Battery Emulator
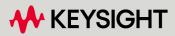
E36731A

This manual contains SCPI programming information for the E36731A Battery Emulator.

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Safety Information

1 Remote Operation

Introduction to the SCPI Language

Programming Ranges

SCPI Error Messages

Reset and Non-volatile Settings

SCPI Status Registers

This chapter describes the remote operation for the E36731A battery emulator.

Introduction to the SCPI Language

Standard Commands for Programmable Instruments (SCPI) is an ASCII-based instrument command language designed for test and measurement instruments. Refer to Simplified Programming Overview for basic techniques for programming the instrument over the remote interface.

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 SOURce subsystem is shown below to illustrate the tree system.

[SOURce:]
      CURRent <current> | MIN | MAX
      CURRent? MIN | MAX
      CURRent:
            TRIGgered <current> | MIN | MAX
            TRIGgered? MIN | MAX
      VOLTage <voltage> | MIN | MAX
      VOLTage? MIN|MAX
      VOLTage:
            TRIGgered <voltage> | MIN | MAX
            TRIGgered? MIN | MAX

SOURce is the root keyword of the command, CURRent and VOLTage are second-level keywords, and TRIGgered is the third-level keyword. A colon (:) separates a command keyword from a lower-level keyword.

Command Format Used in this Manual

The format used to show commands in this manual is shown below:

CURRent <current> | MINimum | MAXimum

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

For example, in the above syntax statement, CURR and CURRENT are both acceptable forms. You can use upper-case or lower-case letters. Therefore, CURRENT, curr, and Curr are all acceptable. Other forms, such as CUR and CURREN, will generate an error.

A vertical bar (|) separates multiple parameter choices for a given command string.

Angle brackets (<>) indicate that you must specify a value for the enclosed parameter. For example, the above syntax statement shows the current parameter enclosed in angle brackets. The brackets are not sent with the command string. You must specify a value for the parameter (such as CURR 0.1).

Braces ({ }) indicate parameters that may be repeated zero or more times. It is used especially for showing arrays. The notation <A>{,<B>} shows that parameter "A" must be entered, while parameter "B" may be omitted or may be entered one or more times

Some parameters are enclosed in square brackets ([]). The 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.

A colon (:) separates 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:

APPLy CH1,3.5,1.5

Command Separators

A colon (:) separates a command keyword from a lower-level keyword as shown below:

SOURce:CURRent:TRIGgered

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

SOUR:VOLT MIN;CURR MAX

is the same as sending the following two commands:

SOUR:VOLT MIN

SOUR:CURR MAX

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 the colon and semicolon:

DISP:TEXT:CLE;:SOUR:CURR MIN

Using the MIN and MAX parameters

You can substitute MINimum or MAXimum in place of a parameter for many commands. For example, consider the following command:

CURRent <current> | MIN | MAX

Instead of selecting a specific current, you can substitute MINimum to set the current to its minimum value or MAXimum to set the current to its maximum value.

Querying Parameter Settings

You can query the value of most parameters by adding a question mark (?) to the command. For example, the following command sets the input current to 5 A:

CURR 5

You can query the value by executing:

CURR?

You can also query the maximum or minimum value allowed with the present function as follows:

CURR? MAX; CURR? MIN

> **CAUTION** If you send two query commands without reading the response from the first, and then attempt to read the second response, you may receive some data from the first response followed by the complete second response. To avoid this, do not send a query command without reading the response. When you cannot avoid this situation, send a device clear before sending the second query command.

SCPI Command Terminators

A command string sent to the instrument must terminate with a <new line> character. The IEEE-488 EOI (end-or-identify) message is interpreted as a <new line> character and can be used to terminate a command string in place of a <new line> character. A <carriage return> followed by a <new line> is also accepted. Command string termination will always reset the current SCPI command path to the root level. The <new line> character has the ASCII decimal code of 10.

IEEE-488.2 Common Commands

The IEEE-488.2 standard defines a set of common commands that perform functions like reset, self-test, and status operations. Common commands always begin with an asterisk (*), are four to five 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 different data formats to be used in program messages and response messages.

