers in IEEE-488.2 Binary Block format.	This is a required parameter
<value>	Numeric	Peak-to-peak trace values between -1 and +1 represented as a comma-separated list of real numbers.	This is a required parameter

Remarks

- The specified trace values correspond to the peak values of the trace output mode (see **SOURCE:MODE** command). For example, "-1.0" corresponds to -1 Vdc in the VOLTage mode or -1 mA in the CURRent mode.
- You can download between 2 and 512,000 trace points per 34951A module (each trace point requires 4 bytes of volatile memory).

- You can store up to 32 traces in volatile memory on the 34951A module. Use the **TRACe:DELeTe[:NAME]** command to delete traces from memory.
- For binary downloads, the syntax is a pound sign (#) followed by a non-zero digit representing the number of digits in the decimal integer to follow. This digit is followed by a decimal integer indicating the number of 8-bit data bytes to follow. This is followed by a block of data containing the specified number of bytes.

For example:



- For binary downloads, you can specify the byte order (NORMal or SWAPped) using the **FORMat:BORDeR** command.
- After downloading the trace values to memory, use the **SOURce:FUNCTion:TRACe[:NAME]** command to select the active trace, the **SOURce:FUNCTion:ENABle** command to enable the trace mode, and then the **OUTPut:STATe ON** command to output the trace from the specified channels.
- To set the *gain* of the trace output, use the **SOURce:FUNCTion:VOLTage:GAIN** and **SOURce:FUNCTion:CURREnt:GAIN** commands.
- To set the *offset* of the trace output, use the **SOURce:FUNCTion:VOLTage:OFFSet** and **SOURce:FUNCTion:CURREnt:OFFSet** commands.
- All trace data is stored in volatile memory and is therefore lost when power is turned off. In addition, trace data is *not* stored as part of the instrument state (see ***SAV** command) and you must download the trace points to memory again after recalling a stored state.

Examples

The following program segment downloads seven trace points to memory on the module in slot 4. The trace name is "NEG_RAMP".

```
TRAC 4,NEG_RAMP, 1, .67, .33, 0, -.33, -.67, -1
SOUR:FUNC:TRAC NEG_RAMP, (@4001,4002) !Assign trace to channels 1 and 2
OUTP:STAT ON, (@4001,4002) !Enable outputs from channels 1 and 2
SOUR:FUNC:ENAB ON, (@4001,4002) !Enable trace mode on channels 1 and 2
```

The following command downloads four points to memory on the module in slot 3 (each trace point requires 4 bytes of volatile memory). The trace name is "TEST_WFORM".

```
TRAC 3,TEST_WFORM, #216 <binary data>
```

See Also

FORMat:BORDER

SOURce:FUNCtion:ENABle

SOURce:FUNCtion:TRACe[:NAME]

SOURce:MODE

TRACe[:DATA]:DAC

TRACe:DELeTe[:NAME]

TRACe:FREE?

TRACe[:DATA]:DAC

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

TRACe[:DATA]:DAC <slot>, <name>, {<binary_block>|<value>, <value> [,<value>, . . .]}

Description

This command downloads 16-bit signed *integer* values between -32768 and +32767 into **volatile** memory on the 34951A Isolated DAC Module in the specified slot. You can download between 2 and 512,000 points as IEEE-488.2 Binary Block data or as a comma-separated list of real numbers. Once you have downloaded the points to memory, you can adjust the amplitude and offset of the output to the desired levels.

NOTE

Downloading signed integer values using TRACe[:DATA]:DAC is generally faster than downloading floating-point values (see [TRACe\[:DATA\]](#) command); however, floating-point values are more convenient, for example, when using trigonometric functions which return values between -1 and +1.

Parameters

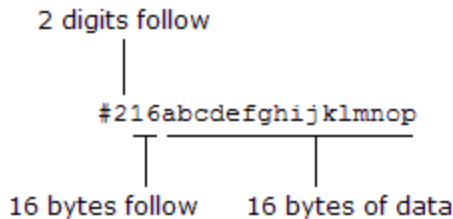
Name	Type	Range of Values	Default Value
<slot>	Discrete	{1 2 3 4 5 6 7 8}	This is a required parameter
<name>	ASCII String	A trace name consisting of up to 12 characters. The first character must be a letter (A-Z), but the remaining 11 characters can be letters, numbers (0-9), or an underscore (_). Blank spaces are not allowed.	This is a required parameter
<binary_block>	Numeric	Peak-to-peak trace values between -32768 and +32767 represented as integers in IEEE-488.2 Binary Block format.	This is a required parameter
<value>	Numeric	Peak-to-peak trace values between -32768 and +32767 represented as a comma-separated list of real numbers.	This is a required parameter

Remarks

- The specified trace values correspond to the peak values of the trace output mode (see [SOURCE:MODE](#) command). For example, "-32768" corresponds to -1 Vdc in the VOLTage mode or -1 mA in the CURRent mode.

- You can download between 2 and 512,000 trace points per 34951A module (each trace point requires 4 bytes of volatile memory).
- You can store up to 32 traces in volatile memory on the 34951A module. Use the **TRACe:DELeTe[:NAME]** command to delete traces from memory.
- For binary downloads, the syntax is a pound sign (#) followed by a non-zero digit representing the number of digits in the decimal integer to follow. This digit is followed by a decimal integer indicating the number of 8-bit data bytes to follow. This is followed by a block of data containing the specified number of bytes.

For example:



- For binary downloads, you can specify the byte order (NORMal or SWAPped) using the **FORMat:BORDer** command.
- After downloading the trace values to memory, use the **SOURce:FUNCtion:TRACe[:NAME]** command to select the active trace, the **SOURce:FUNCtion:ENABle** command to enable the trace mode, and then the **OUTPut:STATe ON** command to output the trace from the specified channels.
- To set the *gain* of the trace output, use the **SOURce:FUNCtion:VOLTage:GAIN** and **SOURce:FUNCtion:CURREnt:GAIN** commands.
- To set the *offset* of the trace output, use the **SOURce:FUNCtion:VOLTage:OFFSet** and **SOURce:FUNCtion:CURREnt:OFFSet** commands.
- All trace data is stored in volatile memory and is therefore lost when power is turned off. In addition, trace data is *not* stored as part of the instrument state (see ***SAV** command) and you must download the trace points to memory again after recalling a stored state.

Examples

The following program segment downloads five trace points to memory on the module in slot 4. The trace name is "NEG_RAMP".

```
TRAC:DAC 4,NEG_RAMP, 32767, 16384, 0, -16384, -32768
SOUR:FUNC:TRAC NEG_RAMP, (@4001,4002) !Assign trace to channels 1 and 2
OUTP:STAT ON, (@4001,4002) !Enable outputs from channels 1 and 2
SOUR:FUNC:ENAB ON, (@4001,4002) !Enable trace mode on channels 1 and 2
```

The following command downloads four points to memory on the module in slot 3 (each trace point requires 2 bytes of volatile memory). The trace name is "TEST_WFORM".

```
TRAC:DAC 3,TEST_WFORM, #18 <binary data>
```

See Also

FORMat:BORDER

SOURce:FUNCtion:TRACe[:NAME]

SOURce:FUNCtion:ENABLE

SOURce:MODE

TRACe[:DATA]

TRACe:DELeTe[:NAME]

TRACe:FREE?

TRACe[:DATA]:DIGital[:<width>]

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

TRACe[:DATA]:DIGital[:<width>] (@<channel>), <name>, {<binary_block>|<value>, <value> [,<value>, ...]}

Description

This command downloads *integer* values into **volatile** memory on the specified channel on the 34950A Digital I/O Module. You can download values as IEEE-488.2 Binary Block data or as a comma-separated list of integers.

Parameters

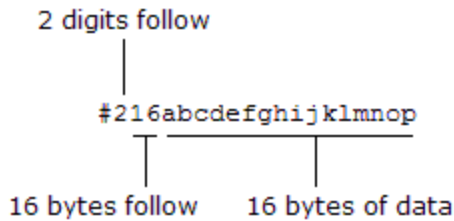
Name	Type	Range of Values	Default Value
<width>	Discrete	{BYTE 1 WORD 2 LWORD 4} BYTE (or "1" byte): 8 bits WORD (or "2" bytes): 16 bits LWORD (or "4" bytes): 32 bits	BYTE (8 bits)
<channel>	Numeric	One channel in the form (@sccc). Select from s101 or s201.	This is a required parameter
<name>	ASCII String	A trace name consisting of up to 12 characters. The first character must be a letter (A-Z), but the remaining 11 characters can be letters, numbers (0-9), or an underscore (_). Blank spaces are not allowed.	This is a required parameter
<binary_block>	Numeric	Integer values in IEEE-488.2 Binary Block format, appropriate for the specified <width>: BYTE: 8-bit integers in block format WORD: 16-bit integers in block format LWORD: 32-bit integers in block format	This is a required parameter
<value>	Numeric	Comma-separated list of integer values.	This is a required parameter

Remarks

- Each bank has its own memory (64K bytes each) for use in buffered output transfers. You can download up to 32 traces into each bank. Use the **TRACe:DELeTe[:NAME]** command to delete traces from memory.

- For binary downloads, the syntax is a pound sign (#) followed by a non-zero digit representing the number of digits in the decimal integer to follow. This digit is followed by a decimal integer indicating the number of 8-bit data bytes to follow. This is followed by a block of data containing the specified number of bytes.

For example:



- For binary downloads, you can specify the byte order (NORMAL or SWAPped) using the **FORMat:BOReR** command.
- Downloading a trace to the module while memory is enabled is *not* allowed (see **SOURce:DIGit-al:MEMory:ENABle** command).
- After downloading the trace to memory, use the **SOURce:DIGital:MEMory:TRACe** command to select the active trace and the **SOURce:DIGital:MEMory:ENABle** command to enable the trace mode.
- If a trace is not currently assigned to the specified bank, the downloaded trace will become the assigned trace.
- A Factory Reset (***RST** command), Instrument Preset (**SYSTem:PRESet** command), and Card Reset (**SYSTem:CPON** command) deletes the trace from memory and removes all trace name associations. In addition, storing the instrument state (***SAV** command) will delete the trace from memory and remove all trace name associations.

Examples

The following program segment downloads a 4-point trace pattern to channel 101 on the module in slot 3. The cycle count is set to output the complete trace three times. Once memory is enabled, a software trigger is used to trigger the memory output. The trace name is "DOUT1".

```
SOUR:DIG:DATA:WORD #HFFFF, (@3101)  !Set initial output pattern
SOUR:DIG:MEM:NCYC 3, (@3101)  !Output complete trace 3 times
TRAC:DIG:WORD (@3101), DOUT1, 255, 200, 128, 0  !Download trace points
SOUR:DIG:MEM:TRAC DOUT1, (@3101)  !Assign trace to channel 101
SOUR:DIG:MEM:ENAB ON, (@3101)  !Enable trace mode on channel 101
SOUR:DIG:MEM:START (@3101)  !Trigger memory output
```

The following command downloads binary data to channel 201 on the module in slot 3. The trace name is "MY_TRACE".

```
TRAC:DIG:WORD (@3201), MY_TRACE, #216 <binary data>
```

See Also

FORMat:BORDER

SOURce:DIGital:MEMory:CYCLes

SOURce:DIGital:MEMory:ENABle

SOURce:DIGital:MEMory:TRACe

TRACe:DELeTe[:NAME]

TRACe[:DATA]:DIGital:FUNCTion

TRACe:FREE?

TRACe[:DATA]:DIGital:FUNction

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Example](#)

Syntax

TRACe[:DATA]:DIGital:FUNction (@<channel>), <type>, <name>, <points>

Description

This command generates and downloads one of two built-in traces to the specified bank on the 34950A Digital I/O Module. Choose from a "count up" pattern (0, 1, 2, 3, ...) or a "walking ones" pattern (00000001, 00000010, 00000100, ...).

NOTE

You can generate a "count down" or "walking zero" pattern by inverting the data line polarity (see [CONFigure:DIGital:POLarity](#) command).

Parameters

Name	Type	Range of Values	Default Value
<channel>	Numeric	One channel in the form (@sccc). Select from s101 or s201.	This is a required parameter
<type>	Discrete	{COUNT WONes}	This is a required parameter
<name>	ASCII String	A trace name consisting of up to 12 characters. The first character must be a letter (A-Z), but the remaining 11 characters can be letters, numbers (0-9), or an underscore (_). Blank spaces are not allowed. The name must be unique to the specified channel (bank).	This is a required parameter
<points>	Numeric	The length of the trace in number of samples, and must fit in the available space.	1,000 sample points

Remarks

- Each bank has its own memory (64K bytes each) for use in buffered output transfers. You can download up to 32 traces into each bank. Use the [TRACe:DELeTe\[:NAME\]](#) command to delete traces from memory.
- The direction and width of memory operations are determined by the first channel on the bank.
- If the specified number of samples is greater than the amount of available memory on the module, an error will be generated.

- If you change the width of a bank (see **CONFigure:DIGital:WIDTh** command), all traces in memory are cleared.
- Downloading a trace to the module while memory is enabled is *not* allowed (see **SOURce:DIGital:MEMory:ENABle** command).
- After downloading the trace to memory, use the **SOURce:DIGital:MEMory:TRACe** command to select the active trace and the **SOURce:DIGital:MEMory:ENABle** command to enable the trace mode.
- If a trace is not currently assigned to the specified bank, the downloaded trace will become the assigned trace.
- A Factory Reset (***RST** command), Instrument Preset (**SYSTem:PRESet** command), and Card Reset (**SYSTem:CPON** command) deletes the trace from memory and removes all trace name associations. In addition, storing the instrument state (***SAV** command) will delete the trace from memory and remove all trace name associations.

Example

The following program segment downloads and outputs a "walking ones" pattern from channel 101 on the module in slot 3. The length of the trace is set to 32 samples. In addition, the cycle count is set to output the complete trace three times. Once memory is enabled, a software trigger is used to trigger the memory output.

```
SOUR:DIG:DATA:WORD #HFFF, (@3101) !Set initial output pattern
SOUR:DIG:MEM:NCYC 3, (@3101) !Output complete trace 3 times
TRAC:DIG:FUNC (@3101),WONES,PATTERN_1,32 !Download "walking ones" pattern
SOUR:DIG:MEM:TRAC PATTERN_1, (@3101) !Assign trace to channel 101
SOUR:DIG:MEM:ENAB ON, (@3101) !Enable memory on channel 101
SOUR:DIG:MEM:START (@3101) !Trigger memory output
```

See Also

SOURce:DIGital:MEMory:CYCLes

SOURce:DIGital:MEMory:ENABle

SOURce:DIGital:MEMory:TRACe

TRACe:CATalog?

TRACe[:DATA]:DIGital[:<width>]

TRACe:DELeTe[:NAME]

TRACe[:DATA]:FUNction

Syntax | Description | Parameters | Remarks | Return Format | Example

Syntax

TRACe[:DATA]:FUNction <slot>, <type>, <name>, <points>

Description

This command generates trace data based on several built-in standard waveforms on the 34951A Isolated DAC Module in the specified slot. The data generated is between -1 and +1 and you can download between 8 and 512,000 points. All of the built-in waveforms are 1 cycle in length.

NOTE

When using traces with a large number of points, it will take an appreciable amount of time to download the points to the module (the download rate is approximately 10,000 points per second). Therefore, when downloading large traces, you may want to increase the timeout value of your programming application and use the ***OPC?** command to indicate the completion of the download.

Parameters

Name	Type	Range of Values	Default Value
<slot>	Discrete	{1 2 3 4 5 6 7 8}	This is a required parameter
<type>	Discrete	{RAMP SINusoid SQUare TRIangle}	This is a required parameter
<name>	ASCII String	A trace name consisting of up to 12 characters. The first character must be a letter (A-Z), but the remaining 11 characters can be letters, numbers (0-9), or an underscore (_). Blank spaces are not allowed.	This is a required parameter
<points>	Numeric	The length of the trace between 8 and 512,000 points.	This is a required parameter

Remarks

- The trace values generated by this command correspond to the peak values of the trace output mode (see **SOURce:MODE** command). For example, "-1.0" corresponds to -1 Vdc in the VOLTage mode or -1 mA in the CURRent mode.
- You can store up to 32 traces in volatile memory on the 34951A module. Use the **TRACe:DELeTe[:NAME]** command to delete traces from memory.

- If the specified number of points is greater than the amount of available memory on the module, an error will be generated.
- After downloading the trace values to memory, use the **SOURce:FUNCTION:TRACe[:NAME]** command to select the active trace, the **SOURce:FUNCTION:ENABLE** command to enable the trace mode, and then the **OUTPut:STATe ON** command to output the trace from the specified channels.
- To set the *gain* of the trace output, use the **SOURce:FUNCTION:VOLTage:GAIN** and **SOURce:FUNCTION:CURRENT:GAIN** commands.
- To set the *offset* of the trace output, use the **SOURce:FUNCTION:VOLTage:OFFSet** and **SOURce:FUNCTION:CURRENT:OFFSet** commands.

Example

The following program segment downloads a 1000-point sine waveform to memory on the module in slot 4 and outputs the waveform from DAC channel 1. The trace name is "TEST_SINE".

```
TRAC:FUNC 4,SIN, TEST_SINE, 1000 !Download 1000-point sine to memory
SOUR:FUNC:TRAC TEST_SINE, (@4001) !Assign trace to channel 1
OUTP:STAT ON, (@4001) !Enable outputs from channel 1
SOUR:FUNC:ENAB ON, (@4001) !Enable trace mode on channel 1
```

See Also

OUTPut:STATe ON

SOURce:FUNCTION:ENABLE

SOURce:FUNCTION:TRACe[:NAME]

SOURce:FUNCTION:CURRENT:GAIN

SOURce:FUNCTION:CURRENT:OFFSet

SOURce:FUNCTION:VOLTage:GAIN

SOURce:FUNCTION:VOLTage:OFFSet

TRACe:CATalog?

TRACe:DELeTe[:NAME]

TRACe:DELeTe:ALL

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

TRACe:DELeTe:ALL {(@<channel>)|<slot>}

Description

This command deletes all trace waveform from **volatile** memory. Deleting a trace also frees up space in memory previously allocated for the trace waveform.

Used With:

- 34950A Digital I/O Module (digital output channels only)
- 34951A Isolated DAC Module

Parameters

Name	Type	Range of Values	Default Value
<channel> 34950A Only	Numeric	One channel in the form (@sccc). Select from s101 through s104, s201 through s204.	This is a required parameter
<slot> 34951A Only	Discrete	{1 2 3 4 5 6 7 8}	This is a required parameter

Remarks

- Any channels that were associated with the deleted trace name will lose that association.
- As traces are deleted, there may be non-contiguous blocks of memory. Use the **TRACe:FREE?** command to determine the largest contiguous block of memory available.
- For the 34950A, if you change the width of a bank (see **CONFigure:DIGital:WIDTh** command), all traces in memory are cleared.
- For the 34950A, this command does not delete the built-in trace patterns (count-up pattern or "walking ones" pattern).
- For the 34950A, you cannot delete a trace while buffered memory is enabled. If necessary, use the **[SENSe:]DIGital:MEMory:ENABle** command to disable memory and then delete the trace.
- For the 34951A, this command does not delete any of the built-in trace waveforms (Sine, Square, Ramp, etc).

- For the 34951A, you cannot delete a trace that is currently being output on the specified slot. If you attempt to delete an active trace, an error will be generated. If necessary, use the **SOURce:FUNCTION:ENABLE** command to turn off the trace so it can be deleted.
- To delete a specific trace name, use the **TRACe:DELeTe[:NAME]** command.
- A Factory Reset (***RST** command), Instrument Preset (**SYSTem:PRESet** command), and Card Reset (**SYSTem:CPON** command) deletes the trace waveform from memory and removes all trace name associations. In addition, storing the instrument state (***SAV** command) will delete the trace waveform from memory and remove all trace name associations.

Examples

The following command deletes all traces stored on channel 101 the **34950A** in slot 3.

```
TRAC:DEL:ALL (@3101)
```

The following command deletes all traces stored on the **34951A** in slot 4.

```
TRAC:DEL:ALL 4
```

See Also

[SENSe:]DIGital:MEMory:ENABle

SOURce:FUNCTION:ENABle

TRACe:DELeTe[:NAME]

TRACe:FREE?

TRACe:DELeTe[:NAME]

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

TRACe:DELeTe[:NAME] {(@<channel>)|<slot>}, <name>

Description

This command deletes a trace from **volatile** memory. Deleting a trace also frees up space in memory previously allocated for the trace.

Used With:

- 34950A Digital I/O Module (digital output channels only)
- 34951A Isolated DAC Module

Parameters

Name	Type	Range of Values	Default Value
<channel> 34950A Only	Numeric	One channel in the form (@sccc). Select from s101 through s104, s201 through s204.	This is a required parameter
<slot> 34951A Only	Discrete	{1 2 3 4 5 6 7 8}	This is a required parameter
<name>	ASCII String	A previously-defined trace name consisting of up to 12 characters.	This is a required parameter

Remarks

- If the specified trace name is not currently stored in memory, an error is generated.
- Any channels that were associated with the deleted trace name will lose that association.
- As traces are deleted, there may be non-contiguous blocks of memory. Use the **TRACe:FREE?** command to determine the largest contiguous block of memory available.
- For the 34950A, if you change the width of a bank (see **CONFigure:DIGital:WIDTh** command), all traces in memory are cleared.
- For the 34950A, this command does not delete the built-in trace patterns (count-up pattern or "walking ones" pattern).

- For the 34950A, you cannot delete a trace while buffered memory is enabled. If necessary, use the **[SENSe:]DIGital:MEMory:ENABle** command to disable memory and then delete the trace.
- For the 34951A, this command does not delete any of the built-in trace waveforms (Sine, Square, Ramp, etc).
- For the 34951A, you cannot delete a trace that is currently being output on the specified slot. If you attempt to delete an active trace, an error will be generated. If necessary, use the **SOURce:FUNCTion:ENABle** command to turn off the trace so it can be deleted.
- To delete *all* traces from the specified slot, use the **TRACe:DELeTe:ALL** command.
- A Factory Reset (***RST** command), Instrument Preset (**SYSTem:PRESet** command), and Card Reset (**SYSTem:CPON** command) deletes the trace waveform from memory and removes all trace name associations. In addition, storing the instrument state (***SAV** command) will delete the trace waveform from memory and remove all trace name associations.

Examples

The following command deletes the trace named "DOUT1" from channel 101 on the **34950A** in slot 3.

```
TRAC:DEL (@3101),DOUT1
```

The following command deletes the trace named "TEST_WFORM" from the **34951A** in slot 4.

```
TRAC:DEL 4,TEST_WFORM
```

See Also

[SENSe:]DIGital:MEMory:ENABle

SOURce:FUNCTion:ENABle

TRACe:DELeTe:ALL

TRACe:FREE?

TRACe:FREE?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

TRACe:FREE? {(@<channel>)|<slot>}

Description

This command returns the largest contiguous block of available **volatile** memory. The value returned is the number of trace points available for the specified slot.

Used With:

- 34950A Digital I/O Module (digital output channels only)
- 34951A Isolated DAC Module

Parameters

Name	Type	Range of Values	Default Value
<channel> 34950A Only	Numeric	One channel in the form (@sccc). Select from s101 through s104, s201 through s204.	This is a required parameter
<slot> 34951A Only	Discrete	{1 2 3 4 5 6 7 8}	This is a required parameter

Remarks

- Use the **TRACe:DELeTe[:NAME]** command to delete traces from memory.
- Use the **TRACe:POINts?** command to determine the number of points used by a specific trace name.
- Each bank on the 34950A has its own memory (64K bytes each) for use in buffered output transfers. You can download up to 32 traces into each bank.
- You can store up to 512,000 trace points per 34951A module.
- For the 34950A, if you change the width of a bank (see **CONFigure:DIgital:WIDTh** command), all traces in memory are cleared.
- A Factory Reset (***RST** command), Instrument Preset (**SYSTem:PRESet** command), and Card Reset (**SYSTem:CPON** command) deletes the trace waveform from memory and removes all trace name associations.

Return Format

The query command reads the available memory and returns the number of trace samples (34950A) or trace points (34951A) available in the form "**+512000**".

Examples

The following command returns the number of trace samples available on channel 101 on the **34950A** in slot 3.

```
TRAC:FREE? (@3101)
```

Typical Response: **+3632**

The following command returns the number of trace points available on the **34951A** in slot 4.

```
TRAC:FREE? 4
```

Typical Response: **+510976**

See Also

TRACe:DELeTe[:NAME]

TRACe:POINts?

TRACe:POINts?

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

TRACe:POINts? {(@<channel>)|<slot>}, <name>

Description

This command returns the number of points (samples) used by the trace waveform.

Used With:

- 34950A Digital I/O Module (digital output channels only)
- 34951A Isolated DAC Module

Parameters

Name	Type	Range of Values	Default Value
<channel> 34950A Only	Numeric	One channel in the form (@sccc). Select from s101 through s104, s201 through s204.	This is a required parameter
<slot> 34951A Only	Discrete	{1 2 3 4 5 6 7 8}	This is a required parameter
<name>	ASCII String	A previously-defined trace name consisting of up to 12 characters.	This is a required parameter

Remarks

- The specified trace must have been previously assigned to a channel in the specified slot (see **SOURce:DIGital:MEMory:TRACe** command for the 34950A or **SOURce:FUNCTion:TRACe[:NAME]** command for the 34951A).
- Each bank on the 34950A has its own memory (64K bytes each) for use in buffered output transfers. You can download up to 32 traces into each bank.
- You can store up to 512,000 trace points per 34951A module.
- For the 34950A, if you change the width of a bank (see **CONFigure:DIGital:WIDTh** command), all traces in memory are cleared.
- A Factory Reset (***RST** command), Instrument Preset (**SYSTem:PRESet** command), and Card Reset (**SYSTem:CPON** command) deletes the trace from memory and removes all trace name associations.

Return Format

The query command reads the number of trace samples (34950A) or trace points (34951A) used by the specified trace. The number of samples (points) is returned in the form "**+100**".

Examples

The following program segment downloads a 32-sample count-up trace to memory on channel 101 on the **34950A** in slot 3 and then reads the number of trace samples.

```
TRAC:DIG:FUNC (@3101),COUN,DOUT1,32 !Download 32-sample trace to memory
SOUR:DIG:MEM:TRAC DOUT1,(@3101) !Assign trace to channel 101
TRAC:POIN? (@3101),DOUT1
```

Typical Response: **+32**

The following program segment downloads a 100-point sine waveform to memory on the **34951A** in slot 4 and then reads the number of trace points.

```
TRAC:FUNC 4,SIN, TEST_SINE, 100 !Download 100-point sine to memory
SOUR:FUNC:TRAC TEST_SINE,(@4001) !Assign trace to channel 1
TRAC:POIN? 4,TEST_SINE
```

Typical Response: **+100**

See Also

SOURce:DIGital:MEMory:TRACe

SOURce:FUNCtion:TRACe[:NAME]

TRACe[:DATA]:DIGital:FUNCtion

TRACe[:DATA]:FUNCtion

TRACe:DELeTe[:NAME]

TRACe:FREE?

TRIGger Subsystem Introduction

Command Summary

NOTE

Hold the mouse cursor over a command to view the full syntax statement.

TRIGger:COUNT

TRIGger:COUNT?

TRIGger:DElay

TRIGger:DElay?

TRIGger:DElay:AUTO

TRIGger:DElay:AUTO?

TRIGger:SOURce

TRIGger:SOURce?

TRIGger:SOURce:ALARm[:MODE]

TRIGger:SOURce:ALARm[:MODE]?

TRIGger:TIMer

TRIGger:TIMer?

TRIGger:COUNT

Syntax | Description | Parameters | Remarks | Return Format | Examples

Syntax

TRIGger:COUNT {<count>|MIN|MAX|DEF|INFinity}

TRIGger:COUNT? [{MIN|MAX}]

Description

This command selects the number of triggers that will be accepted by the internal DMM before returning to the "idle" trigger state. The trigger count applies to both scanning and stand-alone DMM measurements (with no scan list).

Used With:

- 34921A through 34925A Multiplexer Modules
- 34950A Digital I/O Module (digital input and counter channels only)
- 34952A Multifunction Module (digital input and totalizer channels only)
- Internal DMM

Parameters

Name	Type	Range of Values	Default Value
<count>	Numeric	1 to 500,000 triggers, or continuous (INFinity). MIN = 1 sweep, MAX = 500,000 triggers	1 trigger

Remarks

- After setting the trigger count, you must place the internal DMM in the "wait-for-trigger" state using the **INITiate** or **READ?** command. A trigger will not be accepted from the selected trigger source (see **TRIGger:SOURce** command) until the internal DMM is in the "wait-for-trigger" state.
 - a. For the BUS source, the trigger count sets the number of ***TRG** commands that will be accepted before returning to the "idle" trigger state.
 - b. For the EXTERNAL source, the trigger count sets the number of external pulses that will be accepted before returning to the "idle" trigger state.

- c. For the ALARmX source, the trigger count sets the number of alarms that will be allowed before returning to the "idle" trigger state.
- d. For the TIMer source, the trigger count sets the number of times the instrument will sweep through the scan list and therefore determines the overall duration of the scan.
- You can specify a trigger count in conjunction with a sample count and a sweep count. The three parameters operate independent of one another, and the total number of readings returned will be the product of the three parameters.
 - a. The *sample count* selects the number of auto-triggered samples per channel per trigger (see **SAMPlE:COUNT** command).
 - b. The *sweep count* selects the number of sweeps per trigger event during a scan (see **SWEep:COUNT** command).
- You can store at least 500,000 readings in memory and all readings are automatically time stamped. If memory overflows, the new readings will overwrite the first (oldest) readings stored; the most recent readings are always preserved.
- To set the trigger-to-trigger interval (in seconds) for measurements on the channels in the present scan list, use the **TRIGger:TIMer** command.
- The CONFigure and MEASure? commands automatically set the trigger count to 1.
- The instrument clears all readings from memory when the triggering configuration is changed.
- The instrument sets the trigger count to 1 after a Factory Reset (***RST** command). An Instrument Preset (**SYSTem:PRESet** command) or Card Reset (**SYSTem:CPON** command) does *not* change the setting.

Return Format

The query command returns the trigger count in the form "+1.00000000E+00". For a continuous trigger (INFinity), the query command returns "9.9E+37".

Examples

The following program segment configures two channels for dc voltage measurements, puts the channels in the scan list (the scan list is redefined), and sets the trigger count to 10. For each trigger received, one reading is returned for each channel (20 readings total).

```
CONF:VOLT:DC 10,0.003, (@1003,1008)
ROUT:SCAN (@1003,1008)
TRIG:COUNT 10
INIT
```

The following program segment configures the internal DMM for an ac voltage measurement (no <ch_list> is specified) and sets the trigger count to 5. For each trigger received, one reading is returned (5 readings total).

```
CONF:VOLT:AC
TRIG:COUNT 5
INIT
```

The following query returns the current trigger count.

```
TRIG:COUN?
```

Typical Response: **+5.00000000E+00**

See Also

ROUTe:CHANnel:ADVance:SOURce

ROUTe:SCAN

SAMPlE:COUNt

SWEEp:COUNt

TRIGger:SOURce

TRIGger:TIMer

TRIGger:DElay

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

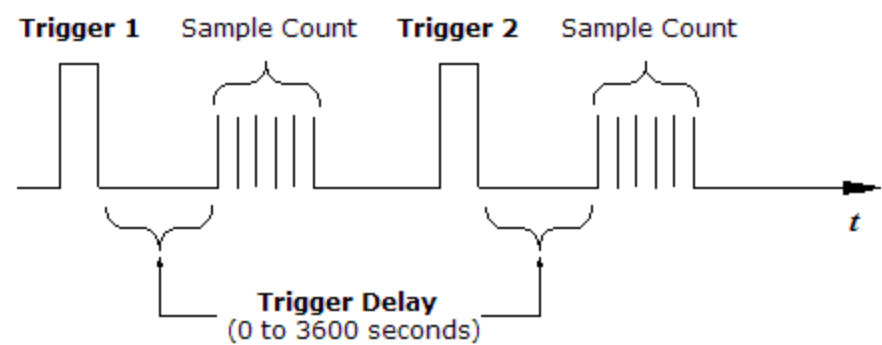
Syntax

TRIGger:DElay {<seconds>|MIN|MAX}

TRIGger:DElay? [{MIN|MAX}]

Description

This command adds a delay between the trigger signal and the first sample taken by the internal DMM (not used for scanning). The may be useful in applications where you want to allow the input to settle before taking a reading or for pacing a burst of readings. The programmed trigger delay overrides the default trigger delay that the instrument automatically adds to the measurement.



Used With:

- Internal DMM

Parameters

Name	Type	Range of Values	Default Value
<seconds>	Numeric	0 to 3600 seconds, with 4 μ s resolution. MIN = 0 seconds, MAX = 3600 seconds	Automatic

Remarks

- The default trigger delay is Automatic; the instrument determines the delay based on function, range, and integration time.
- If you specify a trigger delay other than Automatic, that same delay is used for *all* functions and ranges.

- If you have configured the instrument to take more than one reading per trigger (sample count > 1, see **SAMPLE:COUNT** command), the specified trigger delay is inserted between the trigger and the *first* reading in the sample burst.
- The default trigger delays for ac measurements (see **TRIGger:DElay:AUTO** and **ROUTe:CHANnel:DElay:AUTO** commands) do not account for worst case settling delays that can occur when measuring ac signals with large dc offsets. Significant measurement errors may result. Use the **TRIGger:DElay** command or **ROUTe:CHANnel:DElay** command (for scanned measurements) to allow adequate settling time before the measurement.
- The **CONFigure** and **MEASure?** commands set the trigger delay to Automatic.
- The instrument clears all readings from memory when the triggering configuration is changed.
- The instrument selects an automatic trigger delay after a Factory Reset (***RST** command). An Instrument Pre-set (**SYSTem:PRESet** command) or Card Reset (**SYSTem:CPON** command) does *not* change the setting.

Return Format

The query command returns the delay in seconds in the form "+1.00000000E+00".

Examples

The following program segment configures the internal DMM for a ac voltage measurement (no scan list), sets the sample count to 5, and a trigger delay of 2 seconds. When a trigger is received from the selected trigger source, a total of five readings will be returned (the trigger delay is inserted between the trigger and the first reading in the sample burst).

```
CONF:VOLT:AC
SAMP:COUN 5    !Sample count = 5
TRIG:DEL 2    !Trigger delay = 2 seconds
INIT
```

The following query returns the trigger delay selected.

```
TRIG:DEL?
```

Typical Response: +2.00000000E+00

See Also

ROUTe:CHANnel:DElay

SAMPLE:COUNT

TRIGger:DElay:AUTO

TRIGger:SOURce

TRIGger:DElay:AUTO

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

TRIGger:DElay:AUTO <mode>

TRIGger:DElay:AUTO?

Description

This command disables or enables an automatic trigger delay. If enabled, the instrument determines the delay based on function, range, and integration time.

Used With:

- 34921A through 34925A Multiplexer Modules

Parameters

Name	Type	Range of Values	Default Value
<mode>	Boolean	{OFF 0 ON 1}	Automatic

Remarks

- Selecting a specific trigger delay using the **TRIGger:DElay** command disables the automatic trigger delay.
- The default trigger delays for ac measurements do not account for worst case settling delays that can occur when measuring ac signals with large dc offsets. Significant measurement errors may result. Use the **TRIGger:DElay** command (for stand-alone DMM measurements) or **ROUTe:CHANnel:DElay** command (for scanned measurements) to allow adequate settling time before the measurement.
- The CONFigure and MEASure? commands set the trigger delay to Automatic.
- The instrument clears all readings from memory when the triggering configuration is changed.
- The instrument enables an automatic trigger delay after a Factory Reset (***RST** command). An Instrument Preset (**SYSTem:PRESet** command) or Card Reset (**SYSTem:CPON** command) does *not* change the setting.

Return Format

The query command returns "0" (OFF) or "1" (ON).

Examples

The following command enables an automatic trigger delay.

```
TRIG:DEL:AUTO OFF
```

The following query returns the automatic trigger delay setting.

```
TRIG:DEL:AUTO?
```

Typical Response: **0**

See Also

TRIGger:DElay

TRIGger:SOURce

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

TRIGger:SOURce <source>

TRIGger:SOURce?

Description

This command selects the trigger source for measurements. The instrument will accept an immediate (continuous) trigger, a software (bus) command, an external TTL trigger pulse, an alarm-initiated action, or an internally-paced timer. The front-panel sample annunciator ("*") turns on during each measurement.

Used With:

- 34921A through 34925A Multiplexer Modules
- 34950A Digital I/O Module (digital input and counter channels only)
- 34952A Multifunction Module (digital input and totalizer channels only)

Parameters

Name	Type	Range of Values	Default Value
< source >	Discrete	{IMMediate BUS EXTeRnal ALARm1 ALARm2 ALARm3 ALARm4 TImEr}	IMMediate (continuou s)

Remarks

- When making measurements independent of any channels or a scan list, this command selects the trigger source for the internal DMM.
- When using channels and a scan list, this command controls the onset of each sweep through the scan list (a sweep is one pass through the scan list). The selected source is used for all channels in the scan list.
- After selecting the trigger source, you must place the internal DMM in the "wait-for-trigger" state using the **INITiate** or **READ?** command. A trigger will not be accepted from the selected trigger source until the internal DMM is in the "wait-for-trigger" state.
- For the *IMMediate* (continuous) source, the trigger signal is always present. When you place the internal DMM in the "wait-for-trigger" state, the trigger is issued immediately.

- For the *BUS* (software) source, the internal DMM is triggered by the ***TRG** command received over the remote interface. The ***TRG** command will not be accepted unless the internal DMM is in the "wait-for-trigger" state (see **INITiate** command). If the internal DMM receives an external trigger before the next "waiting for trigger" state, it will buffer one ***TRG** command and then ignore any additional triggers received (no error is generated).
- For the *EXTErnal* source, the internal DMM will accept a hardware trigger applied to the rear-panel **Ext Trig Input** line (Pin 6). The internal DMM takes one reading, or the specified number of readings (sample count), each time a low-true TTL pulse is received. If the internal DMM receives an external trigger but is not in the "wait-for-trigger" state, it will buffer one trigger and then ignore any additional triggers received (no error is generated).
- For the *ALARm*x source, the internal DMM is triggered each time a reading crosses an alarm limit on a channel. See the **OUTPut:ALARm<n>:SOURce** command for more information. With this source, you can use the Monitor mode (see **ROUTe:MONitor:STATe** command) to continuously take readings on a selected channel and wait for an alarm on that channel. Channels do *not* have to be part of the active scan list to be monitored; however, the channel must be configured for a measurement in order to be monitored. Use the **TRIGger:SOURce:ALARm[:MODE]** command to control the behavior of the scan when an alarm condition is detected (single or continuous).
- For the *TIMer* source, you control the trigger-to-trigger interval (in seconds) for measurements on the channels in the present scan list. Use the **TRIGger:TIMer** command to set the wait period.
- Although the **TRIGger:SOURce** command shares some of the same signals as the **ROUTe:CHANnel:ADVance:SOURce** command (used for external scanning), they cannot be set to the same source (except **IMMediate**). If you attempt to select the same source, an error is generated and the **TRIGger:SOURce** is reset to **IMMediate**.
- The **CONFigure** and **MEASure?** commands automatically set the trigger source to **IMMediate**.
- The instrument clears all readings from memory when the triggering configuration is changed.
- The instrument selects the immediate trigger source after a Factory Reset (***RST** command). An Instrument Preset (**SYSTem:PRESet** command) or Card Reset (**SYSTem:CPON** command) does *not* change the setting.

Return Format

The query command returns the present trigger source: "IMM", "BUS", "EXT", "ALAR1", "ALAR2", "ALAR3", "ALAR4", or "TIM".

Examples

The following program segment selects the external trigger source. In this configuration, the instrument sweeps through the scan list once each time a low-true TTL pulse is received on the rear-panel *Ext Trig Input* line (Pin 6).

```
TRIG:SOUR EXT
INIT
```

The following program segment selects the bus (software) trigger source. Note that the ***TRG** command will not be accepted unless the internal DMM is in the "wait-for-trigger" state.

TRIG:SOUR BUS

```
INIT
*TRG
```

The following program segment selects the alarm source and configures the instrument to scan when an alarm is reported on Alarm 1. The Monitor mode is used to evaluate alarm conditions on the selected channel.

```
TRIG:SOUR ALARM1           !Select trigger source
TRIG:SOUR:ALARM CONT       !Select continuous scan mode
CALC:LIM:UPP 10.25, (@1003) !Set upper alarm limit
CALC:LIM:UPP:STAT ON, (@1003) !Enable alarms
OUTP:ALARM1:SOUR (@1003)   !Report alarms on Alarm 1
ROUT:MON:CHAN (@1003)      !Select monitor channel
ROUT:MON:CHAN:ENAB ON, (@1003) !Enable monitoring on selected channel
ROUT:MON:STAT ON           !Enable monitor mode
INIT
```

The following program segment selects the timer source and sets the scan interval to 30 milliseconds.

```
TRIG:SOUR TIMER           !Select trigger source
TRIG:TIM 30E-03           !Scan interval is 30 ms
INIT
```

The following query returns the trigger source currently selected.

```
TRIG:SOUR?
```

Typical Response: **EXT**

See Also

***TRG**

OUTPut:ALARm<n>:SOURce

ROUTe:CHANnel:ADVance:SOURce

ROUTe:MONitor:STATe

TRIGger:SOURce:ALARm[:MODE]

TRIGger:TIMer

TRIGger:SOURce:ALARm[:MODE]

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

TRIGger:SOURce:ALARm[:MODE] <source>

TRIGger:SOURce:ALARm[:MODE]?

Description

This command selects the alarm trigger source. When an alarm is specified as the scan trigger source (see [TRIGger:SOURce](#) command), this command controls the behavior of the scan when an alarm condition is detected.

Used With:

- 34921A through 34925A Multiplexer Modules
- 34950A Digital I/O Module (digital input and counter channels only)
- 34952A Multifunction Module (digital input and totalizer channels only)

Parameters

Name	Type	Range of Values	Default Value
<source>	Discrete	{SINGle CONTInuous}	SINGle

Remarks

- For the *SINGle* source, the instrument will sweep through the scan list one time when an alarm condition is detected.
- For the *CONTInuous* source, the instrument will sweep through the scan list continuously until the trigger count (see [TRIGger:COUNt](#) command) is met.
 - a. If the alarm *tracking* mode is used (see [OUTPut:ALARm:MODE](#) command) and if the alarm condition returns to within the limits during a scan, the instrument will complete the current sweep and then pause the scan. When the alarm condition goes outside the limits again, the scan will continue.
 - b. While in the continuous mode, you can use an infinite trigger count. To stop the scan, send the [ABORt](#) command or a Device Clear (the readings will remain in memory).
- The instrument selects the single trigger source after a Factory Reset ([*RST](#) command). An Instrument Pre-set ([SYSTem:PRESet](#) command) or Card Reset ([SYSTem:CPON](#) command) does *not* change the setting.

Return Format

The query command returns the present trigger alarm source: "SING" or "CONT".

Examples

The following program segment selects the alarm source and configures the instrument to scan when an alarm is reported on Alarm 1. The Monitor mode is used to evaluate alarm conditions on the selected channel.

```
TRIG:SOUR ALARM1           !Select trigger source
TRIG:SOUR:ALARM CONT      !Select continuous scan mode
CALC:LIM:UPP 10.25, (@1003) !Set upper alarm limit
CALC:LIM:UPP:STAT ON, (@1003) !Enable alarms
OUTP:ALARM1:SOUR (@1003)    !Report alarms on Alarm 1
OUTP:ALARM:MODE TRACK      !Enable track mode on all four alarm output
lines
ROUT:MON:CHAN (@1003)       !Select monitor channel
ROUT:MON:CHAN:ENAB ON, (@1003) !Enable monitoring on selected channel
ROUT:MON:STAT ON           !Enable monitor mode
TRIG:COUN 100 !Set trigger count
INIT
```

The following query returns the trigger alarm source currently selected.

```
TRIG:SOUR:ALAR?
```

Typical Response: **CONT**

See Also

CALCulate:LIMit:LOWer

CALCulate:LIMit:LOWer:STATe

CALCulate:LIMit:UPPer

CALCulate:LIMit:UPPer:STATe

TRIGger:COUNt

TRIGger:SOURce

OUTPut:ALARm:MODE

OUTPut:ALARm<n>:SOURce

TRIGger:TIMer

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

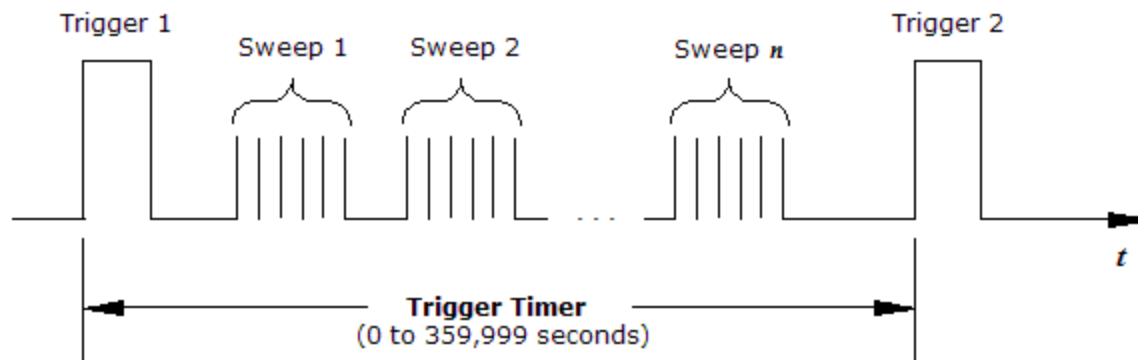
Syntax

TRIGger:TIMer {<seconds>|MIN|MAX|DEF}

TRIGger:TIMer? [{MIN|MAX}]

Description

This command sets the trigger-to-trigger interval (in seconds) for measurements on the channels in the present scan list. This command defines the time from the start of one trigger to the start of the next trigger, up to the specified trigger count (see **TRIGger:COUNt** command).



Used With:

- 34921A through 34925A Multiplexer Modules
- 34950A Digital I/O Module (digital input and counter channels only)
- 34952A Multifunction Module (digital input and totalizer channels only)

Parameters

Name	Type	Range of Values	Default Value
<seconds>	Numeric	0 seconds to 359,999 seconds (99:59:59 hours), with 1 ms resolution. MIN = 0 seconds, MAX = 359,999 seconds	1 second

Remarks

- The scan interval applies to the TIMer trigger source as set by the **TRIGger:SOURce** command.
- For the multiplexer modules, the internal DMM is required. An error is generated if the internal DMM is disabled (see **INSTrument:DMM[:STATe]** command) or not installed in the mainframe.
- If the scan interval is less than the time required to measure all channels in the scan list, the instrument will scan continuously, as fast as possible (no error is generated).
- The CONFigure and MEASure? commands automatically set the trigger interval to 1 second and the scan count to 1 sweep.
- The instrument clears all readings from memory when the triggering configuration is changed.
- The instrument sets the scan interval to immediate (0 seconds) after a Factory Reset (***RST** command). An Instrument Preset (**SYSTem:PRESet** command) or Card Reset (**SYSTem:CPON** command) does *not* change the setting.

Return Format

The query command returns the scan interval in seconds in the form "+1.00000000E+00".

Examples

The following program segment sets the trigger interval to 30 milliseconds.

```
TRIG:SOUR TIMER
TRIG:TIM 30E-03
```

The following query returns the trigger interval in seconds.

```
TRIG:TIM?
```

Typical Response: +3.00000000E-02

See Also

TRIGger:COUNT

TRIGger:SOURce

UNIT Subsystem Introduction

Command Summary

NOTE

Hold the mouse cursor over a command to view the full syntax statement.

UNIT:TEMPerature
UNIT:TEMPerature?

UNIT:TEMPerature

[Syntax](#) | [Description](#) | [Parameters](#) | [Remarks](#) | [Return Format](#) | [Examples](#)

Syntax

UNIT:TEMPerature <units> [, (@<ch_list>)]

UNIT:TEMPerature? [(@<ch_list>)]

Description

This command selects the temperature units (°C, °F, or Kelvins) on the specified channels. If you omit the optional <ch_list> parameter, this command applies to the internal DMM, independent of any channels or a scan list.

The following table shows which temperature transducers are supported by each of the multiplexer modules.

	Thermocouple	RTD 2-Wire	RTD 4-Wire	Thermistor
34921A Armature Multiplexer	Yes ¹	Yes	Yes	Yes
34922A Armature Multiplexer	Yes ²	Yes	Yes	Yes
34923A Reed Multiplexer (2-Wire)	Yes ^{2,3}	Yes ⁴	Yes ⁴	Yes ⁵
34923A Reed Multiplexer (1-Wire)	Yes ^{2,3}	Yes ⁴	No	Yes ⁵
34924A Reed Multiplexer	Yes ^{2,3}	Yes ⁴	Yes ⁴	Yes ⁵
34925A FET Multiplexer (2-Wire)	Yes ²	No	Yes ⁵	No
34925A FET Multiplexer (1-Wire)	Yes ²	No	No	No

¹ Optional 34921T Terminal Block is required for thermocouple measurements with built-in internal reference junction.

² A fixed or external reference junction temperature is required for thermocouple measurements with this module.

³ Impact of higher offset voltage specification (< 50 μ V) must be taken into consideration.

⁴ 1 k Ω or higher range used unless 100 Ω series resistors are bypassed on module.

⁵ 10 k Ω or higher range used for loads over approximately 300 Ω due to series resistance of FET channels.

Parameters

Name	Type	Range of Values	Default Value
<units>	Discrete	{ <u>C</u> <u>F</u> <u>K</u> }	C (Celsius)
<ch_list>	Numeric	One or more channels in the form <u>(@sccc)</u> .	If <ch_list> is omitted, this command applies to the internal DMM.

Remarks

- If you omit the optional <ch_list> parameter, the configuration applies to the internal DMM, independent of any channels or a scan list (any existing scan list is not redefined). An error is generated if the internal DMM is not installed or is disabled.
- You can mix temperature units on different channels within the instrument and on the same module.
- Setting the Mx+B (see **CALCulate:SCALE:UNIT** command) measurement label to °C, °F, or K has no effect on the temperature measurement units currently selected.
- The **CONFigure** and **MEASure?** commands automatically select °C.
- The instrument sets the temperature units to °C after a Factory Reset (***RST** command). An Instrument Pre-set (**SYSTem:PRESet** command) or Card Reset (**SYSTem:CPON** command) does *not* change the setting.

Return Format

The query command returns "C", "F", or "K" for each channel specified. Multiple responses are separated by commas.

Examples

The following command sets the temperature units to °F on channels 12 and 13 in slot 7.

```
UNIT:TEMP F, (@7012,7013)
```

The following query returns the temperature units selected on channels 12 and 13 in slot 7.

```
UNIT:TEMP? (@7012,7013)
```

Typical Response: **F,F**

See Also

CALCulate:SCALE:UNIT

CONFigure:TEMPerature

MEASure:TEMPerature?

SCPI Error Messages

Execution Errors (-101...) | Instrument Errors (100...) | Self-Test Errors (600...) | Calibration Errors (700–749) | Firmware Update Errors (791...) | Plug-In Module Errors (900...)

- A record of up to 20 errors can be stored in the instrument's error queue. Each remote interface I/O session (i.e., GPIB, USB, LAN, etc.) has its own interface-specific error queue. Errors appear in the error queue of the I/O session that caused the error. For example, if an error was generated by a command sent over the GPIB interface, send this command from GPIB to read the error queue.
- The instrument beeps once each time a command syntax or hardware error is generated. The front-panel ERROR annunciator turns on when one or more errors are currently stored in the error queue.
- A special *global* error queue holds all power-on and hardware-related errors (e.g., over-temperature, Safety Interlock, etc.).
- Errors are retrieved in first-in-first-out (FIFO) order. The first error returned is the first error that was stored. Once you have read all of the interface-specific errors, the errors in the global error queue are retrieved.
- Errors are cleared as you read them. When you have read all errors from the interface-specific and global error queues, the ERROR annunciator turns off and the errors are cleared.
- If more than 20 errors have occurred, the last error stored in the queue (the most recent error) is replaced with **-350,"Error queue overflow"**. No additional errors are stored until you remove errors from the queue. If no errors have occurred when you read the error queue, the instrument responds with **+0,"No error"**.
- The front panel reports errors from all I/O sessions as well as the global error queue. To read the error queue from the front panel, use the View key.
- Error conditions are also summarized in the Status Byte Register. For more information on the SCPI Status System for the Keysight 34980A, see [Status System Introduction](#).
- The interface-specific and global error queues are cleared by the ***CLS** (Clear Status) command and when power is cycled. The errors are also cleared when you read the error queue. The error queue is not cleared by a Factory Reset (***RST** command) or an Instrument Preset (**SYSTem:PRESet** command).

• Front-Panel Operation:

If the **ERROR** annunciator is on, press [View] to view the errors. Use the knob to scroll through the error numbers. Press [>] to view the text of the error message. Press [>] again to increase the scrolling speed (the final key press cancels the scroll). All errors are cleared when you exit the menu.

• Remote Interface Operation:

SYSTem:ERRor? *Read and clear one error from the queue*

Errors have the following format (the error string may contain up to 80 characters):

-113,"Undefined header"

Execution Errors

- 101, "Invalid character"
- 102, "Syntax error"
- 103, "Invalid separator"
- 113, "Undefined header"
- 123, "Numeric overflow"
- 213, "INIT ignored"
- 222, "Data out of range; value set to upper limit"
- 222, "Data out of range; value set to lower limit"
- 222, "Data out of range; value set to lower limit"
- 224, "Illegal parameter value, ranges must be positive"
- 230, "Data stale"
- 231, "Internal software error"
- 313, "Calibration memory lost; memory corruption detected"
- 313, "Calibration memory lost; due to firmware revision change"
- 314, "Save/recall memory lost; memory corruption detected"
- 314, "Save/recall memory lost; due to firmware revision change"
- 315, "Configuration memory lost; memory corruption detected"
- 315, "Configuration memory lost; due to firmware revision change"
- 321, "Out of memory; use definite length block for large traces"
- 350, "<nnn>, "Channel list: slot number out of range"
- 350, "DMM processor error queue overflowed"
- 410, "Query INTERRUPTED"
- 420, "Query UNTERMINATED"

Instrument Errors

- 112, "Channel list: channel number out of range"
- 113, "Channel list: empty scan list"
- 114, "Channel list: ABus channels not allowed as endpoint in range"
- 201, "Memory lost: stored state"
- 202, "Memory lost: power-on state"
- 203, "Memory lost: stored readings"
- 204, "Memory lost: time and date"
- 221, "Settings conflict: calculate limit state forced off"
- 222, "Settings conflict: module type does not match state"
- 223, "Settings conflict: trig source changed to IMM"
- 224, "Settings conflict: chan adv source changed to IMM"
- 225, "Settings conflict: DMM disabled or missing"
- 226, "Settings conflict: DMM enabled"
- 227, "Settings conflict: DMM not installed"
- 251, "Unsupported temperature transducer type"
- 261, "Not able to execute while scan initiated"
- 262, "Not able to abort scan"

263, "Not able to execute while DMM is measuring"
264, "Not a scannable channel"
271, "Not able to accept unit names longer than 3 characters"
272, "Not able to accept character in unit name"
281, "Not able to perform on more than one channel"
291, "Not able to recall state: it is empty"
292, "Not able to recall state: DMM enable changed"
301, "Module currently committed to scan"
302, "No module was detected in this slot"
303, "Module is not able to perform requested operation"
304, "Does not exist"
305, "Not able to perform requested operation"
306, "Part of a 4-wire pair"
307, "Incorrectly configured ref channel"
308, "Channel not able to perform requested operation"
309, "Incorrectly formatted channel list"
310, "Operation refused because channel is locked open"
311, "Not able to specify resolution with Auto range"
501, "Isolator UART framing error"
502, "Isolator UART overrun error"
514, "Not allowed"
514, "Not allowed; Instrument locked by another I/O session"
521, "Communications: input buffer overflow"
521, "Input buffer overflow"
522, "Output buffer overflow"
522, "Communications: output buffer overflow"
531, "Insufficient memory"
532, "Cannot achieve requested resolution"
532, "Not able to achieve requested resolution"
540, "Cannot use overload as math reference"
540, "Not able to null channel in overload"
550, "Command not allowed in local"
550, "Not able to execute command in local mode"
551, "Unknown Dmm Inguard"



Self-Test Errors

601, "Self-test: front panel not responding"
602, "Self-test: RAM read/write"
603, "Self-test: A/D sync stuck"
604, "Self-test: A/D slope convergence"

605, "Self-test/Cal: not able to calibrate rundown gain"
606, "Self-test/Cal: rundown gain out of range"
607, "Self-test: rundown too noisy"
608, "Serial configuration readback failed"
609, "DC gain x1 failed"
610, "DC gain x10 failed"
611, "DC gain x100 failed"
612, "Ohms 500 nA source failed"
613, "Ohms 5 uA source failed"
614, "DC 1000V zero failed"
615, "Ohms 10 uA source failed"
616, "DC current sense failed"
617, "Ohms 100 uA source failed"
618, "DC high voltage attenuator failed"
619, "Ohms 1 mA source failed"
620, "AC rms zero failed"
621, "AC rms full scale failed"
622, "Frequency counter failed"
623, "Cannot calibrate precharge"
624, "Unable to sense line frequency"
625, "I/O processor does not respond"
626, "I/O processor failed self-test"

Calibration Errors

The following errors indicate failures that may occur during a calibration. Refer to the 34980A Service Guide for more information.