Channel parameters

Channel parameter <chanlist> is required to address one or more channels. It has the following syntax:

(@<channel> [,<channel>][,<channel>][,<channel>])

You can also specify a range of sequential channels as follows:

(@<start_channel>:<end_channel>)

For example, (@1) specifies channel 1. The channel list, shown as <chanlist> throughout this document, must be preceded with the @ symbol and must be enclosed in parentheses (). Query results are channel list order-sensitive. Results are returned in the order they are specified in the list.

> **NOTE** When adding a channel list parameter to a query, you must include a space character between the query indicator (?) and the channel list parameter. Otherwise error –103, Invalid separator will occur.

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 like MINimum, MAXimum, and DEFault are also accepted.

You can also send engineering unit suffixes (V, A, or SEC) with numeric parameters. If only specific numeric values are accepted, the battery emulator will automatically round the input numeric parameters. The following command uses a numeric parameter:

    CURR <current> | MIN | MAX

Discrete parameters

Discrete parameters are used to program settings that have a limited number of values such as BUS and IMM. Query responses will always return the short form in all upper-case letters. The following command uses discrete parameters:

    TRIG:SOUR BUS | IMM

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 uses a boolean parameter:

    DISP OFF | ON

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 with 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:

DISP:TEXT <quoted string>

Halting an Output in Progress

You can send a device clear at any time to stop an output in progress over the GPIB interface. 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.

– The instrument's input and output buffers are cleared.

– The instrument returns to the trigger "idle" state.

– The instrument is prepared to accept a new command string.

– The following command sends a device clear over the GPIB interface using Keysight BASIC.

CLEAR 705 IEEE-488 Device Clear

Programming Ranges

Power supply mode

The following table shows the maximum voltage, current, and power that can be programmed. The DEFault voltage is always 0.

	Max voltage	Max current (A)	Max power (W)
E36731A	30.9	20.6	200

Electronic load mode

The following table shows the input ranges (voltage, current, power and resistance) and its default value that can be programmed.

Operating Mode	Range		E36731A
CV	High	MAXimum	61.2 V
		MINimum	0.02 V
	Low	MAXimum	15.3 V
		MINimum	0.005 V
	DEFault (*RST)		0.02 V
CC	High	MAXimum	40.8 A
		MINimum	0.01 A
	Low	MAXimum	4.08 A
		MINimum	0.001 A
	DEFault (*RST)		0.01 A
CP	High	MAXimum	255 W
		MINimum	1.5 W
	Medium	MAXimum	25.5 W
		MINimum	0.15 W
	Low	MAXimum	5.1 W
		MINimum	0.02 W
	DEFault (*RST)		1.5 W
CR	MAXimum	MAXimum	4 kΩ
		MINimum	100 Ω
	Medium	MAXimum	1.25 kΩ
		MINimum	10 Ω
	Low	MAXimum	30 Ω
		MINimum	0.08 Ω
	DEFault (*RST)		4 kΩ

SCPI Error Messages

The instrument returns error messages in accordance with the SCPI standard.

– Up to 20 errors can be stored in the instrument's error queue, and the ERROR annunciator turns on when one or more errors are in the error queue.

– Error retrieval is first-in-first-out (FIFO), and errors are cleared as you read them. When you have read all errors from the error queue, the **ERR** annunciator turns off.

– If more than 20 errors have occurred, the last error stored in the queue (the most recent error) is replaced with -350,"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".

– Send SYSTem:ERRor? to read the most recent error. Each error is in the format: –104,"Data type error".

– To read the error queue from the front panel, press **Utilities** > **Error**. If there are more than 10 errors on the display, press **Next** to scroll to the next page.

– The error queue is cleared by power cycles and *CLS., but not *RST.