701, "Cal security disabled by jumper"
702, "Cal: secured"
703, "Cal: invalid secure code"
704, "Cal: secure code too long"
705, "Cal: aborted"
706, "Cal: value out of range"
707, "Cal: signal measurement out of range"
708, "Cal: signal frequency out of range"
709, "Cal: no cal for this function or range"
710, "Cal: full scale correction out of range"
711, "Cal: cal string too long"
720, "Cal: DCV offset out of range"
721, "Cal: DCI offset out of range"
722, "Cal: R723, "Cal: FR724, "Cal: extended resistance self cal failed"
725, "Cal: 300V DC correction out of range"
730, "Cal: precharge DAC convergence failed"
731, "Cal: A/D turnover correction out of range"

732, "Cal: AC flatness DAC convergence failed"
733, "Cal: AC low frequency convergence failed"
734, "Cal: AC low frequency correction out of range"
735, "Cal: AC rms converter noise correction out of range"
736, "Cal: AC rms 100th scale correction out of range"
740, "Cal data lost: secure state"
741, "Cal data lost: string data"
742, "Cal data lost: DCV corrections"
743, "Cal data lost: DCI corrections"
744, "Cal data lost: R745, "Cal data lost: FR746, "Cal data lost: AC corrections"
747, "Calibration failed"
747, "Cal checksum failed, GPIB address"
748, "Cal checksum failed, internal data"
748, "Cal: mainframe cal memory write failure"
748, "Cal: invalid while cal in progress"
748, "Firmware and FPGA revision mismatch"
748, "Cal: no cal in progress"
749, "DMM relay count data lost"

Firmware Update Errors

791, "Firmware update error; unable to begin download"
792, "Firmware update error; programming operation failed"
793, "Firmware update error; data record invalid character"
794, "Firmware update error; data record length mismatch"
795, "Firmware update error; data record checksum mismatch"
796, "Firmware update error; bad checksum for download start"
797, "Firmware update error; bad checksum for download complete"
798, "Firmware update error; download in progress"
799, "Firmware update error; unable to complete download"
800, "Firmware update error; invalid programming address"



TOP

Plug-In Module Errors

901, "Module hardware: unexpected data received"
902, "Module hardware: missing stop bit"
903, "Module hardware: data overrun"
904, "Module hardware: protocol violation"
905, "Module hardware: early end of data"
906, "Module hardware: missing end of data"
907, "Module hardware: module SRQ signal stuck low"

908, "Module hardware: not responding"
910, "Module reported an unknown module type"
911, "Module reported command buffer overflow"
912, "Module reported command syntax error"
913, "Module reported nonvolatile memory fault"
914, "Module reported temperature sensor fault"
915, "Module reported firmware defect"
916, "Module reported incorrect firmware installed"
917, "Module reported overvoltage"
918, "Module reported that maximum number of switches are closed"
919, "Module reported that switch is missing"
920, "Module reported that FPGA update failed"
921, "Module reported that its boot test failed"
922, "Module reported error byte containing unknown error(s)"
923, "DAC Module reported no trace assigned to channel"
924, "Module reported trace download failed"
925, "Module does not support trace"
926, "Invalid width for digital channel"
927, "Trace does not exist"
928, "Module reported ABus safety interlock activated"
929, "Module reported overtemperature"
930, "Module backplane error"
931, "Backplane module transaction failed"
932, "Safety Interlock prevents completion of this command. Check Terminal connection."
933, "Revision mismatch between module firmware and FPGA"
934, "Backplane interrupt line stuck asserted, service disabled"



34934A Channel Addressing

Channel addressing for the 34934A High-Density Matrix Module is dependent upon the matrix set by the module's configuration jumpers. The following tables show the channel addressing scheme for the different matrices, and for configurations that support 2-wire measurements, the channel pairings.

See the 34934A module summary under **Plug-In Module Reference Information** for a visual representation of the channel numbering for row/column combinations of the different matrices.

4x32 Matrix Addressing

Matrix 1 High (M1H)				Matrix 1 Low (M1L)		
Row	Column	Channel	Pairs with	Row	Column	Channel
1	xx	s1xx	----->	1	xx	s(1xx+64)
2	xx	s3xx	----->	2	xx	s(3xx+64)
3	xx	s5xx	----->	3	xx	s(5xx+64)
4	xx	s7xx	----->	4	xx	s(7xx+64)
s = slot number = 1-8 xx = 01-32 example: 2512 = slot 2, row 3, column 12 -----> is paired with channel 2576 on M1L						
or form: $M1H(XXX) = 100(2R-1) + C$ row/column algorithm $sxxx\ M1L(XXX) = 100(2R-1) + C + 64$ example: $2512 = 100(2(3)-1) + 12$ $2576 = 100(2(3)-1) + 12 + 64$						
Matrix 2 High (M2H)				Matrix 2 Low (M2L)		
Row	Column	Channel	Pairs with	Row	Column	Channel
1	xx	s(1xx+32)	----->	1	xx	s(1xx+96)
2	xx	s(3xx+32)	----->	2	xx	s(3xx+96)
3	xx	s(5xx+32)	----->	3	xx	s(5xx+96)
4	xx	s(7xx+32)	----->	4	xx	s(7xx+96)
s = slot number = 1-8 xx = 01-32 example: 1747 = slot 1, row 4, column 15 -----> is paired with channel 1811 on M2L						
or form: row/column algorithm $sxxx\ M2H(XXX) = 100(2R-1) + C + 32$ $M2L(XXX) = 100(2R-1) + C + 96$ example: $1747 = 100(2(4)-1) + 15 + 32$ $1811 = 100(2(4)-1) + 15 + 96$						

4x64 Matrix Addressing

Matrix High (MH)				Matrix Low (ML)		
Row	Column	Channel	Pairs with	Row	Column	Channel
1	xx	s1xx	----->	1	xx	s(1xx+64)
2	xx	s3xx	----->	2	xx	s(3xx+64)
3	xx	s5xx	----->	3	xx	s(5xx+64)
4	xx	s7xx	----->	4	xx	s(7xx+64)
s = slot number = 1-8 xx = 01-64 example: 2320 = slot 2, row 2, column 20 -----> is paired with channel 2384 on ML						
or form: row/column algorithm $sxxx\ MH(xxx) = 100(2R-1) + C$ $ML(xxx) = 100(2R-1) + C + 64$ example: $2320 = 100(2(2)-1) + 20$ $2384 = 100(2(2)-1) + 20 + 64$						

4x128 Matrix Addressing

Matrix (M)		
Row	Column	Channel
1	xxx	s(100+xxx)
2	xxx	s(300+xxx)
3	xxx	s(500+xxx)
4	xxx	s(700+xxx)
s = slot number = 1-8 xxx = 001-128 example: 1800 = slot 1, row 4, column 100		
or form: row/column algorithm $sxxx\ M(xxx) = 100(2R-1) + C$ example: $1800 = 100(2(4)-1) + 100$		

8x32 Matrix Addressing

Matrix High (MH)				Matrix Low (ML)		
Row	Column	Channel	Pairs with	Row	Column	Channel
1	xx	s1xx	----->	1	xx	s(1xx+32)
2	xx	s2xx	----->	2	xx	s(2xx+32)
3	xx	s3xx	----->	3	xx	s(3xx+32)

4	xx	s4xx	----->	4	xx	s(4xx+32)
5	xx	s5xx	----->	5	xx	s(5xx+32)
6	xx	s6xx	----->	6	xx	s(6xx+32)
7	xx	s7xx	----->	7	xx	s(7xx+32)
8	xx	s8xx	----->	8	xx	s(8xx+32)
s = slot number = 1-8 xx = 01-32 example: 1631 = slot 1, row 6, column 31 -----> is paired with channel 1663 on ML						
or form: row/column algorithm $sxxx\ MH(xxx) = 100R + C$ $ML(xxx) = 100R + C + 32$ example: 1631 = 100(6) + 31 1663 = 100(6) + 31 + 32						

8x64 Matrix Addressing

Matrix (M)		
Row	Column	Channel
1	xx	s1xx
2	xx	s2xx
3	xx	s3xx
4	xx	s4xx
5	xx	s5xx
6	xx	s6xx
7	xx	s7xx
8	xx	s8xx
s = slot number = 1-8 xx = 01-64 example: 2560 = slot 2, row 5, column 60		
or form: row/column algorithm $sxxx\ M(xxx) = 100R + C$ example: 2560 = 100(5) + 60		

16x32 Matrix Addressing

Matrix (M)		
Row	Column	Channel
1	xx	s(100+xx)

2	xx	s(150+xx)
3	xx	s(200+xx)
4	xx	s(250+xx)
5	xx	s(300+xx)
6	xx	s(350+xx)
7	xx	s(400+xx)
8	xx	s(450+xx)
9	xx	s(500+xx)
10	xx	s(550+xx)
11	xx	s(600+xx)
12	xx	s(650+xx)
13	xx	s(700+xx)
14	xx	s(750+xx)
15	xx	s(800+xx)
16	xx	s(850+xx)
s = slot number = 1-8 xx = 01-32 example: 1765 = slot 1, row 14, column 15		
or form: row/column algorithm $sxxx\ M(xxx) = 50(R+1) + C$ example: 1765 = 50(14 +1) + 15		

34934A Channel Addressing

Channel addressing for the 34934A High-Density Matrix Module is dependent upon the matrix set by the module's configuration jumpers. The following tables show the channel addressing scheme for the different matrices, and for configurations that support 2-wire measurements, the channel pairings.

See the 34934A module summary under **Plug-In Module Reference Information** for a visual representation of the channel numbering for row/column combinations of the different matrices.

4x32 Matrix Addressing

Matrix 1 High (M1H)				Matrix 1 Low (M1L)		
Row	Column	Channel	Pairs with	Row	Column	Channel
1	xx	s1xx	----->	1	xx	s(1xx+64)
2	xx	s3xx	----->	2	xx	s(3xx+64)
3	xx	s5xx	----->	3	xx	s(5xx+64)
4	xx	s7xx	----->	4	xx	s(7xx+64)
s = slot number = 1-8 xx = 01-32 example: 2512 = slot 2, row 3, column 12 -----> is paired with channel 2576 on M1L						
or form: $M1H(xxx) = 100(2R-1) + C$ row/column algorithm $sxxx\ M1L(xxx) = 100(2R-1) + C + 64$ example: $2512 = 100(2(3)-1) + 12$ $2576 = 100(2(3)-1) + 12 + 64$						
Matrix 2 High (M2H)				Matrix 2 Low (M2L)		
Row	Column	Channel	Pairs with	Row	Column	Channel
1	xx	s(1xx+32)	----->	1	xx	s(1xx+96)
2	xx	s(3xx+32)	----->	2	xx	s(3xx+96)
3	xx	s(5xx+32)	----->	3	xx	s(5xx+96)
4	xx	s(7xx+32)	----->	4	xx	s(7xx+96)
s = slot number = 1-8 xx = 01-32 example: 1747 = slot 1, row 4, column 15 -----> is paired with channel 1811 on M2L						
or form: row/column algorithm $sxxx\ M2H(xxx) = 100(2R-1) + C + 32$ $M2L(xxx) = 100(2R-1) + C + 96$ example: $1747 = 100(2(4)-1) + 15 + 32$ $1811 = 100(2(4)-1) + 15 + 96$						

4x64 Matrix Addressing

Matrix High (MH)				Matrix Low (ML)		
Row	Column	Channel	Pairs with	Row	Column	Channel
1	xx	s1xx	----->	1	xx	s(1xx+64)
2	xx	s3xx	----->	2	xx	s(3xx+64)
3	xx	s5xx	----->	3	xx	s(5xx+64)
4	xx	s7xx	----->	4	xx	s(7xx+64)
s = slot number = 1-8 xx = 01-64 example: 2320 = slot 2, row 2, column 20 -----> is paired with channel 2384 on ML						
or form: row/column algorithm $sxxx\ MH(xxx) = 100(2R-1) + C$ $ML(xxx) = 100(2R-1) + C + 64$ example: $2320 = 100(2(2)-1) + 20$ $2384 = 100(2(2)-1) + 20 + 64$						

4x128 Matrix Addressing

Matrix (M)		
Row	Column	Channel
1	xxx	s(100+xxx)
2	xxx	s(300+xxx)
3	xxx	s(500+xxx)
4	xxx	s(700+xxx)
s = slot number = 1-8 xxx = 001-128 example: 1800 = slot 1, row 4, column 100		
or form: row/column algorithm $sxxx\ M(xxx) = 100(2R-1) + C$ example: $1800 = 100(2(4)-1) + 100$		

8x32 Matrix Addressing

Matrix High (MH)				Matrix Low (ML)		
Row	Column	Channel	Pairs with	Row	Column	Channel
1	xx	s1xx	----->	1	xx	s(1xx+32)
2	xx	s2xx	----->	2	xx	s(2xx+32)
3	xx	s3xx	----->	3	xx	s(3xx+32)

4	xx	s4xx	----->	4	xx	s(4xx+32)
5	xx	s5xx	----->	5	xx	s(5xx+32)
6	xx	s6xx	----->	6	xx	s(6xx+32)
7	xx	s7xx	----->	7	xx	s(7xx+32)
8	xx	s8xx	----->	8	xx	s(8xx+32)
s = slot number = 1-8 xx = 01-32 example: 1631 = slot 1, row 6, column 31 -----> is paired with channel 1663 on ML						
or form: row/column algorithm $sxxx\ MH(xxx) = 100R + C$ $ML(xxx) = 100R + C + 32$ example: 1631 = 100(6) + 31 1663 = 100(6) + 31 + 32						

8x64 Matrix Addressing

Matrix (M)		
Row	Column	Channel
1	xx	s1xx
2	xx	s2xx
3	xx	s3xx
4	xx	s4xx
5	xx	s5xx
6	xx	s6xx
7	xx	s7xx
8	xx	s8xx
s = slot number = 1-8 xx = 01-64 example: 2560 = slot 2, row 5, column 60		
or form: row/column algorithm $sxxx\ M(xxx) = 100R + C$ example: 2560 = 100(5) + 60		

16x32 Matrix Addressing

Matrix (M)		
Row	Column	Channel
1	xx	s(100+xx)

2	xx	s(150+xx)
3	xx	s(200+xx)
4	xx	s(250+xx)
5	xx	s(300+xx)
6	xx	s(350+xx)
7	xx	s(400+xx)
8	xx	s(450+xx)
9	xx	s(500+xx)
10	xx	s(550+xx)
11	xx	s(600+xx)
12	xx	s(650+xx)
13	xx	s(700+xx)
14	xx	s(750+xx)
15	xx	s(800+xx)
16	xx	s(850+xx)
s = slot number = 1-8 xx = 01-32 example: 1765 = slot 1, row 14, column 15		
or form: row/column algorithm $sxxx\ M(xxx) = 50(R+1) + C$ example: 1765 = 50(14 +1) + 15		

Instrument Preset State

The following tables show the state of the instrument after a **SYSTem:PRESet** command is issued.

Measurement Configuration	Preset State
Function	No Change
Range	No Change
Resolution	No Change
Integration Time	No Change
Input Resistance	No Change
Channel Labels	No Change
Channel Delay	No Change
Reading Format	No Change
Sample Count	No Change
Trigger Count	No Change
Trigger Delay	No Change
Trigger Source	No Change

Scanning Operations	Preset State
Scan List	No Change
Reading Memory	All Readings are Cleared
Min, Max, and Average	All Statistical Data is Cleared
Sweep Count	No Change
Trigger Interval	No Change
Monitor in Progress	Stopped

Mx+B Scaling	Preset State
Scaling State	No Change
Gain Factor ("M")	No Change
Offset Factor ("B")	No Change
Scale Label	No Change

Alarm Limits	Preset State
Alarm Queue	No Change
Alarm State	No Change
HI and LO Alarm Limits	No Change
Alarm Output	No Change
Alarm Output Configuration	No Change

Alarm Output State	Output Lines are Cleared
Alarm Output Slope	No Change

Module Hardware	Preset State
Multiplexer Modules: 34921A, 34922A, 34923A, 34924A, 34925A	All Channels Open 2-Wire/1-Wire Mode: No Change
Matrix Modules: 34931A, 34932A, 34933A	All Channels Open 2-Wire/1-Wire Mode: No Change
GP Modules: 34937A, 34938A, 34939A	All Channels Open
RF Modules: 34941A, 34942A	Channels b 01 and b 03 Selected (b = Bank)
Microwave Modules: 34945A, 34946A, 34947A	34945A: All Channel Drives = Default 34946A: Channels 101 and 201 to COM 34947A: Channels 101, 201, and 301 to COM
System Control Modules: 34950A, 34951A, 34952A, 34959A	34950A: DIO Ports = Input, Count = 0, Trace Patterns are Cleared 34951A: DACs = 0 Vdc, Trace Waveforms are Cleared 34952A: DIO Ports = Input, Count = 0, DACs = 0 Vdc 34959A: DIO Ports = Input, All Relay Channels Open

System-Related Operations	Preset State
Display State	On
Error Queue	Errors Not Cleared
Stored States	No Change
System Date	No Change
System Time	No Change
Temperature Units	No Change

Plug-In Module Reference Information

The links below take you to summary information for the Keysight 34980A plug-in modules. See the *Introduction to the Plug-In Modules* chapter of the *Keysight 34980A Mainframe User's Guide* for general module configuration information. For detailed information on configuring, wiring and operating the plug-in modules, see the *User's Guides* specific to the individual modules or module families.

Low-Frequency Multiplexer Modules

[34921A 40-Channel Armature Multiplexer with Low Thermal Offset](#)

[34922A 70-Channel Armature Multiplexer](#)

[34923A 40-Channel Reed Multiplexer \(2-Wire\)](#)

[34923A 80-Channel Reed Multiplexer \(1-Wire\)](#)

[34924A 70-Channel Reed Multiplexer](#)

[34925A 40-Channel FET Multiplexer \(2-Wire\)](#)

[34925A 80-Channel FET Multiplexer \(1-Wire\)](#)

Matrix Modules

[34931A Dual 4x8 Armature Matrix](#)

[34932A Dual 4x16 Armature Matrix](#)

[34933A Dual 4x8 Reed Matrix \(2-Wire\)](#)

[34933A Quad 4x8 Reed Matrix \(1-Wire\)](#)

[34934A High Density Matrix](#)

General-Purpose Switch Modules

[34937A 32-Channel Form C / Form A General-Purpose Switch](#)

[34938A 20-Channel 5A Form A Switch](#)

[34939A 64-Channel 1A Form A Switch](#)

RF Multiplexer Modules

[34941A Quad 1x4 50 \$\Omega\$ RF Multiplexer](#)

[34942A Quad 1x4 75 \$\Omega\$ RF Multiplexer](#)

Microwave Switch Modules

[34945A Microwave Switch/Attenuator Driver](#)

34946A Dual 1x2 SPDT Terminated Microwave Switch

34947A Triple 1x2 SPDT Unterminated Microwave Switch

System Control Modules

34950A 64-Bit Digital I/O Module with Memory and Counter

34951A 4-Channel Isolated D/A Converter Module with Waveform Memory

34952A Multifunction Module with Digital I/O, Totalizer, and DAC

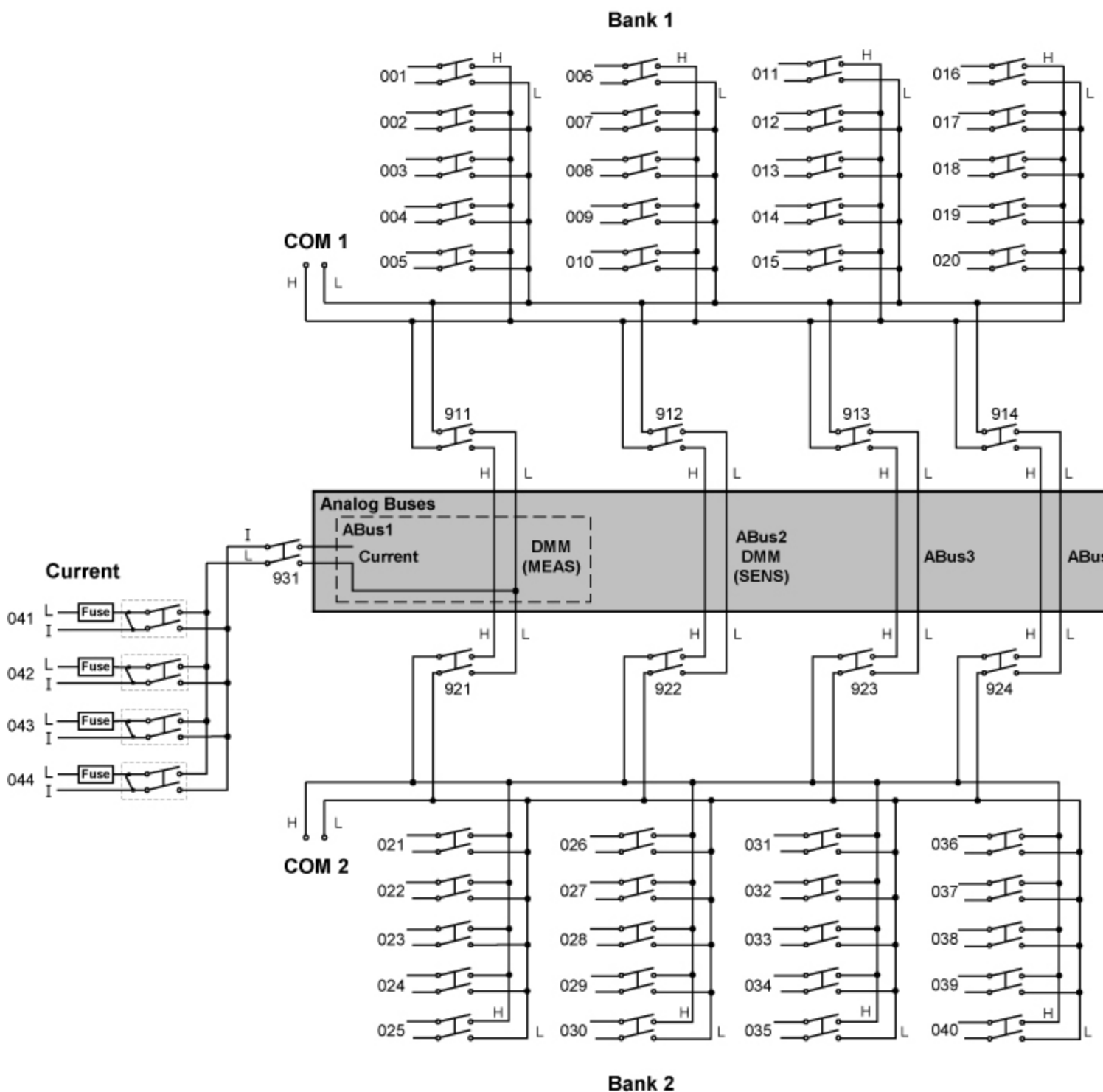
34959A Breadboard Module

Keysight 34921A Module Summary

40-Channel Armature Multiplexer with Low Thermal Offset

[Simplified Schematic](#) | [Wiring Log](#) | [SCPI Commands Used](#) | [Key Specifications](#)

Simplified Schematic



NOTE

This module uses a *Safety Interlock* feature that prevents connections to the Analog Buses if no terminal block or cable is connected.

Wiring Log

A wiring log is available to make it easy to document your wiring configuration for this module. You can open the file in Microsoft® Excel or Adobe® Acrobat® format.

34921A Wiring Log: [Excel format](#) [Adobe PDF format](#)

SCPI Commands Used

CONFigure Subsystem

MEASure? Subsystem

ROUTe:CLOSe

ROUTe:CLOSe:EXCLusive

ROUTe:OPEN

ROUTe:SCAN

SENSe Subsystem

Key Specifications

See the *Keysight 34921A-34925A Low Frequency Multiplexer Modules User's Guide* for detailed operating information.

Max Voltage	±300 V
Max Current	1 A
Bandwidth	45 MHz
Scanning Speed	100 chan/sec
Thermal Offset	< 3 µV

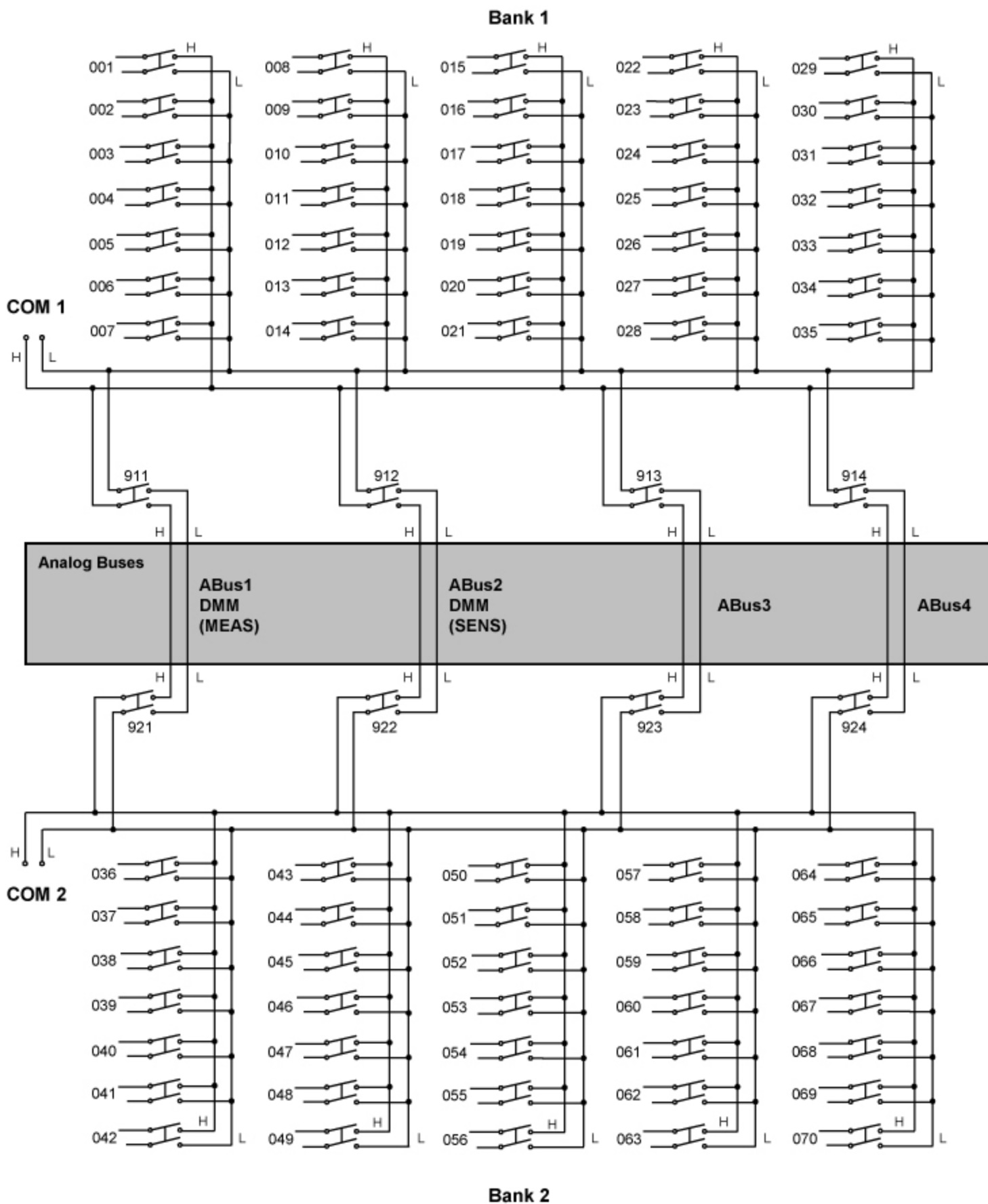
Note: Product specifications are subject to change without notice.

Keysight 34922A Module Summary

70-Channel Armature Multiplexer

[Simplified Schematic](#) | [Wiring Log](#) | [SCPI Commands Used](#) | [Key Specifications](#)

Simplified Schematic



NOTE

This module uses a *Safety Interlock* feature that prevents connections to the Analog Buses if no terminal block or cable is connected.

Wiring Log

A wiring log is available to make it easy to document your wiring configuration for this module. You can open the file in Microsoft® Excel or Adobe® Acrobat® format.

34922A Wiring Log: [Excel format](#) [Adobe PDF format](#)

SCPI Commands Used

CONFigure Subsystem

MEASure? Subsystem

ROUTe:CLOSe

ROUTe:CLOSe:EXCLusive

ROUTe:OPEN

ROUTe:SCAN

SENSe Subsystem

Key Specifications

See the *Keysight 34921A-34925A Low Frequency Multiplexer Modules User's Guide* for detailed operating information.

Max Voltage	±300 V
Max Current	1 A
Bandwidth	25 MHz
Scanning Speed	100 chan/sec
Thermal Offset	< 3 µV

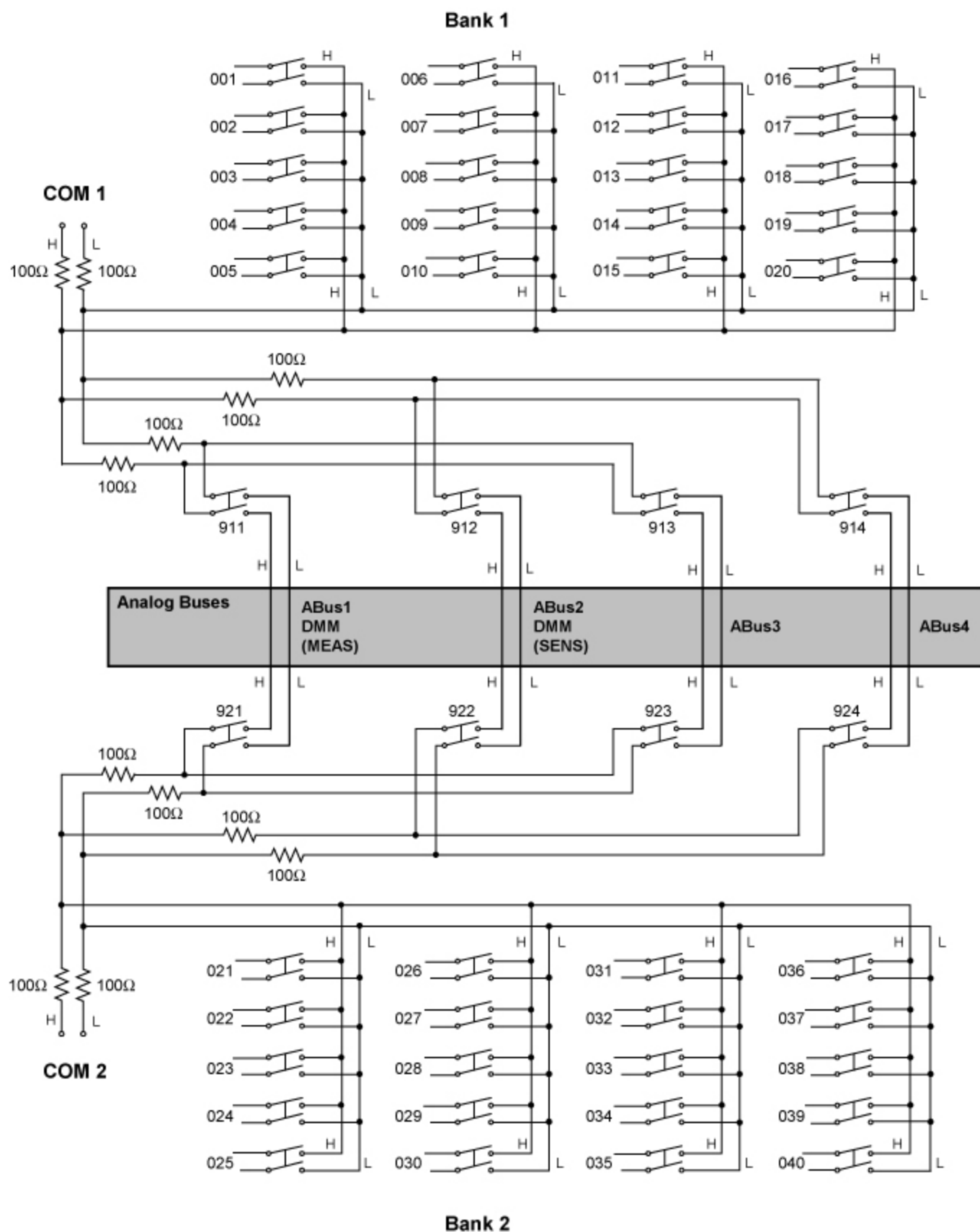
Note: Product specifications are subject to change without notice.

Keysight 34923A Module Summary

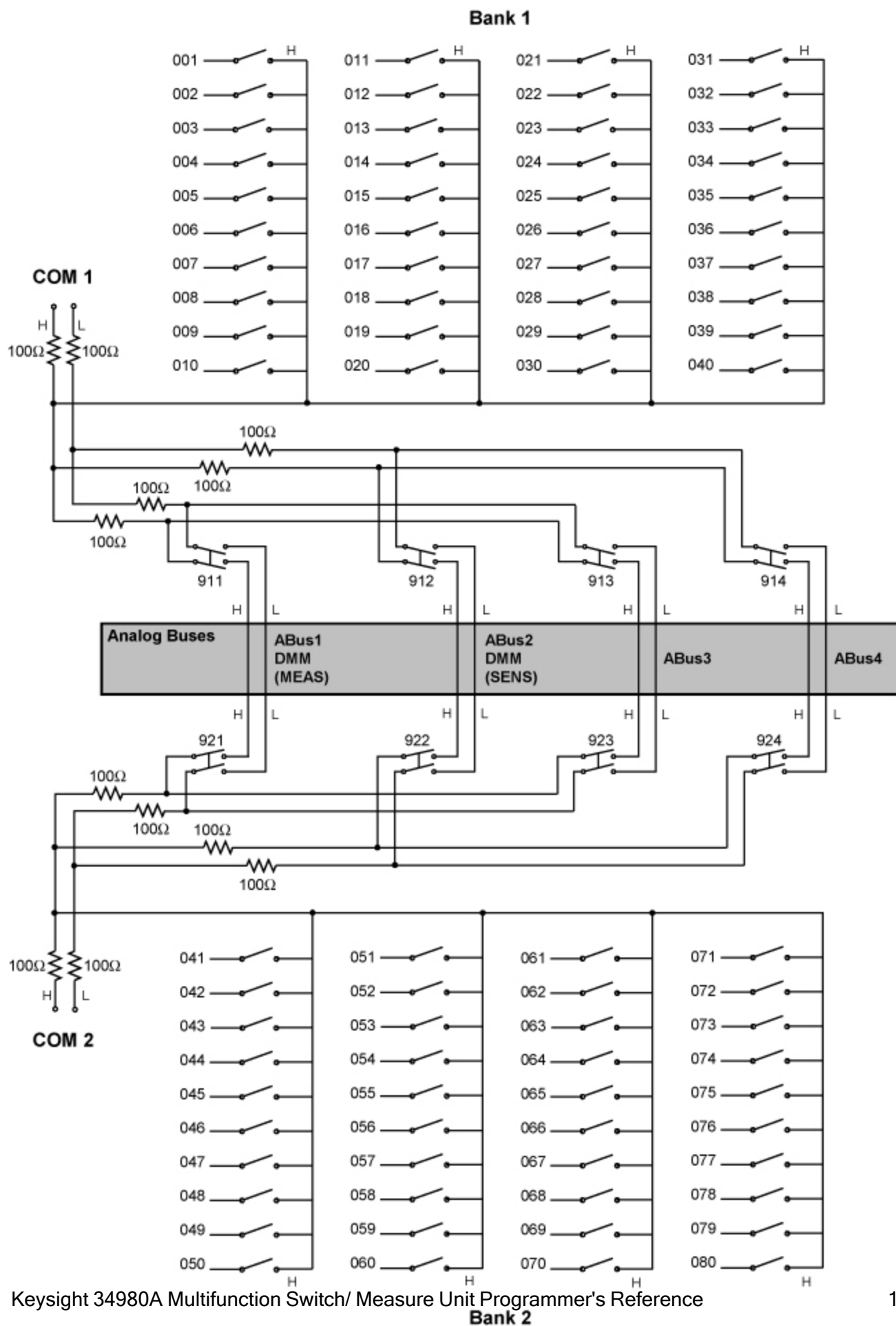
40-Channel Reed Multiplexer

[Simplified Schematic](#) | [Wiring Log](#) | [SCPI Commands Used](#) | [Key Specifications](#)

Simplified Schematic (2-Wire Mode)



Simplified Schematic (1-Wire Mode)



NOTE

This module uses a *Safety Interlock* feature that prevents connections to the Analog Buses if no terminal block or cable is connected.

NOTE

Due to power dissipation issues, there is a limit to the number of relays that can be closed at a time on this module (you cannot close all channels simultaneously). See the **ROUTe:CLOSe** command for more information.

Wiring Log

A wiring log is available to make it easy to document your wiring configuration for this module. You can open the file in Microsoft® Excel or Adobe® Acrobat® format.

34923A Wiring Log (2-Wire Mode): [Excel format](#) [Adobe PDF format](#)

34923A Wiring Log (1-Wire Mode): [Excel format](#) [Adobe PDF format](#)

SCPI Commands Used

CONFigure Subsystem

MEASure? Subsystem

ROUTe:CLOSe

ROUTe:CLOSe:EXCLusive

ROUTe:OPEN

ROUTe:SCAN

SENSe Subsystem

SYSTem:MODule:WIRE:MODE

Key Specifications

See the *Keysight 34921A–34925A Low Frequency Multiplexer Modules User's Guide* for detailed operating information.

Max Voltage	±150 V
Max Current	0.5 A
Bandwidth	45 MHz
Scanning Speed	500 chan/sec
Thermal Offset	< 50 µV

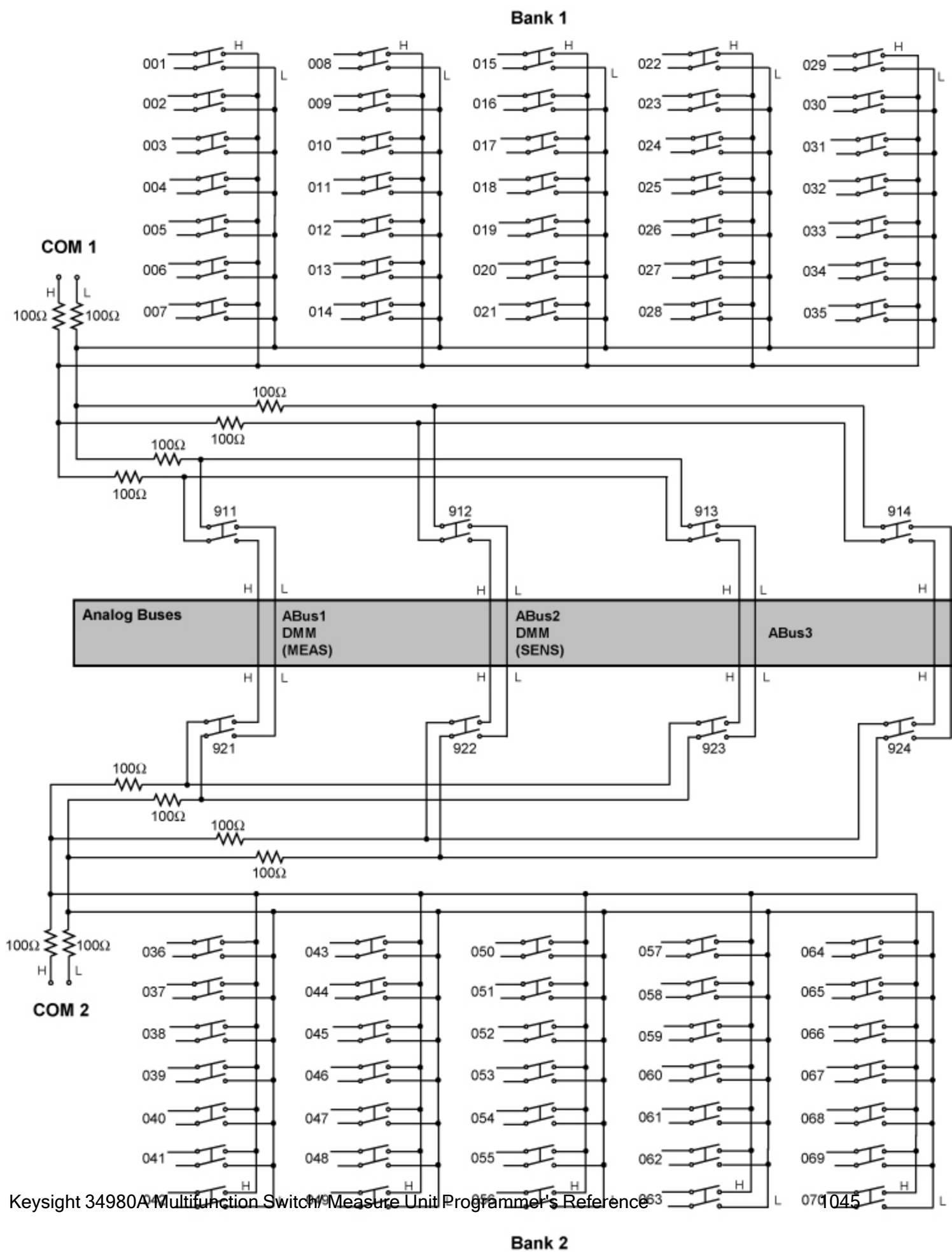
Note: Product specifications are subject to change without notice.

Keysight 34924A Module Summary

70-Channel Reed Multiplexer

[Simplified Schematic](#) | [Wiring Log](#) | [SCPI Commands Used](#) | [Key Specifications](#)

Simplified Schematic



NOTE

This module uses a *Safety Interlock* feature that prevents connections to the Analog Buses if no terminal block or cable is connected.

NOTE

Due to power dissipation issues, there is a limit to the number of relays that can be closed at a time on this module (you cannot close all channels simultaneously). See the **ROUTe:CLOSe** command for more information.

Wiring Log

A wiring log is available to make it easy to document your wiring configuration for this module. You can open the file in Microsoft® Excel or Adobe® Acrobat® format.

34924A Wiring Log: [Excel format](#) [Adobe PDF format](#)

SCPI Commands Used

CONFigure Subsystem

MEASure? Subsystem

ROUTe:CLOSe

ROUTe:CLOSe:EXCLusive

ROUTe:OPEN

ROUTe:SCAN

SENSe Subsystem

Key Specifications

See the *Keysight 34921A–34925A Low Frequency Multiplexer Modules User's Guide* for detailed operating information.

Max Voltage	±150 V
Max Current	0.5 A
Bandwidth	25 MHz
Scanning Speed	500 chan/sec
Thermal Offset	< 50 µV

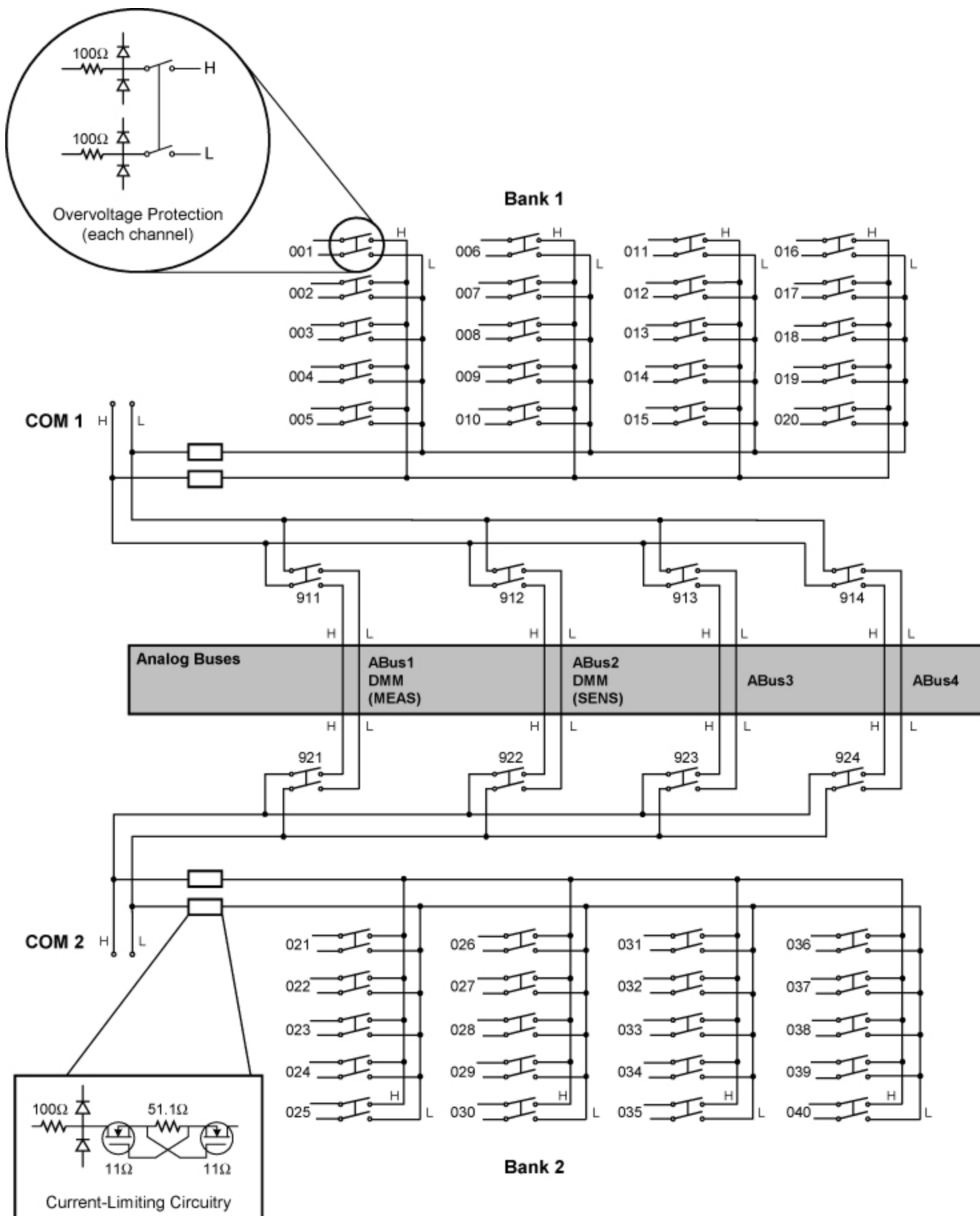
Note: Product specifications are subject to change without notice.

Keysight 34925A Module Summary

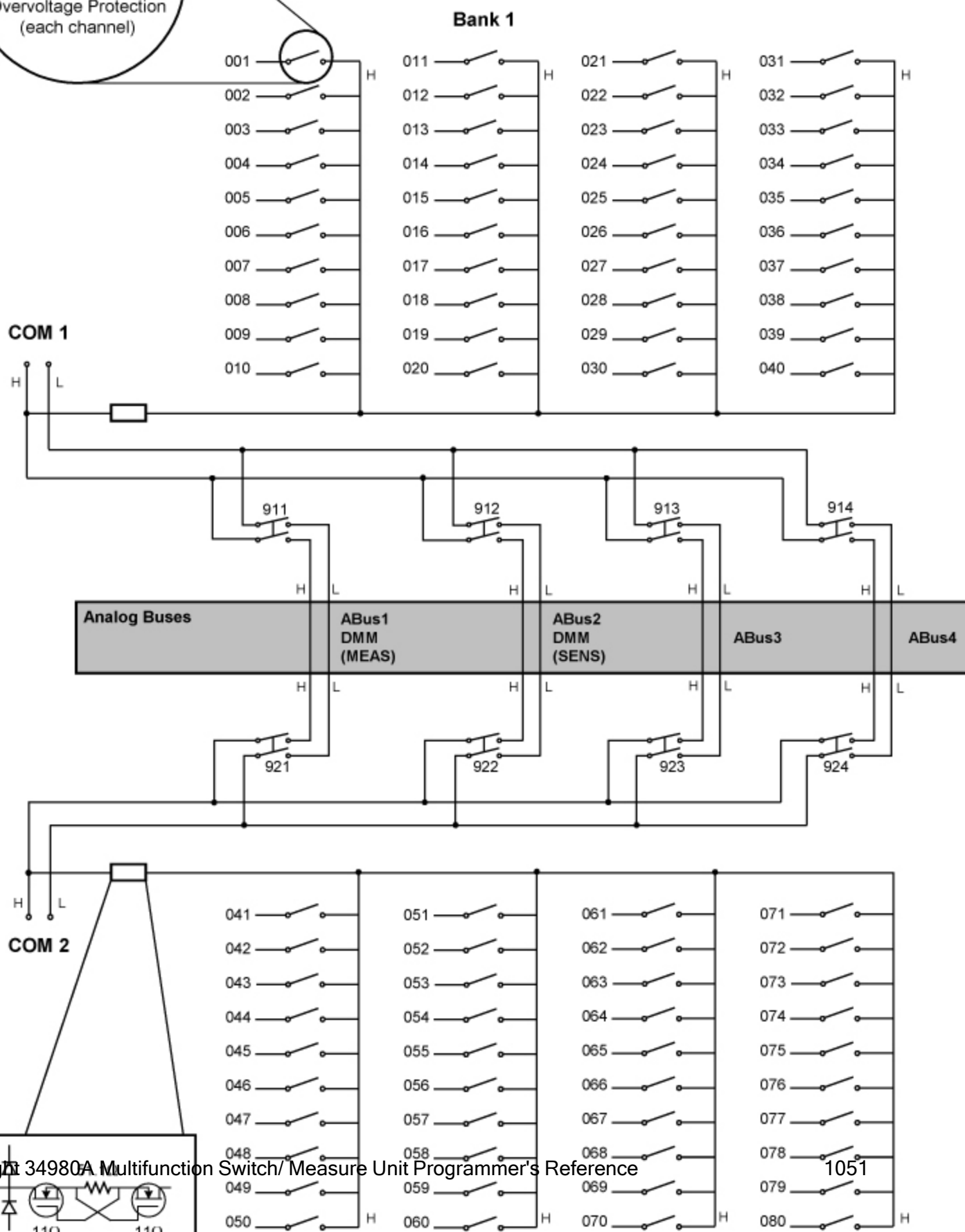
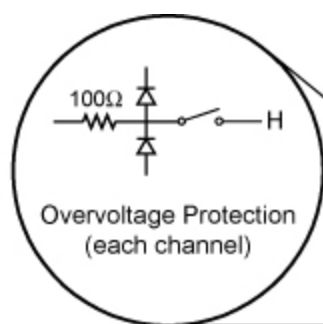
40-Channel Opto-Coupled FET Multiplexer

[Simplified Schematic](#) | [Wiring Log](#) | [SCPI Commands Used](#) | [Key Specifications](#)

Simplified Schematic (2-Wire Mode)



Simplified Schematic (1-Wire Mode)



NOTE

This module uses a *Safety Interlock* feature that prevents connections to the Analog Buses if no terminal block or cable is connected.

Wiring Log

A wiring log is available to make it easy to document your wiring configuration for this module. You can open the file in Microsoft® Excel or Adobe® Acrobat® format.

34925A Wiring Log (2-Wire Mode): [Excel format](#) [Adobe PDF format](#)

34925A Wiring Log (1-Wire Mode): [Excel format](#) [Adobe PDF format](#)

SCPI Commands Used

CONFigure Subsystem

MEASure? Subsystem

ROUTe:CLOSe

ROUTe:CLOSe:EXCLusive

ROUTe:OPEN

ROUTe:SCAN

SENSe Subsystem

SYSTem:MODUle:WIRE:MODE

Key Specifications

See the *Keysight 34921A-34925A Low Frequency Multiplexer Modules User's Guide* for detailed operating information.

Max Voltage	±80 V
Max Current	0.05 A
Bandwidth	1 MHz
Scanning Speed	1000 chan/sec
Thermal Offset	< 3 µV

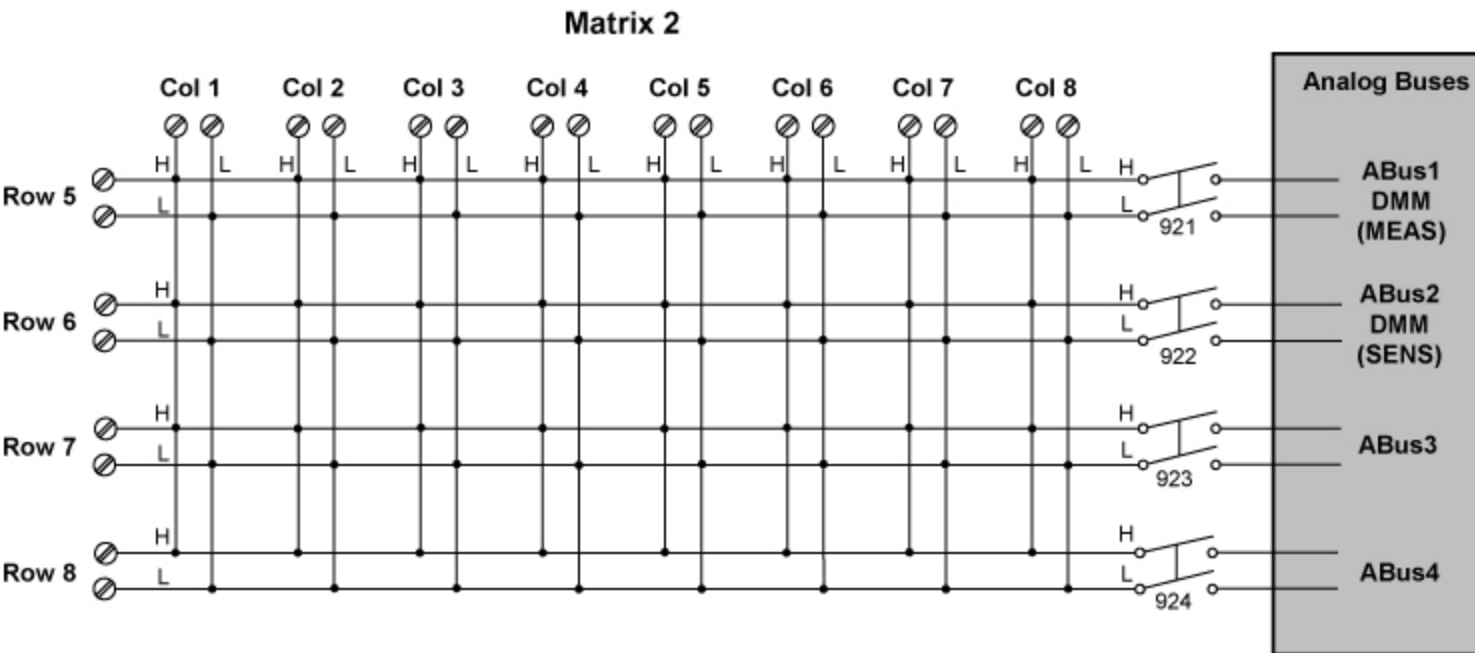
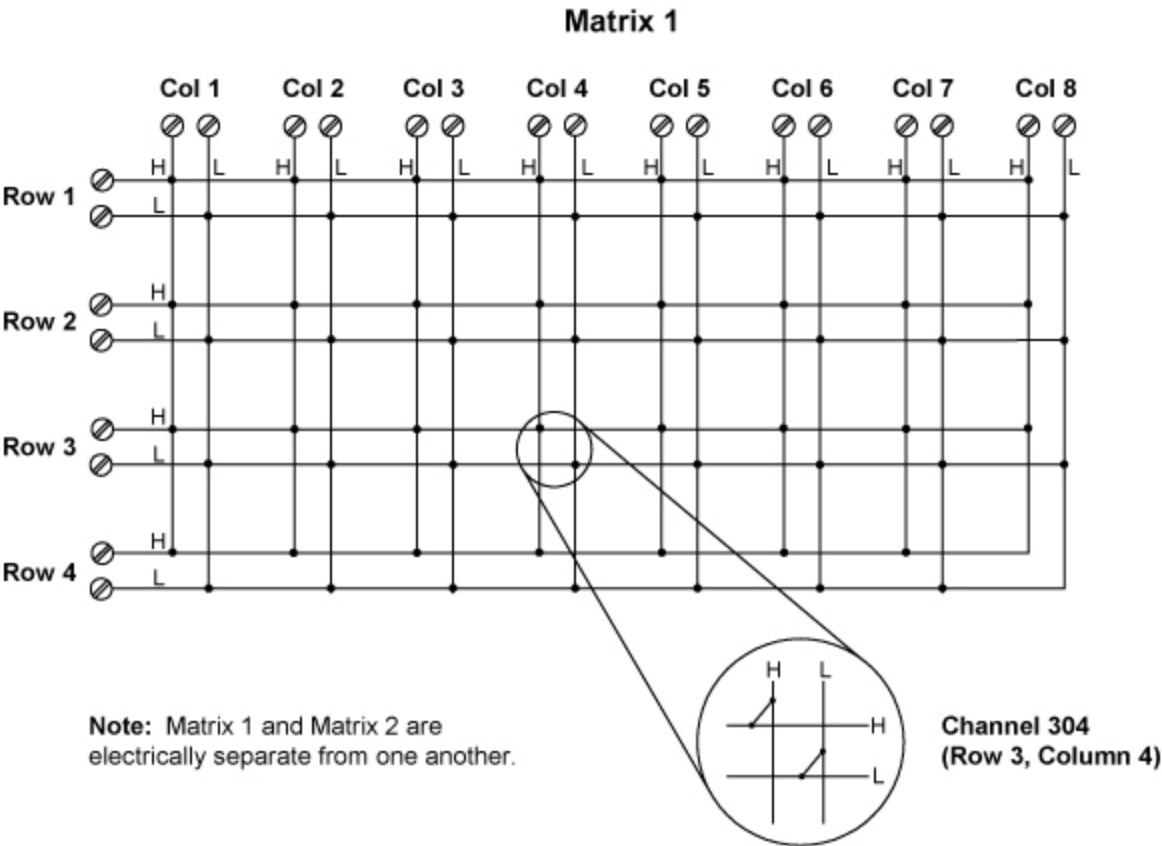
Note: Product specifications are subject to change without notice.