Execution error codes

The instrument's error codes are listed below:

Code	Text
0000	No error This is the response to the ERR? query when there are no errors.
-100	Command error A generic syntax error.
-101	Invalid character An invalid character was found in the command string. You may have inserted a character such as #, $, or % in the command keyword or within a parameter. Example: OUTP:TRAC #ON
-102	Syntax error Invalid syntax was found in the command string. You may have inserted a blank space before or after a colon in the command header, or before a comma. Example: VOLT:LEV ,1
-103	Invalid separator An invalid separator was found in the command string. You may have used a comma instead of a colon, semicolon, or blank space — or you may have used a blank space instead of a comma. Example: TRIG:SOUR,BUS or APPL CH1 1.0 1.0
-104	Data type error The wrong parameter type was found in the command string. You may have specified a number where a string was expected, or vice versa.
-105	GET not allowed A Group Execute Trigger (GET) is not allowed within a command string.

Code	Text
-108	Parameter not allowed
	More parameters were received than expected for the command. You may have entered an extra parameter, or you added a parameter to a command that does not accept a parameter.
	Example: OUTP? 10
-109	Missing parameter
	Fewer parameters were received than expected for the command. You omitted one or more parameters that are required for this command.
	Example: APPL
-112	Program mnemonic too long
	A command header was received which contained more than the maximum 12 characters allowed.
-113	Undefined header
	A command was received that is not valid for this battery emulator. You may have misspelled the command or it may not be a valid command. If you are using the short form of the command, remember that it may contain up to four letters.
	Example: TRIGG:DEL 3
-114	Header suffix out of range
	The numeric suffix attached to a command header is not one of the allowable values.
	Example: STAT:QUES:INST:ISUM4?
-121	Invalid character in number
	An invalid character was found in the number specified for a parameter value.
	Example: *ESE #B01010102
-123	Exponent too large
	A numeric parameter was found whose exponent was larger than 32,000.
-124	Too many digits
	A numeric parameter was found whose mantissa contained more than 255 digits, excluding leading zeros.
-128	Numeric data not allowed
	A numeric parameter was received but a character string was expected.
	Example: DISP:TEXT 123
-131	Invalid suffix
	A suffix was incorrectly specified for a numeric parameter. You may have misspelled the suffix.
	Example: TRIG:DEL 0.5 SECS
-134	Suffix too long
	A suffix for a numeric parameter contained too many characters.
-138	Suffix not allowed
	A suffix was received following a numeric parameter which does not accept a suffix.
	Example: STAT:QUES:ENAB 18 SEC (SEC is not a valid suffix).
-141	Invalid character data
	Either the character data element contained an invalid character or the particular element received was not valid for the header.
-148	Character data not allowed
	A discrete parameter was received but a character string or a numeric parameter was expected. Check the list of parameters to verify that you have used a valid parameter type.
	Example: DISP:TEXT ON
-150	String data error
	A generic string data error.

Code	Text
-151	Invalid string data An invalid character string was received. Check to see if you have enclosed the character string in single or double quotes. Example: DISP:TEXT 'ON
-158	String data not allowed A character string was received but is not allowed for the command. Check the list of parameters to verify that you have used a valid parameter type. Example: TRIG:DEL 'zero'
-161	Invalid block data The number of data bytes sent does not match the number of bytes specified in the header.
-168	Block data not allowed Data was sent in arbitrary block format but is not allowed for this command.
-170	Expression error A generic expression error.
-171	Invalid expression The expression data element was invalid.
-178	Expression data not allowed Expression data element was sent but is not allowed for this command.
-181	Invalid outside macro definition
-183	Invalid inside macro definition
-200	Execution error A generic syntax error.
-211	Trigger ignored
-213	Init ignored
-214	Trigger deadlock
-221	Settings conflict A data element could not be executed because of the present instrument state.
-222	Data out of range A numeric parameter value is outside the valid range for the command. Example: TRIG:DEL -3
-223	Too much data A character string was received but could not be executed because the string length was more than 40 characters. This error can be generated by the CALibration:STRing command.
-224	Illegal parameter value A discrete parameter was received which was not a valid choice for the command. You may have used an invalid parameter choice. Example: DISP:STAT XYZ (XYZ is not a valid choice).
-225	Out of memory The device has insufficient memory to perform the requested operation.
-230	Data corrupt or stale Possible invalid data. A new reading was started but not completed.
-241	Hardware missing The command could not be executed because of missing hardware, such as an option.