Keysight 34931A Module Summary

Dual 4x8 Armature Matrix

[Simplified Schematic](#) | [Wiring Log](#) | [SCPI Commands Used](#) | [Key Specifications](#)

Simplified Schematic



NOTE

This module uses a *Safety Interlock* feature that prevents connections to the Analog Buses if no terminal block or cable is connected.

Wiring Log

A wiring log is available to make it easy to document your wiring configuration for this module. You can open the file in Microsoft® Excel or Adobe® Acrobat® format.

34931A Wiring Log: [Excel format](#) [Adobe PDF format](#)

SCPI Commands Used

ROUTe:CLOSe

ROUTe:CLOSe:EXCLusive

ROUTe:OPEN

Key Specifications

See the *Keysight 34931A-34933A Matrix Modules User's Guide* for detailed operating information.

Max Voltage	±300 V
Max Current	1 A
Bandwidth	30 MHz
Scanning Speed	100 chan/sec
Thermal Offset	< 3 μ V

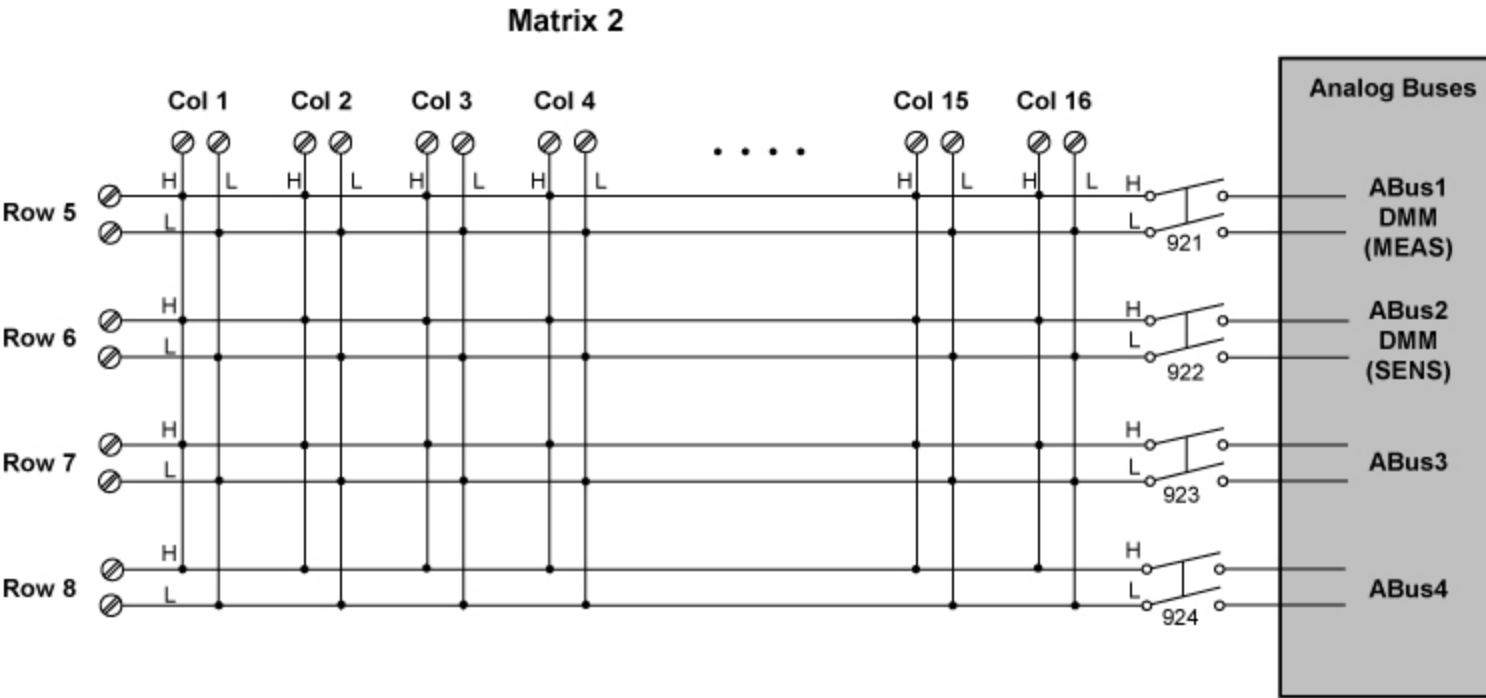
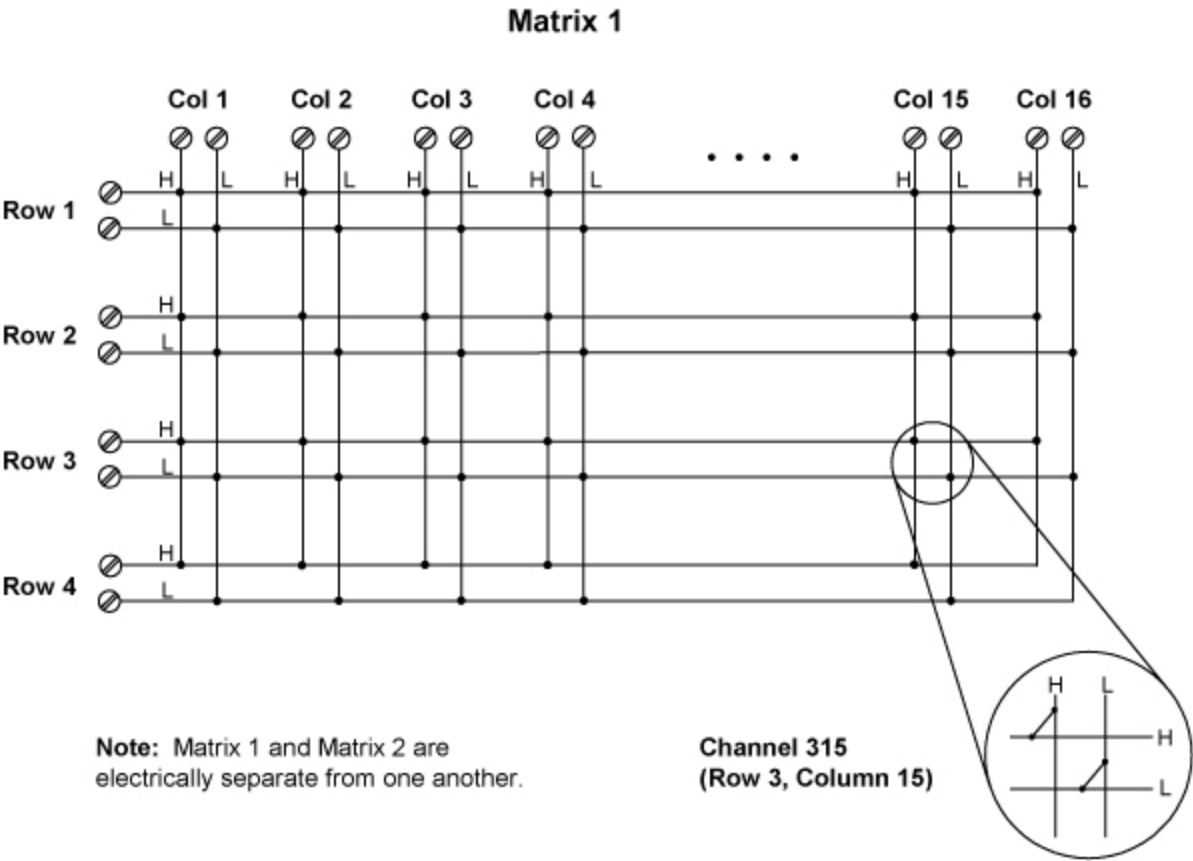
Note: Product specifications are subject to change without notice.

Keysight 34932A Module Summary

Dual 4x16 Armature Matrix

[Simplified Schematic](#) | [Wiring Log](#) | [SCPI Commands Used](#) | [Key Specifications](#)

Simplified Schematic



NOTE

This module uses a *Safety Interlock* feature that prevents connections to the Analog Buses if no terminal block or cable is connected.

Wiring Log

A wiring log is available to make it easy to document your wiring configuration for this module. You can open the file in Microsoft® Excel or Adobe® Acrobat® format.

34932A Wiring Log: [Excel format](#) [Adobe PDF format](#)

SCPI Commands Used

ROUTe:CLOSe

ROUTe:CLOSe:EXCLusive

ROUTe:OPEN

Key Specifications

See the *Keysight 34931A-34933A Matrix Modules User's Guide* for detailed operating information.

Max Voltage	±300 V
Max Current	1 A
Bandwidth	30 MHz
Scanning Speed	100 chan/sec
Thermal Offset	< 3 μ V

Note: Product specifications are subject to change without notice.

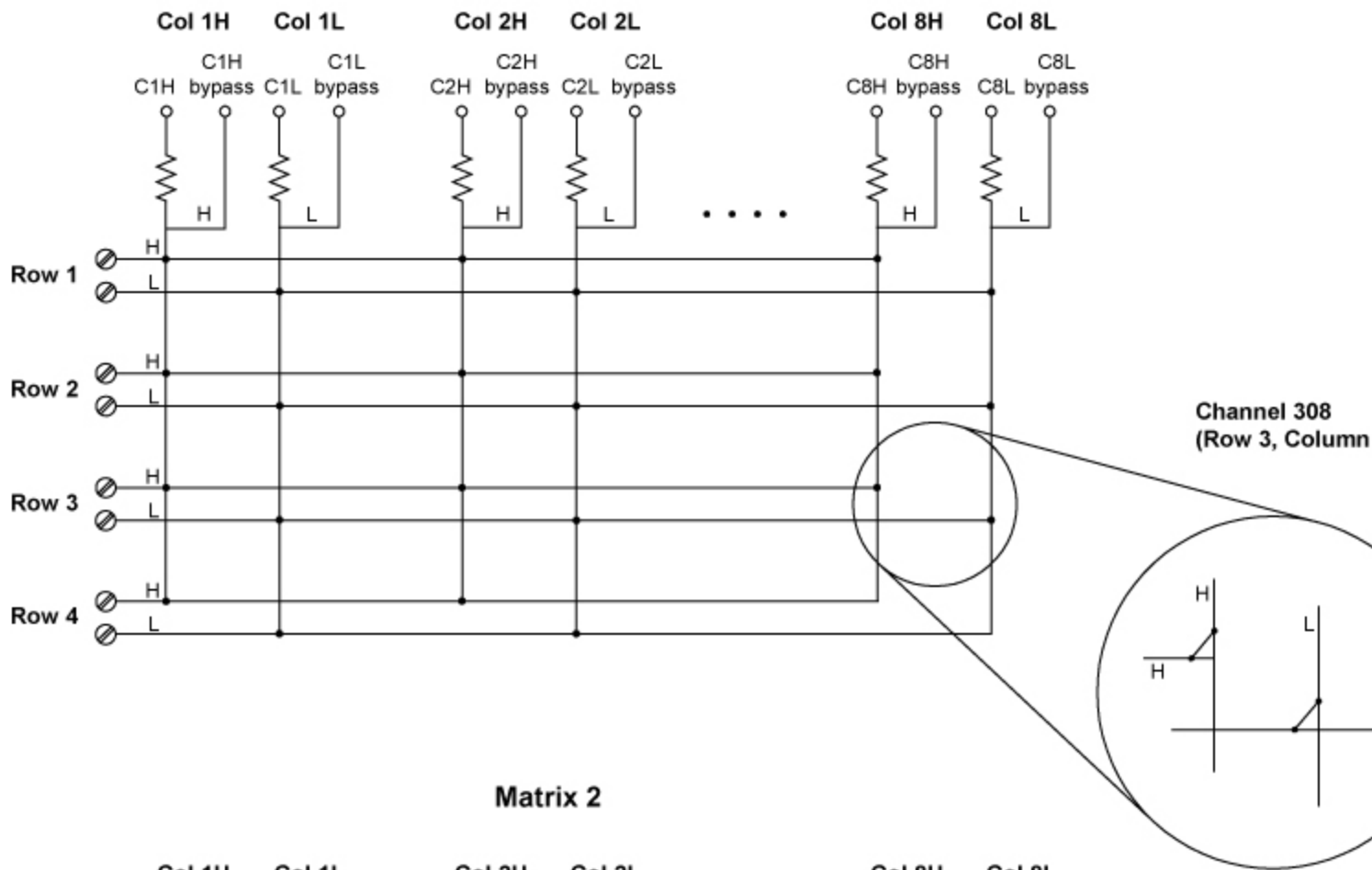
Keysight 34933A Module Summary

Dual 4x8 Reed Matrix

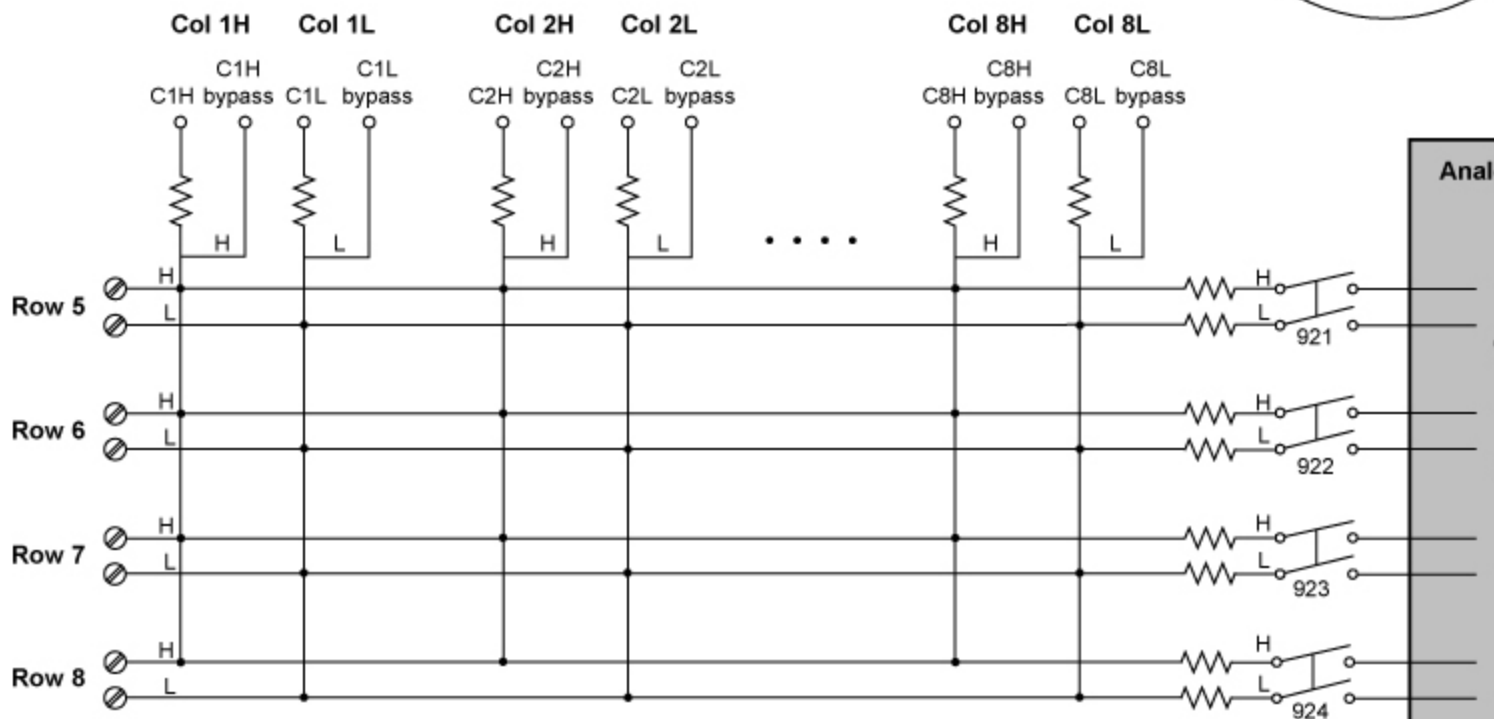
[Simplified Schematic](#) | [Wiring Log](#) | [SCPI Commands Used](#) | [Key Specifications](#)

Simplified Schematic (2-Wire Mode)

Matrix 1



Matrix 2



Notes:

Matrix 1 and Matrix 2 are electrically separate from one another.

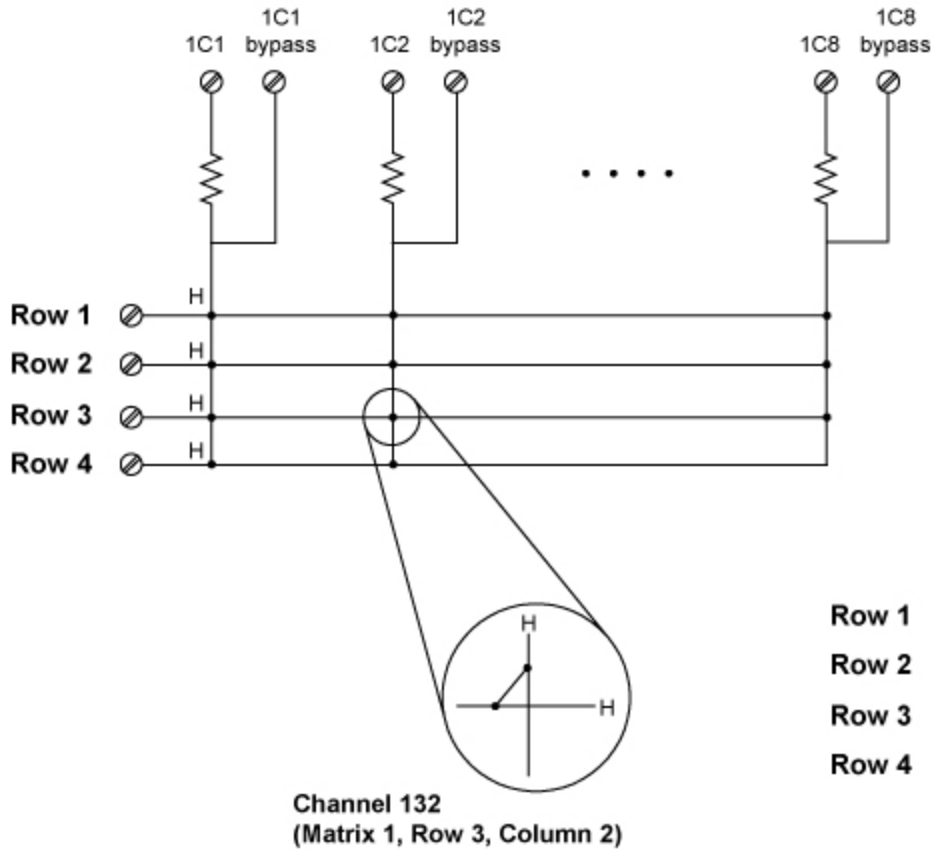
Matrix channel relays are non-latching reed relays.

Matrix 308 is a multifunction switch/measure unit.

All series resistors shown are 100Ω.

Simplified Schematic (1-Wire Mode)

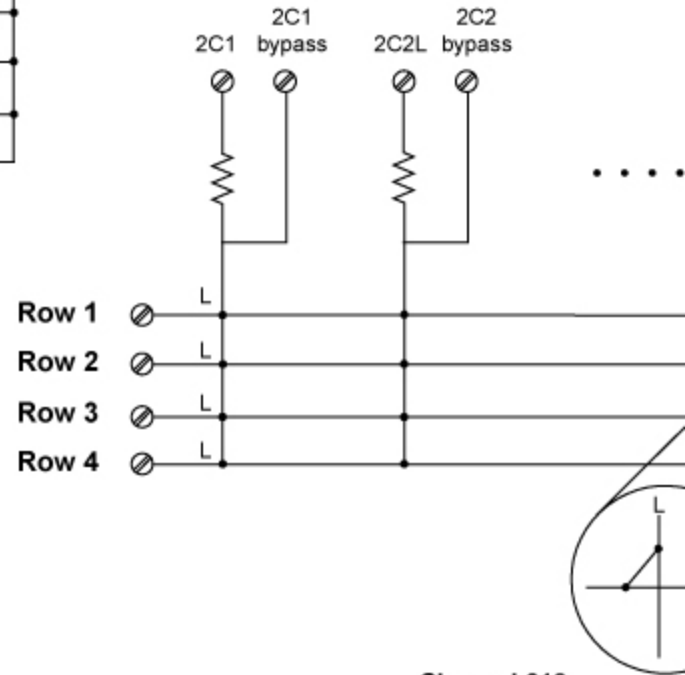
Matrix 1



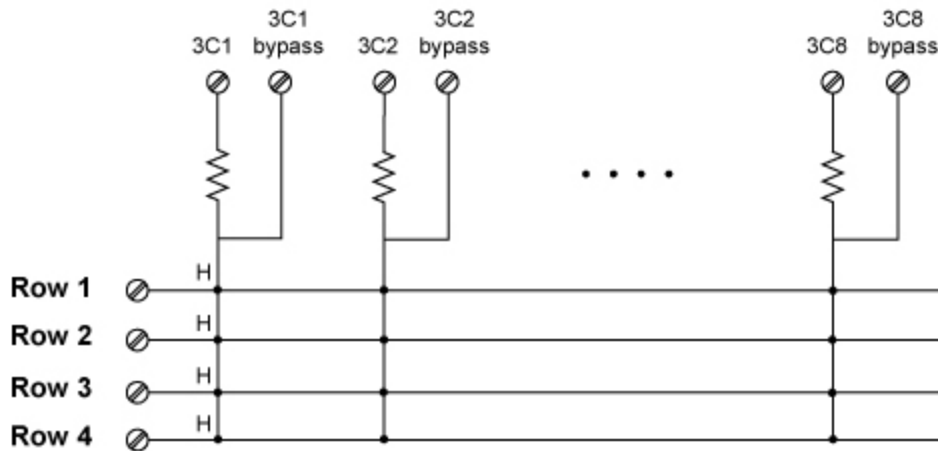
Notes:

Matrix 1 and Matrix 2 are electrically separated.
Matrix channel relays are non-latching relays.
Analog Bus relays are non-latching relays.
All series resistors shown are 100Ω.

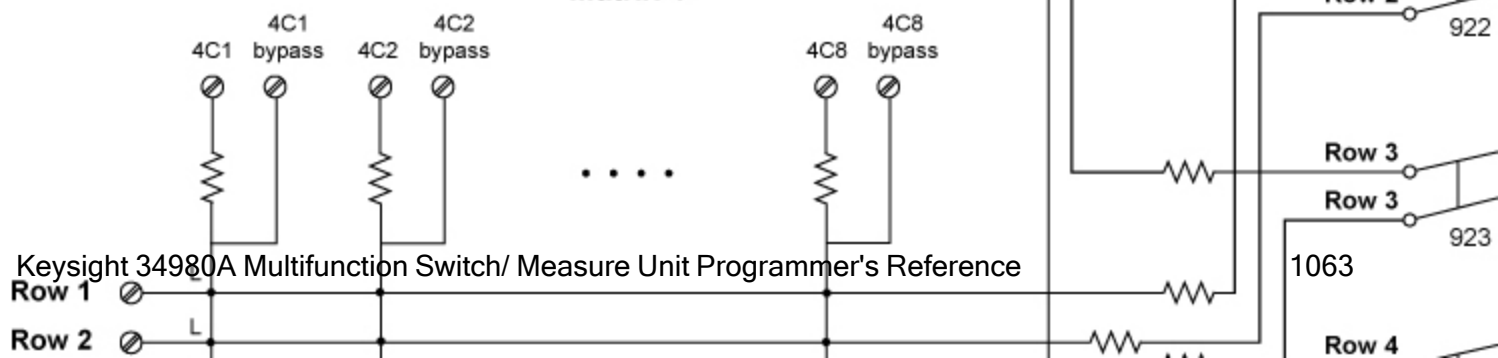
Matrix 2



Matrix 3



Matrix 4



NOTE

This module uses a *Safety Interlock* feature that prevents connections to the Analog Buses if no terminal block or cable is connected.

NOTE

Due to power dissipation issues, there is a limit to the number of relays that can be closed at a time on this module (you cannot close all channels simultaneously). See the **ROUTe:CLOSe** command for more information.

Wiring Log

A wiring log is available to make it easy to document your wiring configuration for this module. You can open the file in Microsoft® Excel or Adobe® Acrobat® format.

34933A Wiring Log (2-Wire Mode): [Excel format](#) [Adobe PDF format](#)

34933A Wiring Log (1-Wire Mode): [Excel format](#) [Adobe PDF format](#)

SCPI Commands Used

ROUTe:CLOSe

ROUTe:CLOSe:EXCLusive

ROUTe:OPEN

SYSTem:MODUle:WIRE:MODE

Key Specifications

See the *Keysight 34931A–34933A Matrix Modules User's Guide* for detailed operating information.

Max Voltage	±150 V
Max Current	0.5 A
Bandwidth	30 MHz
Scanning Speed	500 chan/sec
Thermal Offset	< 50 µV

Note: Product specifications are subject to change without notice.

Keysight 34934A Module Summary

High-Density Matrix

[Simplified Schematics](#) | [SCPI Commands Used](#) | [Key Specifications](#)

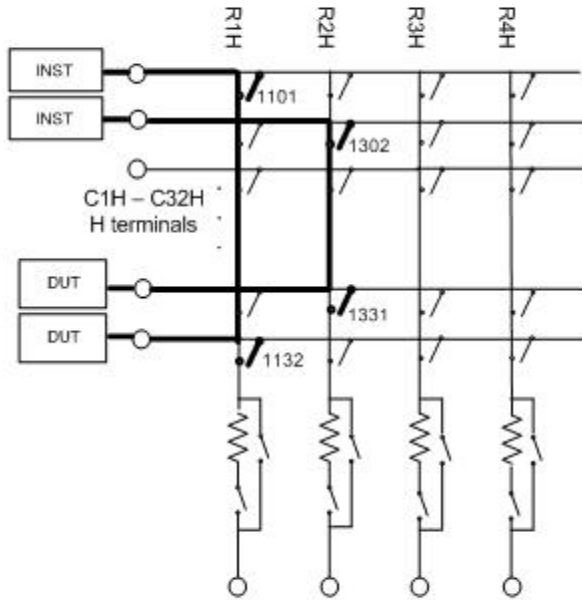
Simplified Schematics

4x32 1-wire operation (see also [34934A Channel Addressing](#))

Wiring Logs: [Excel Format](#) [Adobe PDF Format](#)

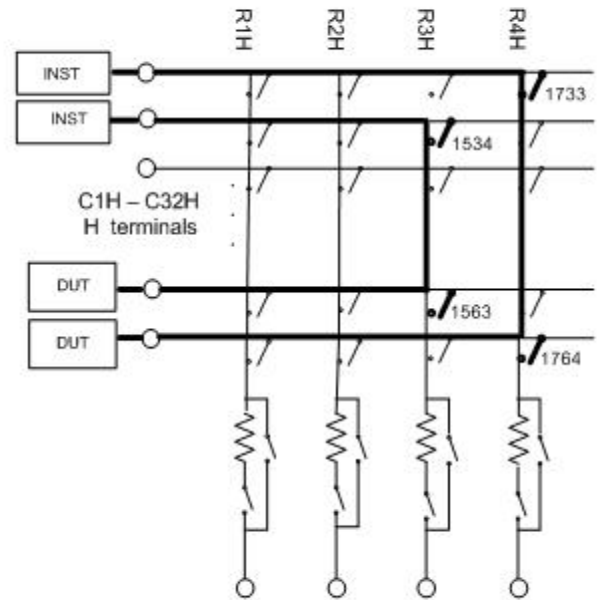
example paths

M1H



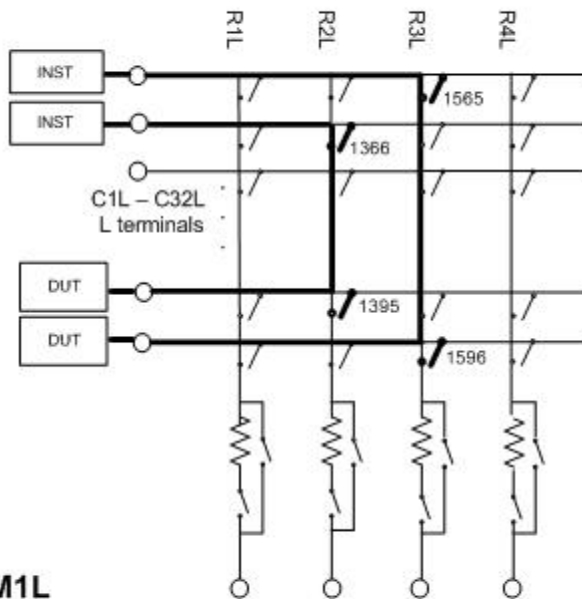
ROUT:CLOS (@1101,1132, 1302, 1331)
row 1H / columns 1, 32
row 2H / columns 2, 31

M2H



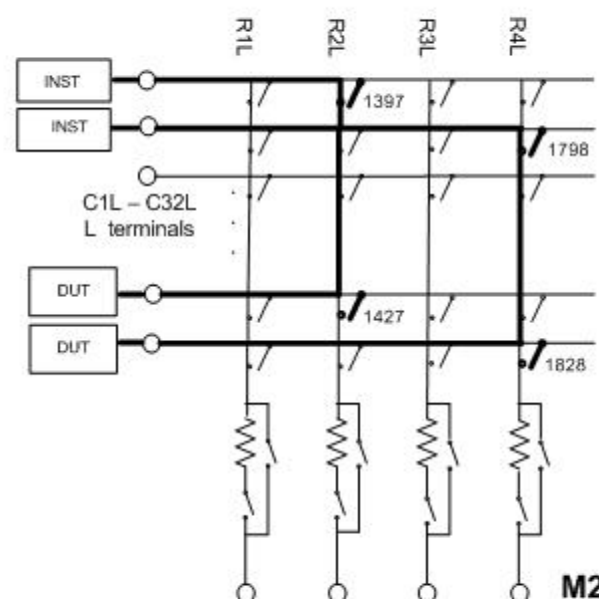
ROUT:CLOS (@1733,1764, 1534, 1563)
row 4H / columns 1, 32
row 3H / columns 2, 31

M1L



ROUT:CLOS (@1565,1596, 1366, 1395)
row 3L / columns 1, 32
row 2L / columns 2, 31

M2L

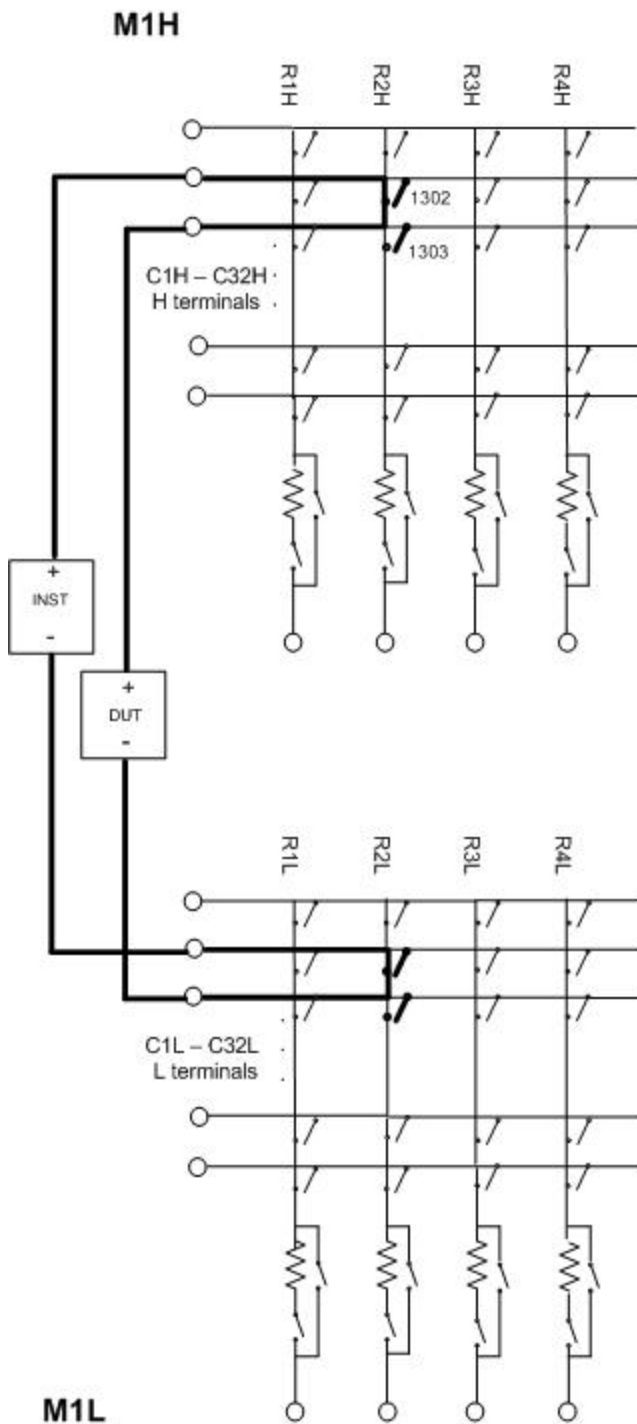


ROUT:CLOS (@1397,1427, 1798, 1828)
row 2L / columns 1, 31
row 4L / columns 2, 32

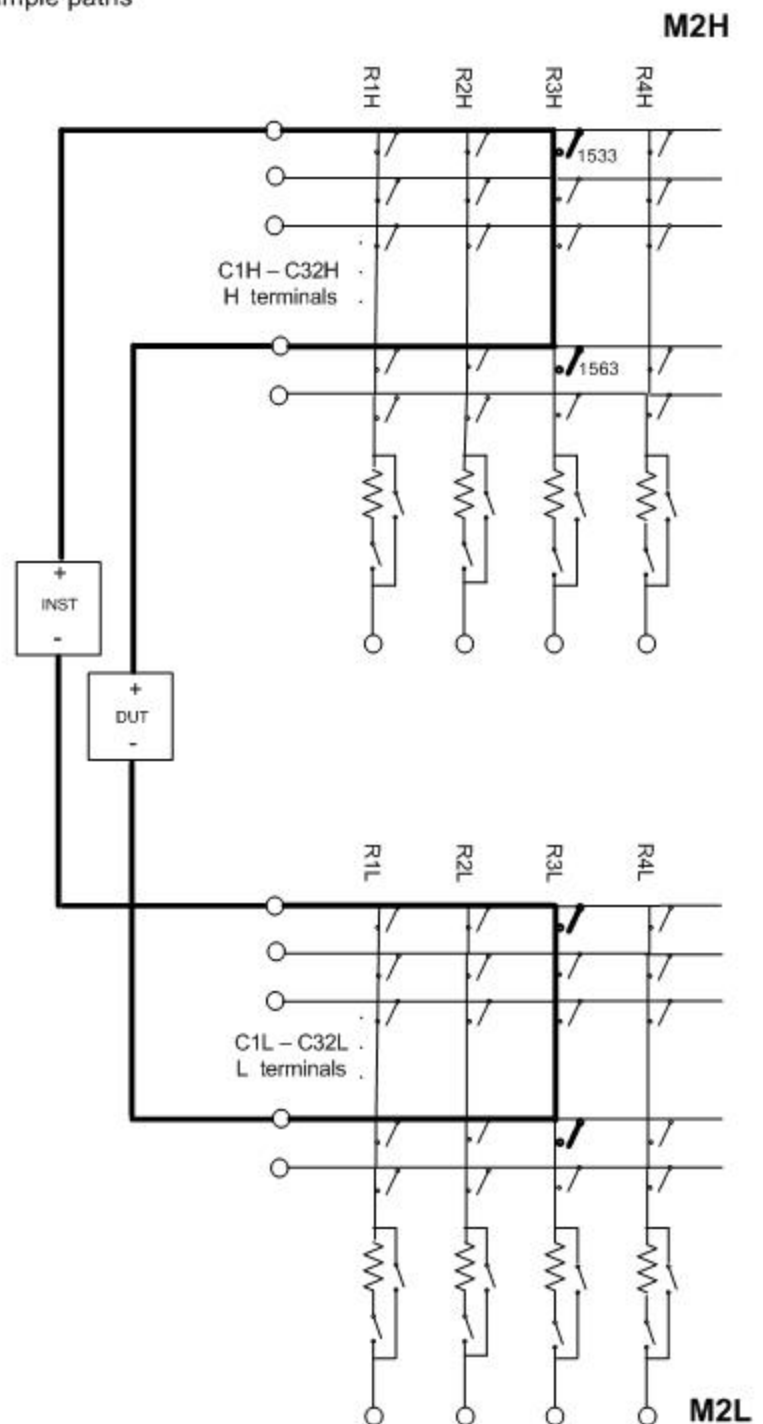
4x32 2-wire operation (see also [34934A Channel Addressing](#))

Wiring Logs: [Excel Format](#) [Adobe PDF Format](#)

example paths



ROUT:CLOS:PAIR (@1302, 1303) row 2H / M1H columns 2, 3
Paired channels are: 1366 1367 row 2L / M1L columns 2, 3

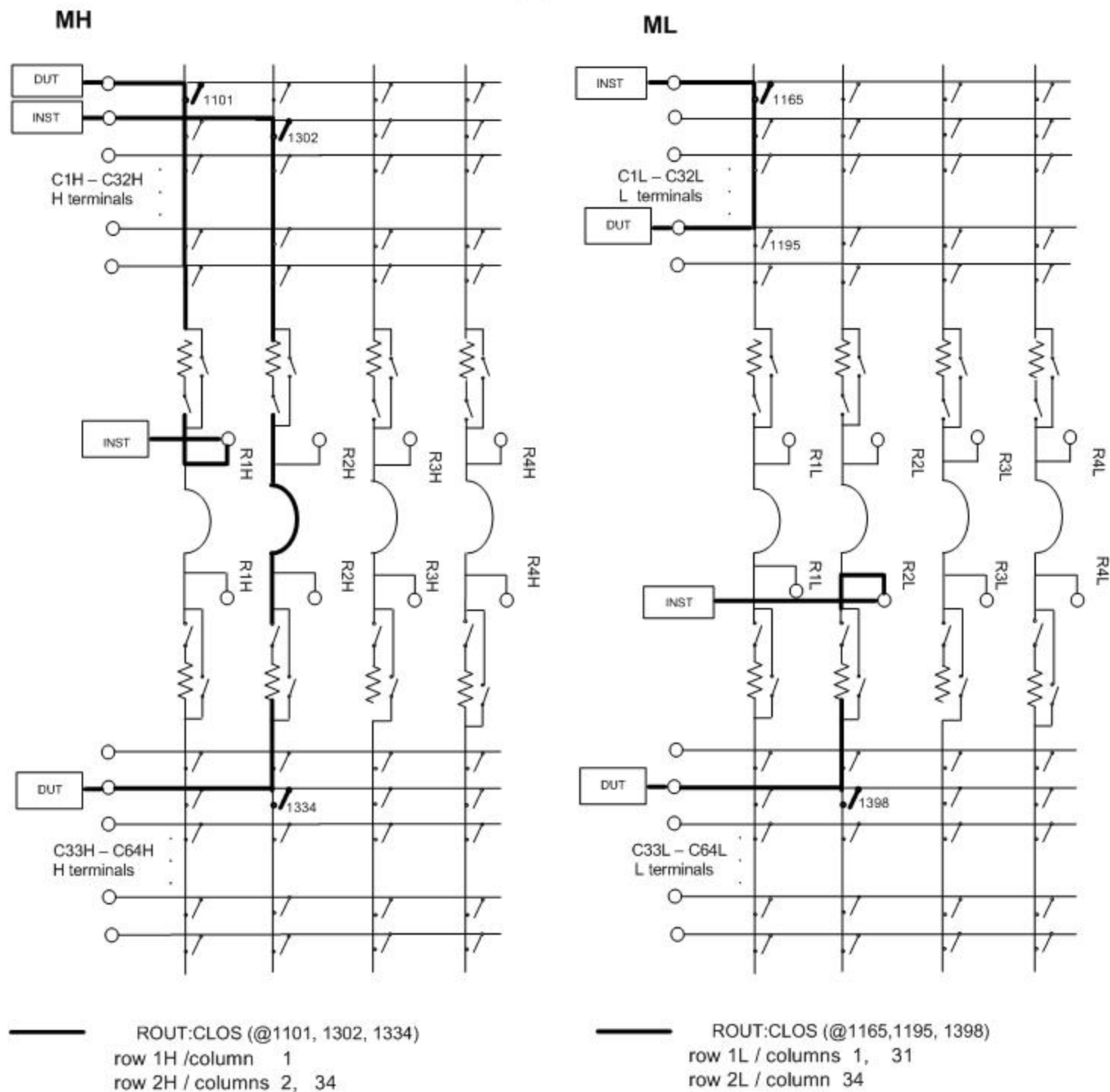


ROUT:CLOS:PAIR (@1533, 1563) row 3H / M2H columns 1, 3
Paired channels are: 1597 1627 row 3L / M2L columns 1, 3

4x64 1-wire operation (see also [34934A Channel Addressing](#))

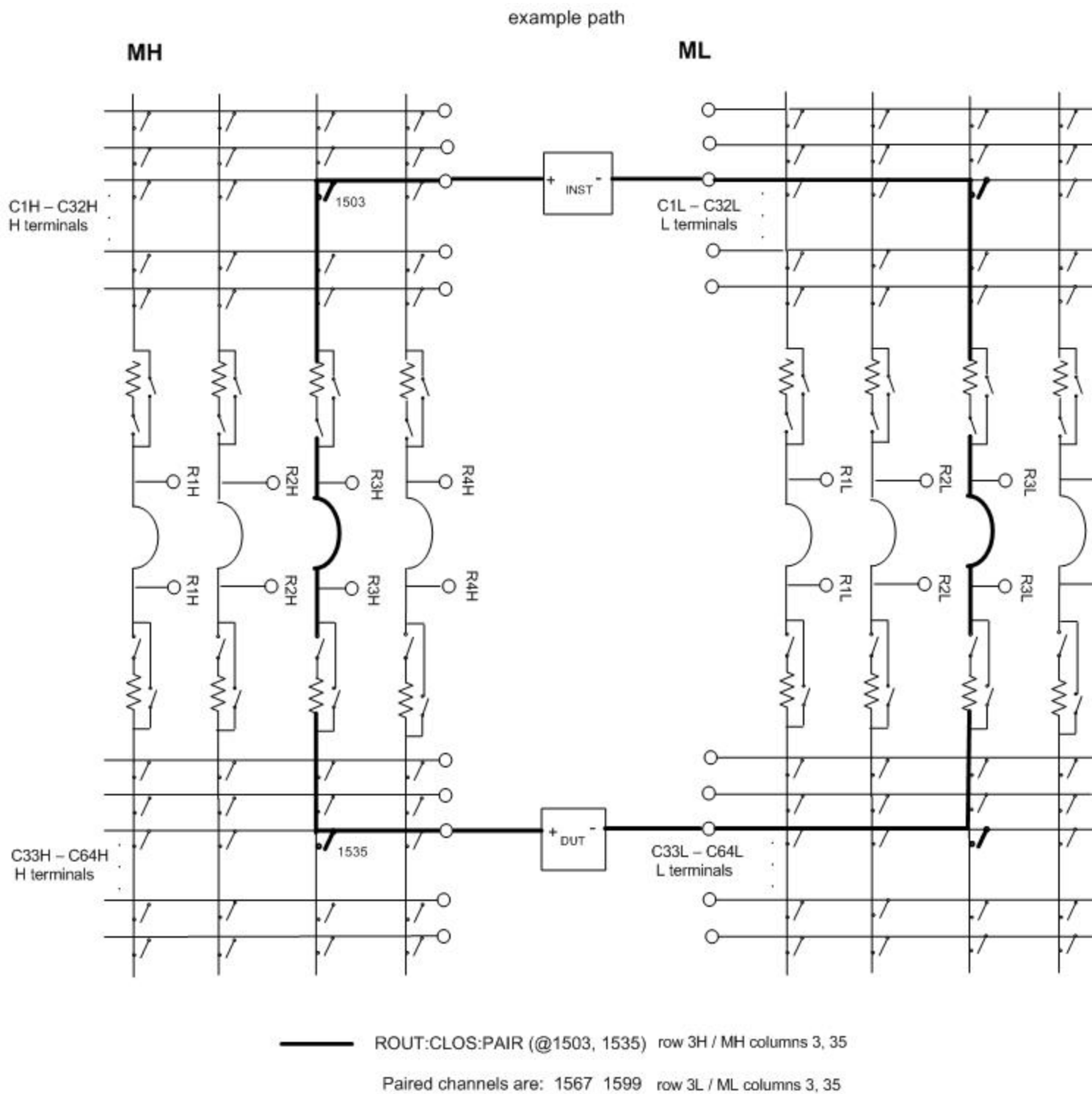
Wiring Logs: [Excel Format](#) [Adobe PDF Format](#)

example paths



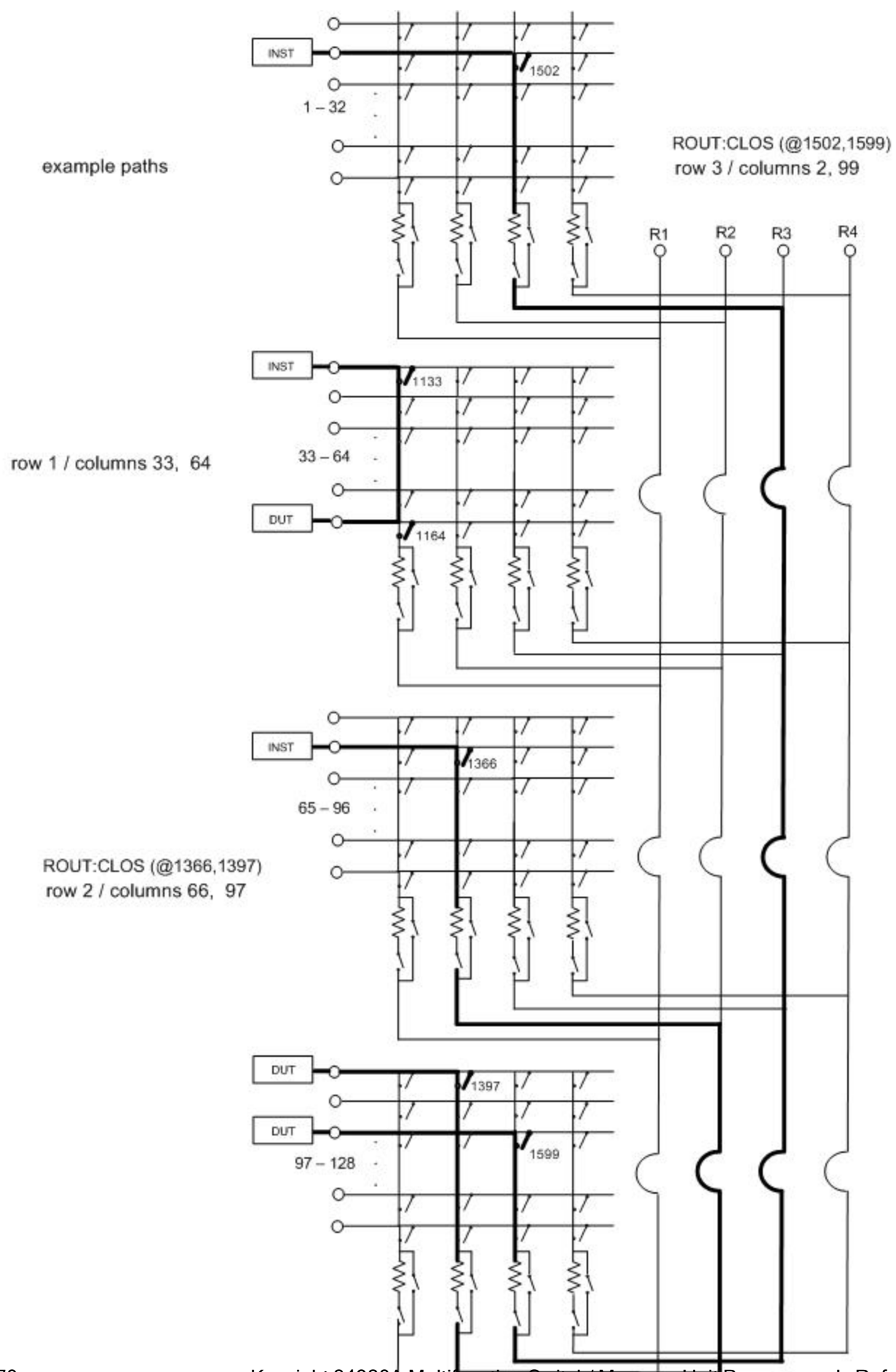
4x64 2-wire operation (see also [34934A Channel Addressing](#))

Wiring Logs: [Excel Format](#) [Adobe PDF Format](#)

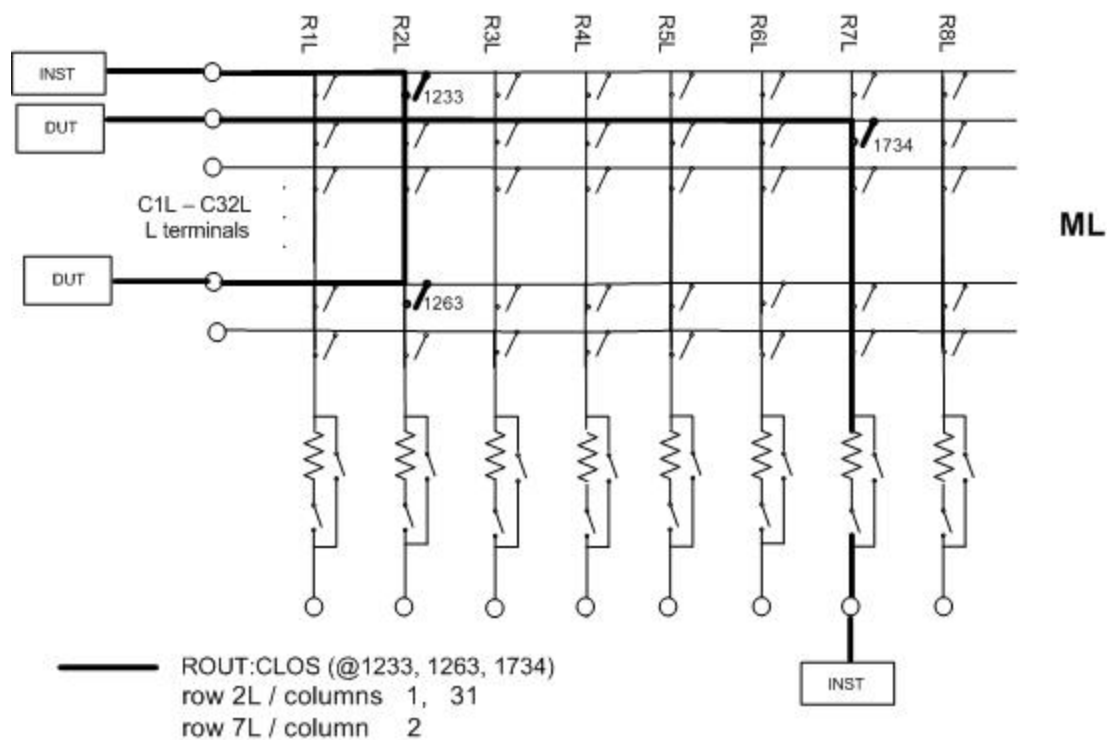


4x128 1-wire operation (see also [34934A Channel Addressing](#))

Wiring Logs: [Excel Format](#) [Adobe PDF Format](#)

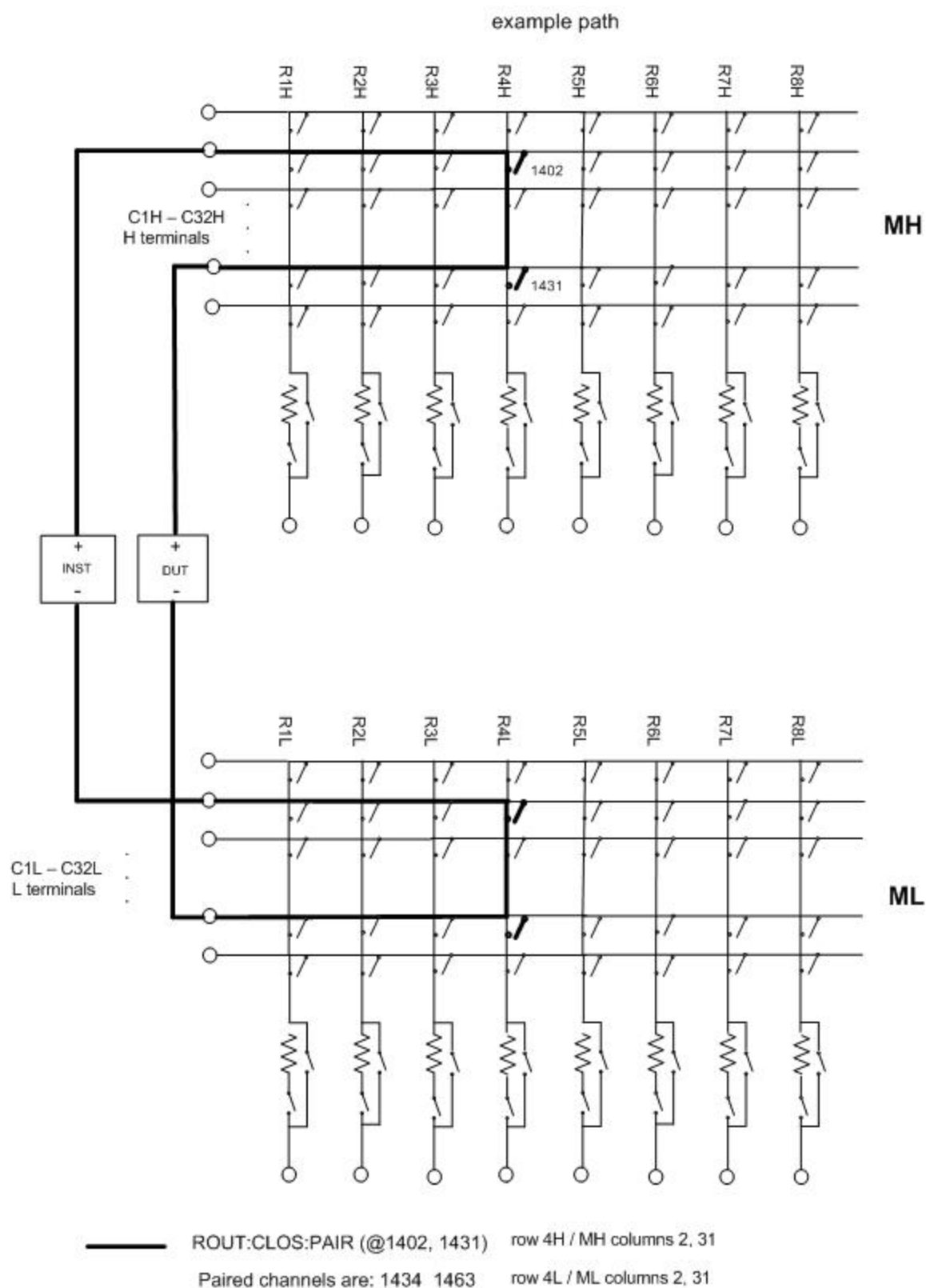


Wiring Logs: [Excel Format](#) [Adobe PDF Format](#)



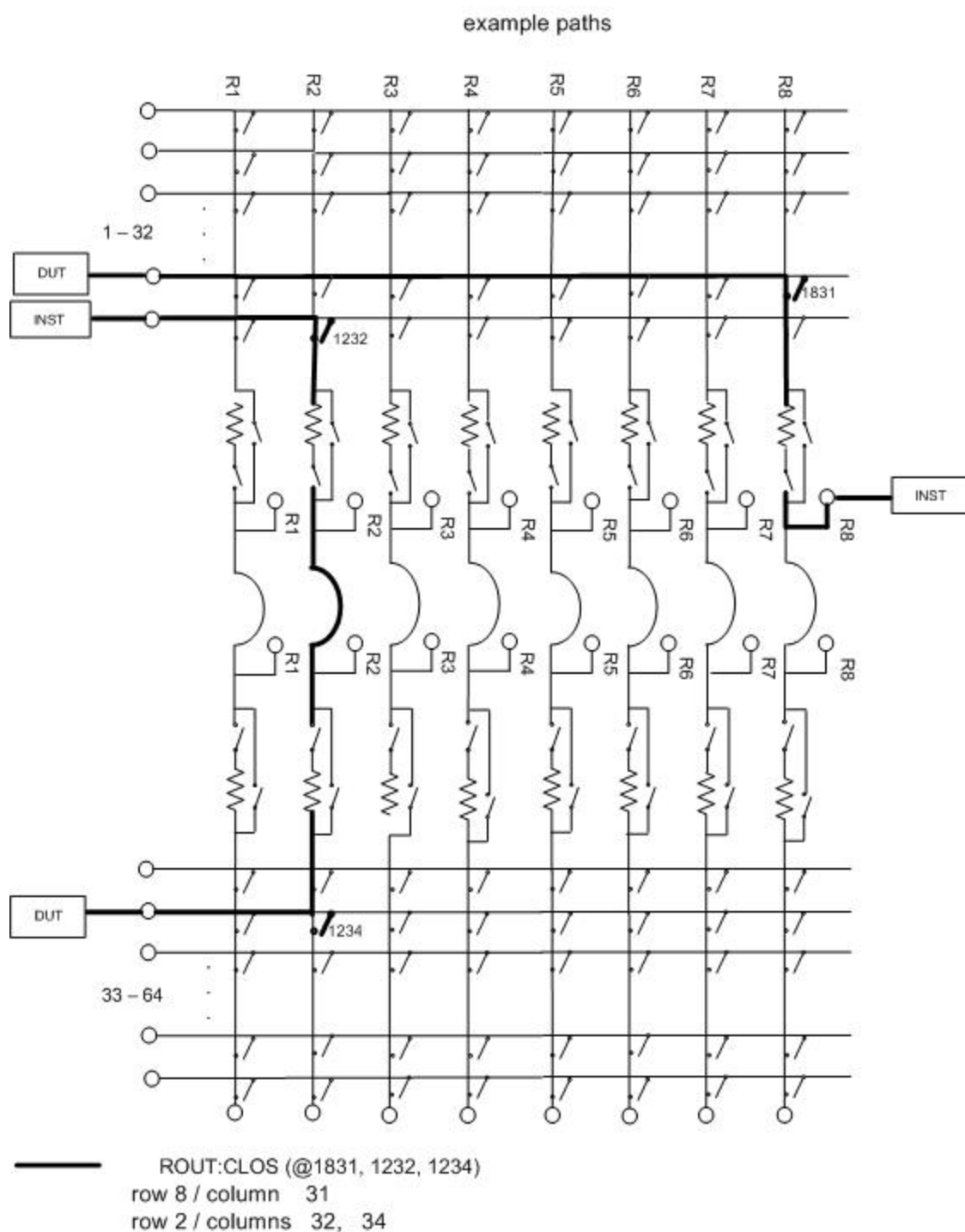
8x32 2-wire operation (see Also [34934A Channel Addressing](#))

Wiring Logs: [Excel Format](#) [Adobe PDF Format](#)



8x64 1-wire operation (see also [34934A Channel Addressing](#))

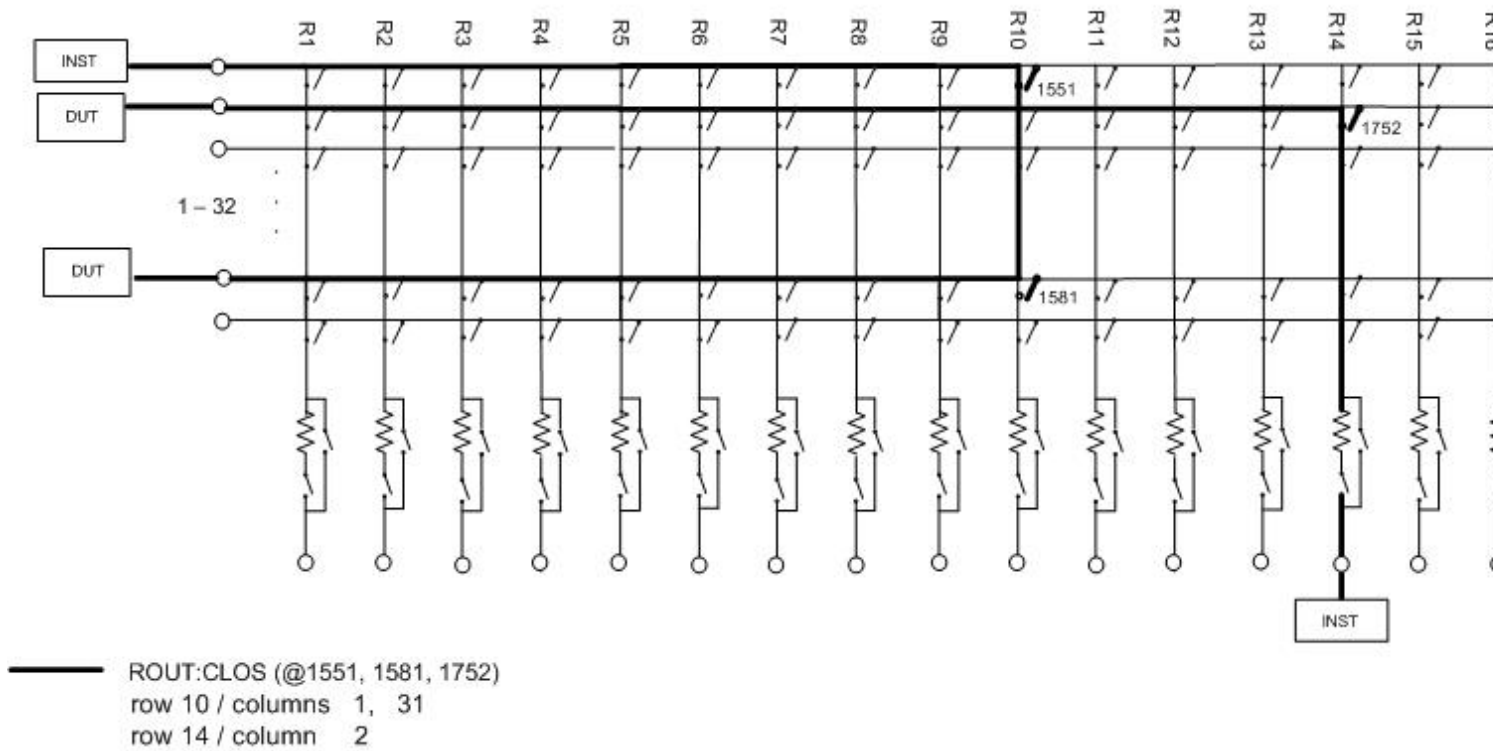
Wiring Logs: [Excel Format](#) [Adobe PDF Format](#)



16x32 1-wire operation (see also [34934A Channel Addressing](#))

Wiring Logs: [Excel Format](#) [Adobe PDF Format](#)

example paths



SCPI Commands Used

ROUTe:CLOSe

ROUTe:CLOSe:EXCLusive

ROUTe:CLOSe:PAIR

ROUTe:OPEN

ROUTe:OPEN:PAIR

SYSTem:MODUle:ROW:PROTection

SYSTem:MODUle:TERMinal:TYPE?

Key Specifications

See the *Keysight 34934A High Density Matrix Module User's Guide* for detailed operating information.

Max Voltage	±100 V
Max Current	0.5 A
Bandwidth	35 MHz
Scanning Speed	500 chan/sec
Thermal Offset	< 50 µV

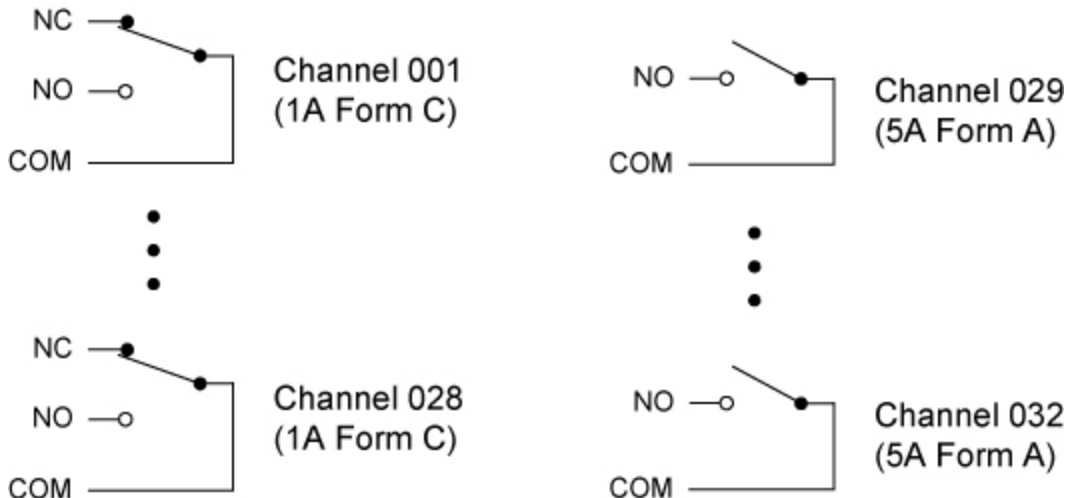
Note: Product specifications are subject to change without notice.

Keysight 34937A Module Summary

32-Channel Form C/Form A General-Purpose Switch

[Simplified Schematic](#) | [Wiring Log](#) | [SCPI Commands Used](#) | [Key Specifications](#)

Simplified Schematic



Wiring Log

A wiring log is available to make it easy to document your wiring configuration for this module. You can open the file in Microsoft® Excel or Adobe® Acrobat® format.

34937A Wiring Log: [Excel format](#) [Adobe PDF format](#)

SCPI Commands Used

ROUTe:CLOSe

ROUTe:CLOSe:EXCLusive

ROUTe:OPEN

SYSTem:MODUle:PFAl:JUMPer:AMP5?

SYSTem:MODUle:TEMPerature?

Key Specifications

See the *Keysight 34937A-34939A General Purpose Switch Modules User's Guide* for detailed operating information.

	Form C Relays	Form A Relays
Max Voltage	300 V	250 Vac
Max Current	1 A	5 A
Bandwidth	10 MHz	10 MHz
Thermal Offset	< 3 μ V	< 3 μ V

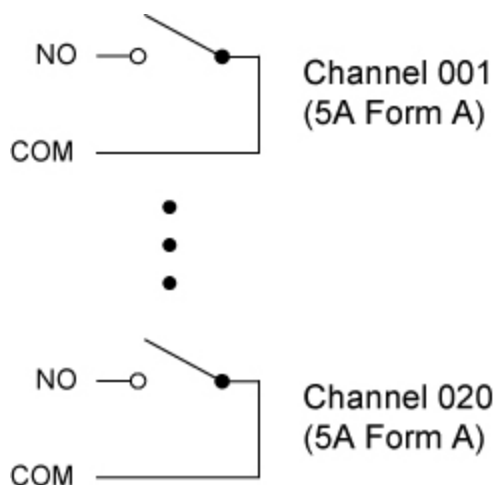
Note: Product specifications are subject to change without notice.

Keysight 34938A Module Summary

20-Channel 5A Form A Switch

[Simplified Schematic](#) | [Wiring Log](#) | [SCPI Commands Used](#) | [Key Specifications](#)

Simplified Schematic



Wiring Log

A wiring log is available to make it easy to document your wiring configuration for this module. You can open the file in Microsoft® Excel or Adobe® Acrobat® format.

34938A Wiring Log: [Excel format](#) [Adobe PDF format](#)

SCPI Commands Used

[ROUTe:CLOSe](#)

[ROUTe:CLOSe:EXCLusive](#)

[ROUTe:OPEN](#)

[SYSTem:MODUle:PFAl:JUMPer:AMP5?](#)

[SYSTem:MODUle:TEMPerature?](#)

Key Specifications

See the *Keysight 34937A-34939A General Purpose Switch Modules User's Guide* for detailed operating information.

Max Voltage	250 Vac

Max Current	5 A
Bandwidth	10 MHz
Thermal Offset	< 3 μ V

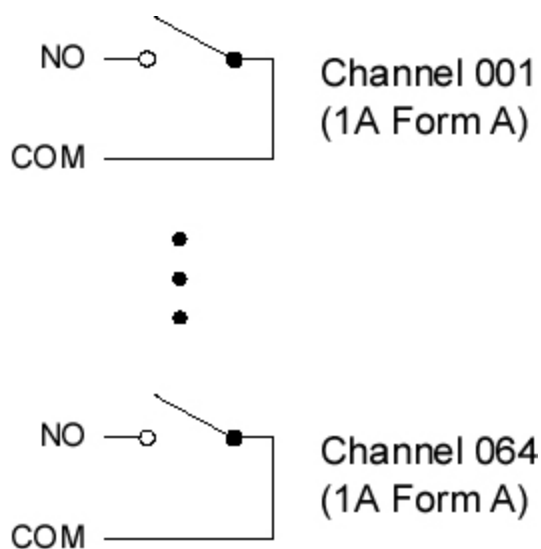
Note: Product specifications are subject to change without notice.

Keysight 34939A Module Summary

64-Channel 1A Form A Switch

[Simplified Schematic](#) | [Wiring Log](#) | [SCPI Commands Used](#) | [Key Specifications](#)

Simplified Schematic



Wiring Log

A wiring log is available to make it easy to document your wiring configuration for this module. You can open the file in Microsoft® Excel or Adobe® Acrobat® format.

34939A Wiring Log: [Excel format](#) [Adobe PDF format](#)

SCPI Commands Used

ROUTe:CLOSe

ROUTe:CLOSe:EXCLusive

ROUTe:OPEN

SYSTem:MODule:TEMPerature?

Key Specifications

See the *Keysight 34937A-34939A General Purpose Switch Modules User's Guide* for detailed operating information.

Max Voltage	250 Vac

Max Current	1 A
Bandwidth	10 MHz
Thermal Offset	< 3 μ V

Note: Product specifications are subject to change without notice.

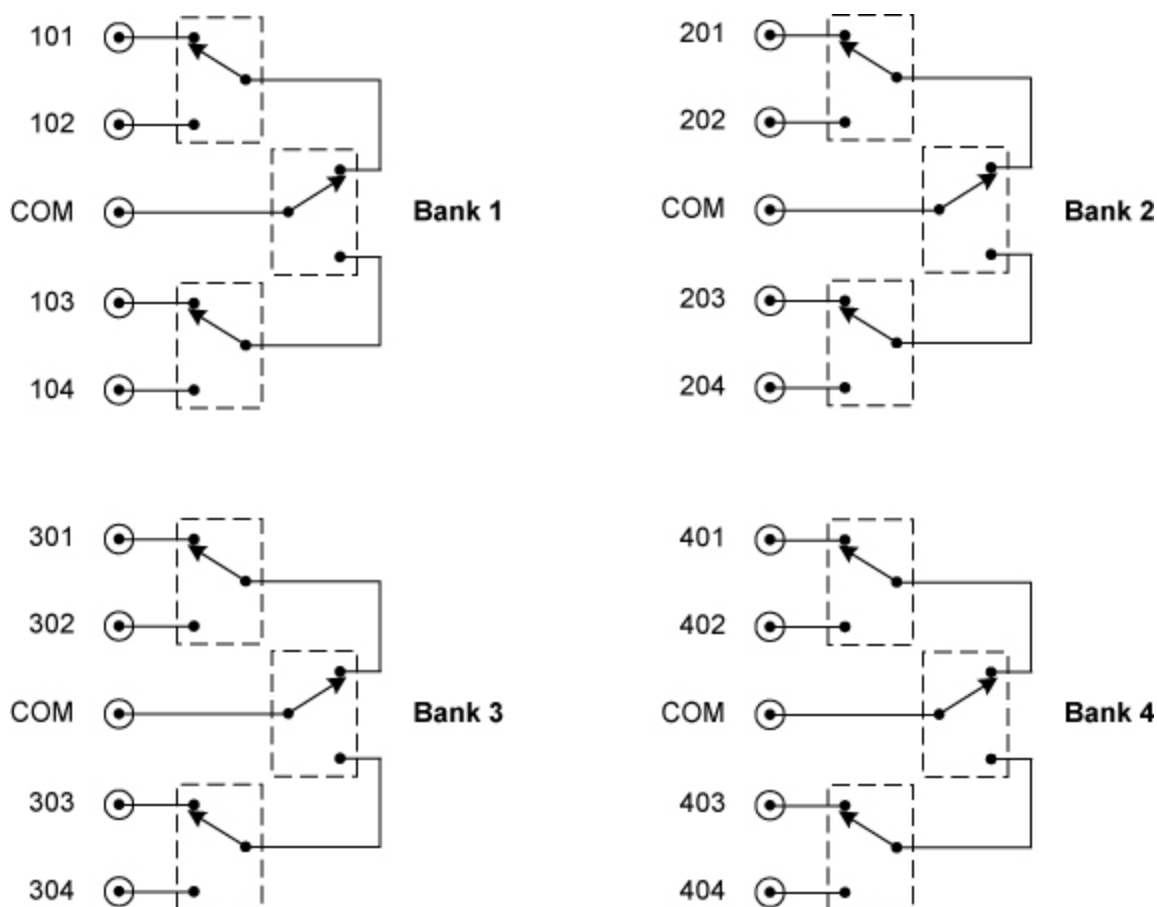
Keysight 34941A Module Summary

Quad 1x4 50Ω RF Multiplexer

See the *Keysight 34941A-34942A RF Multiplexer Modules User's Guide* for detailed operating information.

[Simplified Schematic](#) | [Wiring Log](#) | [SCPI Commands Used](#)

Simplified Schematic



Wiring Log

A wiring log is available to make it easy to document your wiring configuration for this module. You can open the file in Microsoft® Excel or Adobe® Acrobat® format.

34941A Wiring Log: [Excel format](#) [Adobe PDF format](#)

SCPI Commands Used

[ROUTe:CLOSe](#)

ROUTe:CLOSe:EXCLusive

NOTE

This module will *not* respond to the ROUTe:OPEN command (an error is generated). To "open" a channel on these modules, send the ROUTe:CLOSe command to a different channel in the same bank.

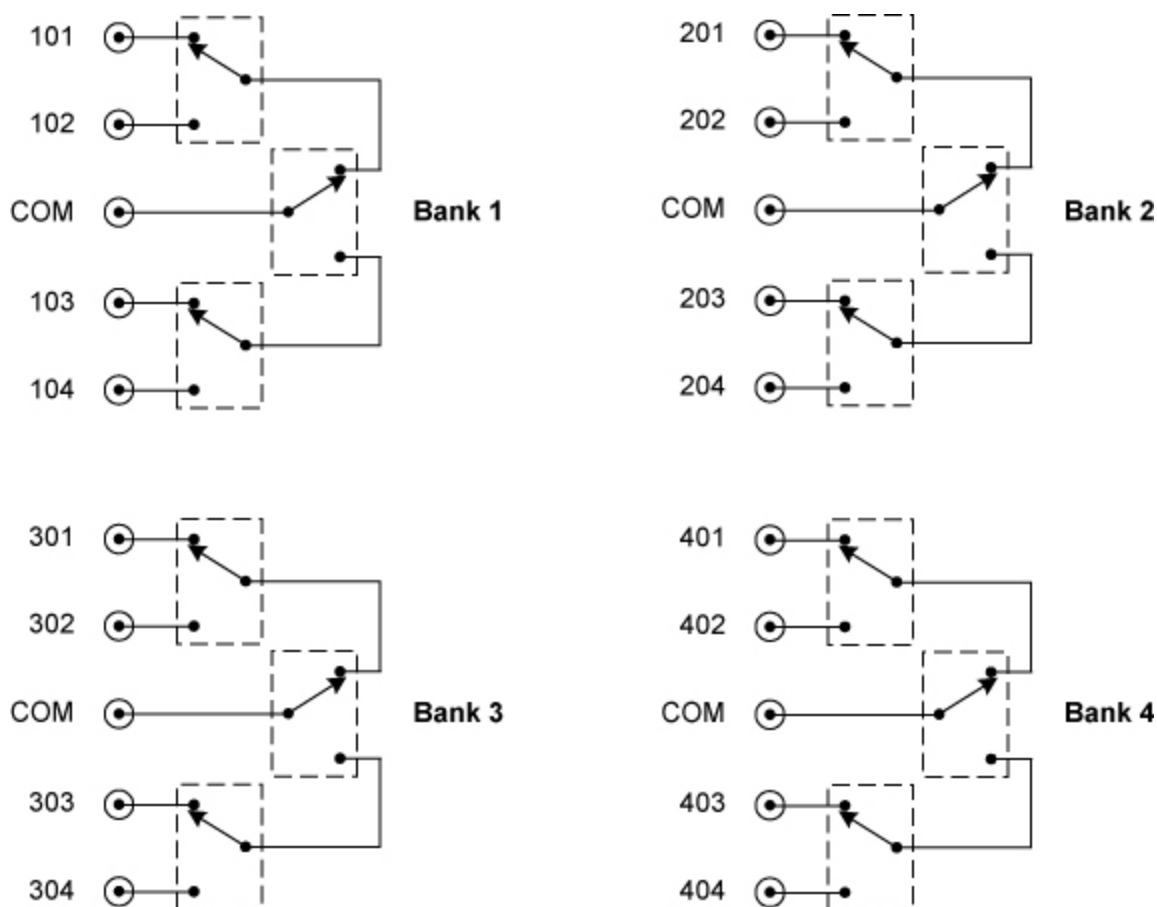
Keysight 34942A Module Summary

Quad 1x4 75Ω RF Multiplexer

See the *Keysight 34941A-34942A RF Multiplexer Modules User's Guide* for detailed operating information.

[Simplified Schematic](#) | [Wiring Log](#) | [SCPI Commands Used](#)

Simplified Schematic



Wiring Log

A wiring log is available to make it easy to document your wiring configuration for this module. You can open the file in Microsoft® Excel or Adobe® Acrobat® format.

34942A Wiring Log: [Excel format](#) [Adobe PDF format](#)

SCPI Commands Used

[ROUTe:CLOSe](#)

ROUTe:CLOSe:EXCLusive

NOTE

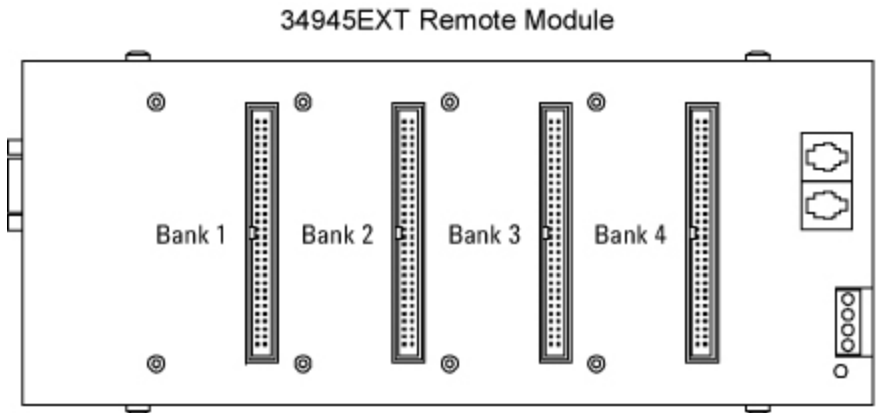
This module will *not* respond to the ROUTe:OPEN command (an error is generated). To "open" a channel on these modules, send the ROUTe:CLOSe command to a different channel in the same bank.

Keysight 34945A Module Summary

Microwave Switch/Attenuator Driver

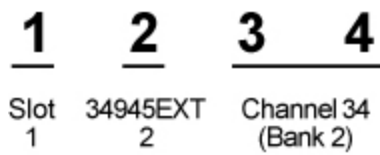
[Channel Numbering](#) | [SCPI Commands Used](#) | [Key Specifications](#)

Channel Numbering



Bank	Channels	Channels
Bank 1	1 – 8	11 – 18
Bank 2	21 – 28	31 – 38
Bank 3	41 – 48	51 – 58
Bank 4	61 – 68	71 – 78

Example: ROUTE:CLOSE (@1234)



SCPI Commands Used

ROUTe:CHANnel:DRIVE:CLOSe:DEFault
ROUTe:CHANnel:DRIVE:OPeN:DEFault
ROUTe:CHANnel:DRIVE:PAIRed[:MODE]
ROUTe:CHANnel:DRIVE:PULSe[:MODE]
ROUTe:CHANnel:DRIVE:PULSe:WIDTh

ROUTe:CHANnel:DRIVE:STATe?
 ROUTe:CHANnel:DRIVE:TIME:RECoverY
 ROUTe:CHANnel:DRIVE:TIME:SETTle
 ROUTe:CHANnel:VERify[:ENABle]
 ROUTe:CHANnel:VERify:POLarity
 ROUTe:CHANnel:VERify:POSition:STATe?
 ROUTe:CLOSe
 ROUTe:OPEN
 ROUTe:RMODule:BANK:DRIVE[:MODE]
 ROUTe:RMODule:BANK:LED:DRIVE[:ENABle]
 ROUTe:RMODule:BANK:LED:DRIVE:LEVel
 ROUTe:RMODule:BANK:PRESet
 ROUTe:RMODule:DRIVE:LIMit
 ROUTe:RMODule:DRIVE:SOURce:BOOT
 ROUTe:RMODule:DRIVE:SOURce[:IMMediate]
 SYSTem:CDEScription:RMODule?
 SYSTem:CTYPe:RMODule?
 SYSTem:RMODule:RESet
 SYSTem:RMODule:STATus?

Key Specifications

See the *Keysight 34945A Microwave Switch/Attenuator Driver Module User's Guide* for detailed operating information.

34945EXT Switch Drive (64 channels, Open-Collector Mode)	
Driver Off Voltage (max)	30 V
Driver Off Leakage Current	< 500 μ V
Driver On Current (max)	600 mA
Driver On Voltage (max)	0.5 V @ 600 mA

34945EXT Switch Drive (64 channels, TTL Mode)	
HI Output Voltage	3 V, I _{out} = 2 mA
LO Output Voltage	0.4 V, I _{in} = 20 mA
LO Input Current	20 mA

34945EXT Position Indicator Sense Inputs	
Channels	64
LO Input Voltage (max)	0.8 V
HI Input Voltage (min)	2.5 V
Input Resistance	>100 k Ω
Maximum Input Voltage	30 V

34945EXT Switch Drive Power Supply (34945EXT powered by 34945A)	
Voltage	24 V nominal
Current	100 mA Continuous + 200 mA (15 ms pulse, 25% duty cycle)

34945EXT External Power Connection	
Voltage Range	4.75 V to 30 V
Current Limit	> 2 A

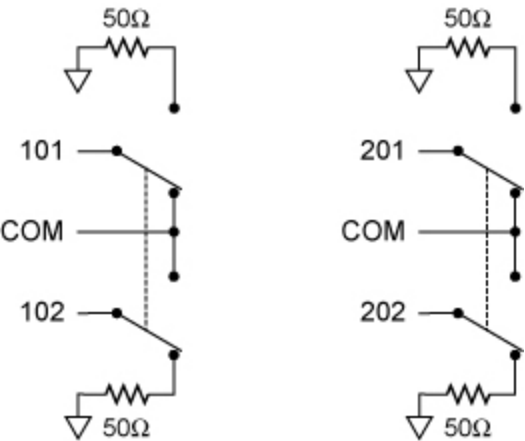
Note: Product specifications are subject to change without notice.

Keysight 34946A Module Summary

Dual 1x2 SPDT Terminated Microwave Switch

[Simplified Schematic](#) | [Wiring Log](#) | [SCPI Commands Used](#) | [Key Specifications](#)

Simplified Schematic



Wiring Log

A wiring log is available to make it easy to document your wiring configuration for this module. You can open the file in Microsoft® Excel or Adobe® Acrobat® format.

34946A Wiring Log: [Excel format](#) [Adobe PDF format](#)

SCPI Commands Used

ROUTe:CLOSe

ROUTe:CLOSe:EXCLusive

NOTE

This module will *not* respond to the ROUTe:OPEN command (an error is generated). To "open" a channel on these modules, send the ROUTe:CLOSe command to a different channel in the same bank.

Key Specifications

See the *Keysight 34946A-34947A Microwave Switch/ Driver Module User's Guide* for detailed operating information.

	@ 4 GHz	@ 20 GHz
Insertion Loss	< 0.42 dB	< 0.69 dB

Isolation	> 85 dB	> 67 dB
Frequency Range	4 GHz	20 GHz
VSWR	< 1.15	< 1.30
Input Impedance	50 Ω	50 Ω

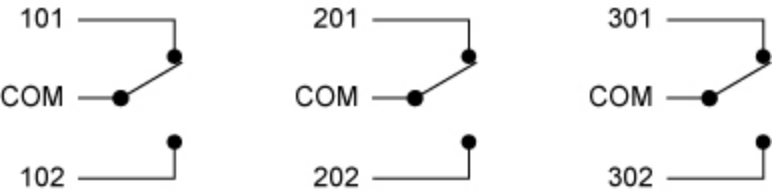
Note: Product specifications are subject to change without notice.

Keysight 34947A Module Summary

Triple 1x2 SPDT Underminated Microwave Switch

[Simplified Schematic](#) | [Wiring Log](#) | [SCPI Commands Used](#) | [Key Specifications](#)

Simplified Schematic



Wiring Log

A wiring log is available to make it easy to document your wiring configuration for this module. You can open the file in Microsoft® Excel or Adobe® Acrobat® format.

34947A Wiring Log: [Excel format](#) [Adobe PDF format](#)

SCPI Commands Used

ROUTe:CLOSe

ROUTe:CLOSe:EXCLusive

NOTE

This module will *not* respond to the ROUTe:OPEN command (an error is generated). To "open" a channel on these modules, send the ROUTe:CLOSe command to a different channel in the same bank.

Key Specifications

See the *Keysight 34946A–34947A Microwave Switch/ Driver Module User's Guide* for detailed operating information.

	@ 4 GHz	@ 20 GHz
Insertion Loss	< 0.42 dB	< 0.69 dB
Isolation	> 85 dB	> 67 dB
Frequency Range	4 GHz	20 GHz
VSWR	< 1.15	< 1.30
Input Impedance	50Ω	50Ω

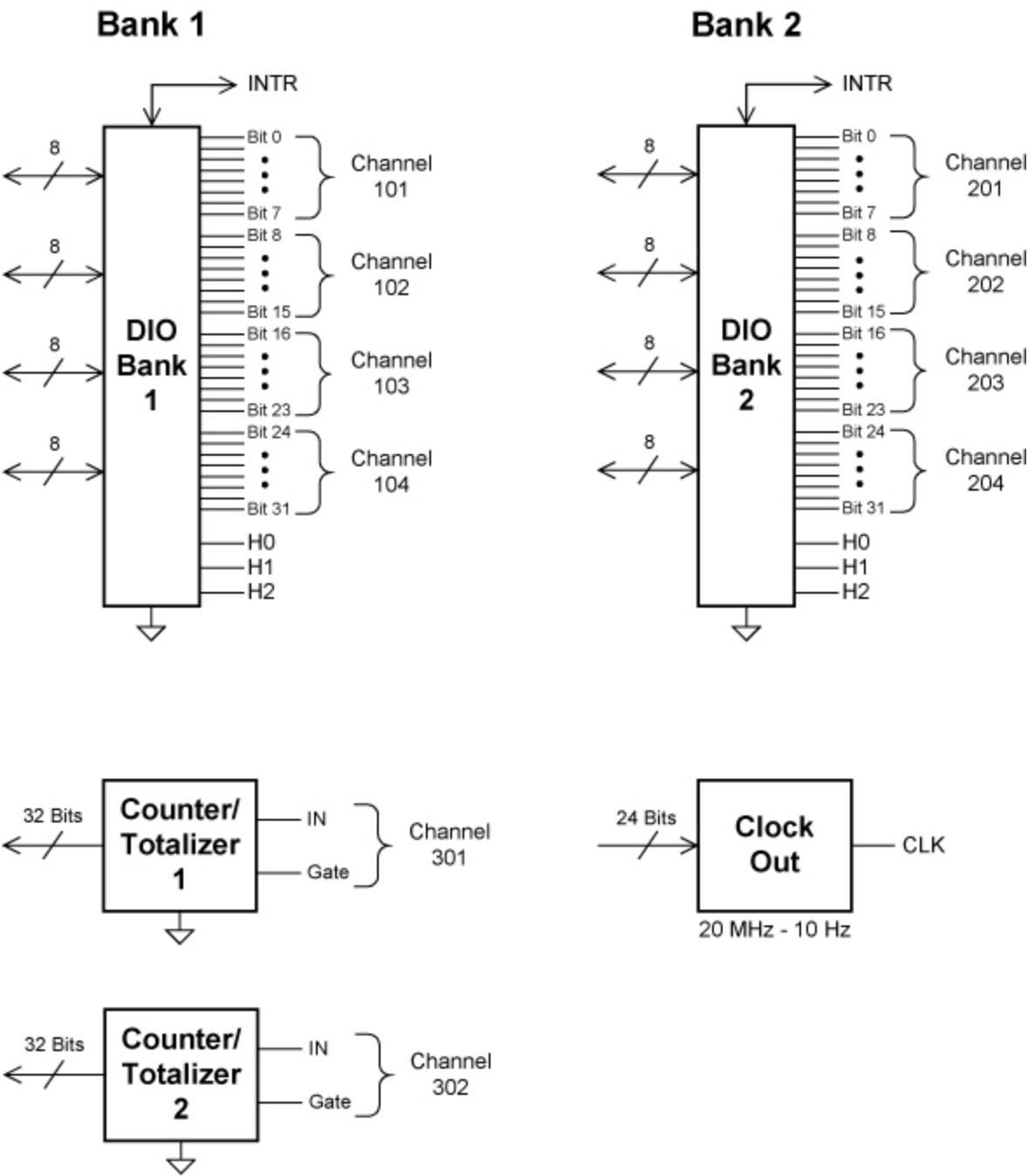
Note: Product specifications are subject to change without notice.

Keysight 34950A Module Summary

64-Bit Digital I/O Module with Memory and Counter

[Simplified Block Diagram](#) | [Wiring Log](#) | [SCPI Commands Used](#) | [Key Specifications](#)

Simplified Block Diagram



Wiring Log

A wiring log is available to make it easy to document your wiring configuration for this module. You can open the file in Microsoft® Excel or Adobe® Acrobat® format.

34950A Wiring Log: [Excel format](#) [Adobe PDF format](#)

SCPI Commands Used

Digital I/O:

CONFigure:DIGital

CONFigure:DIGital:DIRection

CONFigure:DIGital:POLarity

CONFigure:DIGital:WIDTh

MEASure:DIGital?

[SENSe:]DIGital:DATA[:<width>]?

[SENSe:]DIGital:DATA:BIT?

[SENSe:]DIGital:THReshold

SOURce:DIGital:DATA[:<width>]

SOURce:DIGital:DATA:BIT

SOURce:DIGital:DRIVE

SOURce:DIGital:LEVel

SOURce:DIGital:STATe

Buffered (Memory) I/O:

[SENSe:]DIGital:MEMory:CLEar

[SENSe:]DIGital:MEMory:COMPare:ACTion

[SENSe:]DIGital:MEMory[:DATA]?

[SENSe:]DIGital:MEMory[:DATA]:ALL?

[SENSe:]DIGital:MEMory[:DATA]:FORMat

[SENSe:]DIGital:MEMory[:DATA]:POINTs?

[SENSe:]DIGital:MEMory:ENABle

[SENSe:]DIGital:MEMory:SAMPle:COUNt

[SENSe:]DIGital:MEMory:STARt

[SENSe:]DIGital:MEMory:STEP

[SENSe:]DIGital:MEMory:STOP
SOURce:DIGital:MEMory:ABORT
SOURce:DIGital:MEMory:ENABLE
SOURce:DIGital:MEMory:NCYCles
SOURce:DIGital:MEMory:START
SOURce:DIGital:MEMory:STEP
SOURce:DIGital:MEMory:STOP
SOURce:DIGital:MEMory:TRACe

Handshake and Interrupt Lines:

CONFigure:DIGital:HANDshake
CONFigure:DIGital:HANDshake:CTIME
CONFigure:DIGital:HANDshake:DRIVE
CONFigure:DIGital:HANDshake:POLarity
CONFigure:DIGital:HANDshake:RATE
CONFigure:DIGital:HANDshake:STATe
CONFigure:DIGital:HANDshake:SYNChronous:STRobe[:SOURce]
CONFigure:DIGital:INTerrupt:POLarity
[SENSe:]DIGital:HANDshake:THReshold
[SENSe:]DIGital:INTerrupt[:ENABLE]
[SENSe:]DIGital:INTerrupt:MODE
[SENSe:]DIGital:INTerrupt:STATus?
SOURce:DIGital:HANDshake:LEVel
SOURce:DIGital:INTerrupt[:ENABLE]
SOURce:DIGital:INTerrupt:MODE

Pattern Compare:

CALCulate:COMPare:DATA[:<width>]
CALCulate:COMPare:MASK[:<width>]
CALCulate:COMPare:STATe
CALCulate:COMPare:TYPE

Trace Waveforms:

FORMat:BORDER

TRACe:CATalog?

TRACe[:DATA]:DIGital[:<width>]

TRACe[:DATA]:DIGital:FUNCTion

TRACe:DELeTe:ALL

TRACe:DELeTe[:NAME]

TRACe:FREE?

TRACe:POINts?

Counter:

CONFigure:COUNter:DCYClE

CONFigure:COUNter:FREQuency

CONFigure:COUNter:PERiod

CONFigure:COUNter:PWIDth

CONFigure:COUNter:TOTalize

CONFigure:TOTalize

MEASure:COUNter:DCYClE?

MEASure:COUNter:FREQuency?

MEASure:COUNter:PERiod?

MEASure:COUNter:PWIDth?

MEASure:COUNter:TOTalize?

MEASure:TOTalize?

[SENSe:]COUNter:ABORt

[SENSe:]COUNter:DATA?

[SENSe:]COUNter:DCYClE[:DATA]?

[SENSe:]COUNter:FREQuency[:DATA]?

[SENSe:]COUNter:FUNCTion

[SENSe:]COUNter:FUNCTion?

[SENSe:]COUNter:GATE:POLarity

[SENSe:]COUNter:GATE:SOURce

[SENSe:]COUNter:GATE:TIME[:INTernal]

[SENSe:]COUNter:INITiate

[SENSe:]COUNter:PERiod[:DATA]?

[SENSe:]COUNter:PWIDth[:DATA]?

[SENSe:]COUNter:SLOPe
 [SENSe:]COUNter:THReshold:VOLTage
 [SENSe:]COUNter:TOTalize:CLEar:IMMediate
 [SENSe:]COUNter:TOTalize[:DATA]?
 [SENSe:]COUNter:TOTalize:TYPE
 [SENSe:]MODule:COUNter:GATE:THReshold[:VOLTage]
 [SENSe:]TOTalize:CLEar:IMMediate
 [SENSe:]TOTalize:DATA?
 [SENSe:]TOTalize:SLOPe
 [SENSe:]TOTalize:THReshold[:MODE]
 [SENSe:]TOTalize:THReshold:VOLTage
 [SENSe:]TOTalize:TYPE

System Clock Output:

SOURce:MODule:CLOCK:FREQuency
 SOURce:MODule:CLOCK:LEVel
 SOURce:MODule:CLOCK:STATe

Key Specifications

See the *Keysight 34950A 64-Bit Digital I/O and Counter Module User's Guide* for detailed operating information.

Digital Input/Output	
Vin	0 V to 5 V
Vout	1.66 V to 5 V
Iout (max)	24 mA
Frequency (max)	10 MHz

Handshake Lines	
Vin	0 V to 5 V
Vout	1.66 V to 5 V
Iout (max)	24 mA
Frequency (max)	10 MHz

Counter	
Frequency (max)	10 MHz (max), 50% Duty Cycle
Vin	0 V to 5 V

Totalizer	
Maximum Count	$2^{32} - 1$ (4,294,967,295)
Maximum Input Frequency	10 MHz (max), Rising or Falling Edge
Vin	0 V to 3 V
Gate Input	0 V to 3 V

Clock Output	
Frequency	20 MHz to 10 Hz, Configurable, 24 Bits
Vout	1.66 V to 5 V
Accuracy	100 ppm

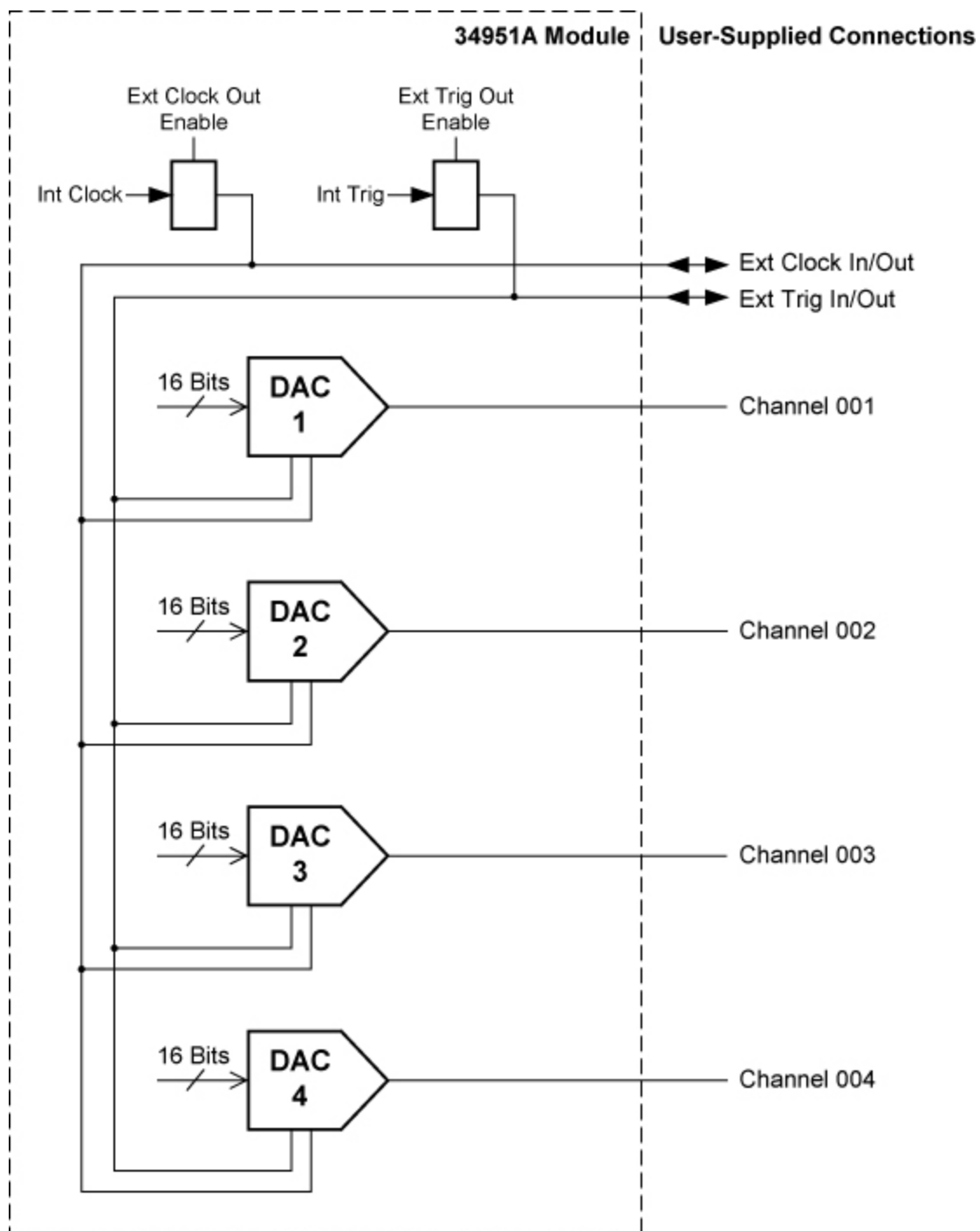
Note: Product specifications are subject to change without notice.

Keysight 34951A Module Summary

4-Channel Isolated D/A Converter with Waveform Memory

[Simplified Block Diagram](#) | [Wiring Log](#) | [SCPI Commands Used](#) | [Key Specifications](#)

Simplified Block Diagram



Wiring Log

A wiring log is available to make it easy to document your wiring configuration for this module. You can open the file in Microsoft® Excel or Adobe® Acrobat® format.

34951A Wiring Log: [Excel format](#) [Adobe PDF format](#)

SCPI Commands Used

DAC Configuration:

OUTPut[:STATe]

SOURce:CURRent[:LEVel]

SOURce:FUNCTion:TRIGger:SOURce

SOURce:MODE

SOURce:MODule:CLOCK:FREQuency

SOURce:MODule:CLOCK:STATe

SOURce:MODule:TRIGger:EXTernal:IMMediate

SOURce:MODule:TRIGger:OUTPut

SOURce:VOLTage[:LEVel]

Trace Waveform Configuration:

FORMat:BORDER

SOURce:FUNCTion:CLOCK:EXTernal:DIVisor

SOURce:FUNCTion:CLOCK:SOURce

SOURce:FUNCTion:CURRent:GAIN

SOURce:FUNCTion:CURRent:OFFSet

SOURce:FUNCTion:ENABLE

SOURce:FUNCTion:FREQuency

SOURce:FUNCTion:HALT

SOURce:FUNCTion:SAMPLE:PERiod

SOURce:FUNCTion:TRACe:NCYCles

SOURce:FUNCTion:TRACe:SINDex

SOURce:FUNCTion:TRACe[:NAME]

SOURce:FUNCTion:TRIGger:IMMediate

SOURce:FUNCTion:VOLTage:GAIN

SOURce:FUNCtion:VOLTage:OFFSet

TRACe:CATalog?

TRACe:DELeTe:ALL

TRACe:DELeTe[:NAME]

TRACe:FREE?

TRACe:POINts?

TRACe[:DATA]

TRACe[:DATA]:DAC

TRACe[:DATA]:FUNCtion

Key Specifications

See the *Keysight 34951A 4-Channel Isolated D/A Converter with Waveform Memory Module User's Guide* for detailed operating information.

General Specifications	
Maximum Update Rate	200 kHz point-to-point
Monotonic	To 16 bits
Isolation	> 80 Vdc/ac peak (chan-to-chassis or chan-to-chan)

DC Voltage	
Amplitude	±16 V up to 10 mA
Resolution	16 bits = 500 µV
Settling Time	40 µs
Output Impedance	< 1Ω with load sensed

DC Current	
Range	±20 mA
Resolution	16 bits = 630 nA
Compliance Voltage	±12 V
Max Open-Circuit Voltage	< ±22 V

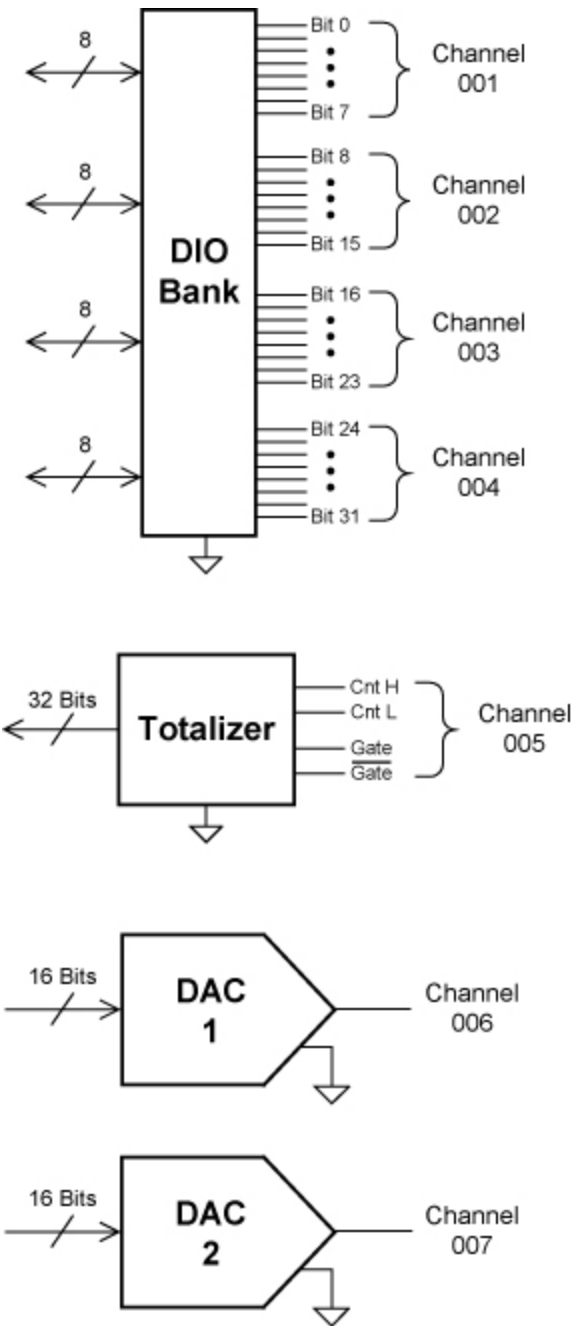
Note: Product specifications are subject to change without notice.

Keysight 34952A Module Summary

Multifunction Module with Digital I/O, Totalizer, and DAC

[Simplified Block Diagram](#) | [Wiring Log](#) | [SCPI Commands Used](#) | [Key Specifications](#)

Simplified Block Diagram



Wiring Log

A wiring log is available to make it easy to document your wiring configuration for this module. You can open the file in Microsoft® Excel or Adobe® Acrobat® format.

34952A Wiring Log: [Excel format](#) [Adobe PDF format](#)

SCPI Commands Used

Digital I/O:

CONFigure:DIGital:DIRection

CONFigure:DIGital:WIDTh

MEASure:DIGital?

[SENSe:]DIGital:DATA[:<width>]?

[SENSe:]DIGital:DATA:BIT?

SOURce:DIGital:DATA[:<width>]

SOURce:DIGital:DATA:BIT

SOURce:DIGital:STATe

Totalizer:

CONFigure:TOTalize

MEASure:TOTalize?

[SENSe:]TOTalize:CLEar:IMMEDIATE

[SENSe:]TOTalize:SLOPe

[SENSe:]TOTalize:THReshold[:MODE]

[SENSe:]TOTalize:TYPE

[SENSe:]TOTalize:DATA?

STATus:MODule:SLOT[n]:CONDition?

STATus:MODule:SLOT[n]:EVENT?

DAC:

SOURce:VOLTagE[:LEVel]

Key Specifications

See the *Keysight 34952A Multifunction Module User's Guide* for detailed operating information.

Digital Input/Output	
Vin(L)	< 0.8 V (TTL)
Vin(H)	> 2.0 V (TTL)
Vout(L)	< 0.8 V @ Iout = -400 mA
Vout(H)	> 2.4 V @ Iout = 1 mA
Vout(H) max	< 42 V with external pullup
Read/Write Speed	95/sec

Totalizer	
Maximum Count	$2^{32} - 1$ (4,294,967,295)
Totalize Input	100 kHz, rising or falling edge
Signal Level	1 Vpp (min), 42 Vpk (max)
Read Speed	85 readings/sec

DAC Output	
DAC 1, 2	± 12 V, non-isolated
Resolution	1 mV
Iout	10 mA max
Settling Time	1 ms to 0.01% of output

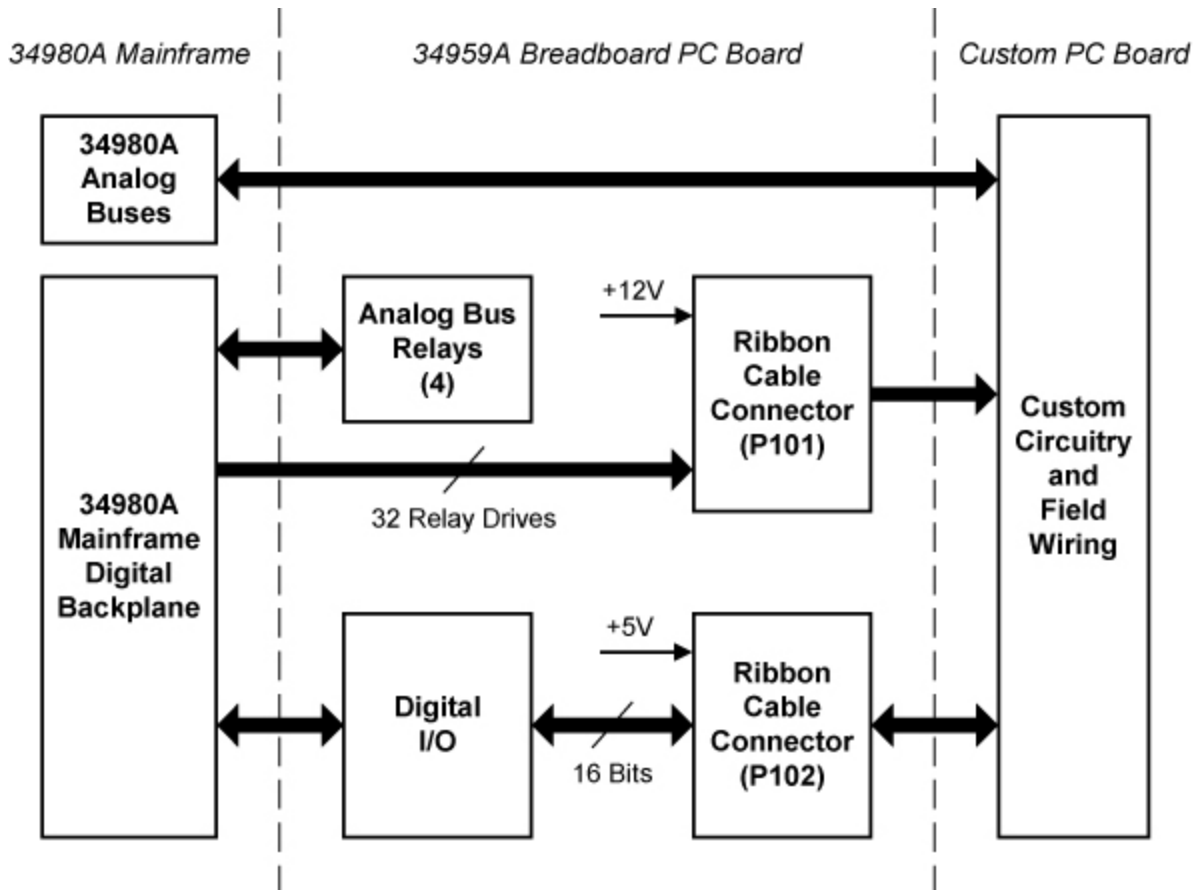
Note: Product specifications are subject to change without notice.

Keysight 34959A Module Summary

Breadboard Module

[Simplified Block Diagram](#) | [SCPI Commands Used](#) | [Key Specifications](#)

Simplified Block Diagram



SCPI Commands Used

Digital I/O:

`CONFigure:DIGital`

`CONFigure:DIGital:DIRection`

`MEASure:DIGital?`

`[SENSe:]DIGital:DATA[:<width>]?`

`[SENSe:]DIGital:DATA:BIT?`

SOURce:DIGital:DATA[:< width>]

SOURce:DIGital:DATA:BIT

SOURce:DIGital:STATe

GP Relays:

ROUTe:CLOSe

ROUTe:OPEN

Key Specifications

See the *Keysight 34959A Breadboard Module User's Guide* for detailed operating information.

Max Module Power Dissipation	6W
Power Available: 12V Regulation, no load to full load 5V Regulation, no load to full load Max Power from 12V Supply Max Power from 5V Supply	10% 5% 6W 1W
DIO Ports (Chs 001 and 002)	8 bits, Configurable as Input or Output
Relay Drives (Chs 101 through 128)	28 Lines, Sink up to 100 mA

Note: Product specifications are subject to change without notice.