Code	Text
-270	Macro error
-272	Macro execution error
-273	Illegal macro label
-276	Macro recursion error
-277	Macro redefinition not allowed
-310	System error
-330	Self-test failed
-350	Queue overflow
-363	Input buffer overrun
-400	Query error A generic error query.
-410	Query INTERRUPTED A command was received which sends data to the output buffer, but the output buffer contained data from a previous command (the previous data is not overwritten). The output buffer is cleared when power has been off, or after a *RST (reset) command has been executed.
-420	Query UNTERMINATED The battery emulator was addressed to talk (i.e., to send data over the interface) but a command has not been received which sends data to the output buffer. For example, you may have executed an APPLy command (which does not generate data) and then attempted an ENTER statement to read data from the remote interface.
-430	Query DEADLOCKED A command was received which generates too much data to fit in the output buffer and the input buffer is also full. Command execution continues but all data is lost.
-440	Query UNTERMINATED after indefinite response A query was received in the same program message after a query indicating an indefinite response was executed.
305	Requested operation is unsupported in current mode
513	LAN invalid IP address
514	LAN duplicate IP address
515	LAN failed to renew DHCP lease
516	LAN failed to configure
517	LAN failed to initialize
518	LAN VXI-11 fault
519	LAN invalid subnet mask or gateway
520	LAN invalid DNS address 1
521	LAN invalid DNS address 2
560	Analog board firmware version mismatched
561	Analog board (CH1) does not respond
563	Analog board (CH1) over temperature
565	DPM board (CH1) over temperature

Code	Text
567	Analog board (CH1) command timed out
570	This instrument is currently operating in high temperature and may impact the accuracy
605	Analog board (CH1) failed to enter boot loader
610	EEPROM test failed
611	EEPROM load failed
612	EEPROM checksum failed
613	EEPROM save failed
614	EEPROM sanitization failed
615	Flash sanitization failed
735	Cannot change while trigger is initiated or acquisition is running Data can't be alter as trigger has already been initiated or acquisition is running. Abort the trigger or acquisition to change data.
736	Trig initiate disallowed as channel is coupled with another channel that has trigger initiated
737	Illegal operation. List system has started for CH1
738	Operation not allowed when in parallel mode
739	There is not a valid acquisition to fetch from
740	Initiate with no sense functions enabled
741	Too many measurement points
750	USB not connected This may be due to data logger requiring a USB thumb drive to be connected.
751	USB host access failed This may be due to DUT fails to access the USB thumb drive.
752	Insufficient space in USB drive This may be due to the memory size required by data logger is larger than the available free space.
753	Data logger is running Data logger setting can't be changed while it's running.
754	Data logger do not have valid data Fetch is not allowed as data logger doesn't have valid data.
755	Measurement is not allowed while data logger running
756	Sample period cannot be more than logging duration
757	Data logger settings exceeded available memory. Settings are adjusted.
801	Voltage and current in incompatible transient modes
802	This command is not allowed while list is running
803	BOSTep list length does not match dwell list
804	EOSTep list length does not match dwell list
805	Voltage list length does not match dwell list
806	Current list length does not match dwell list
807	Power list length does not match dwell list

Code	Text
808	Resistance list length does not match dwell list
809	LIST and STEP transient modes are not compatible
810	Channel can have only one transient mode set
811	No transient has been configured
815	Settings conflict error; Channel must be in CC mode
816	Settings conflict error; Channel must be in CV mode
817	Settings conflict error; Channel must be in CP mode
818	Settings conflict error; Channel must be in CR mode
819	Settings conflict error; Channel must be in CV or CR or CP mode
820	Settings conflict error; Channel must be in CC or CR or CP mode
851	FPGA transmit timeout
852	Front panel failed to enter boot loader
853	CH1 FPGA failed to communicate
855	Primary FPGA failed to communicate
856	Front panel does not respond
857	Cannot change range because value of list, transient or trigger is out of range
900	Firmware update failed

Calibration error codes

The following errors indicate failures that may occur during a calibration.

Code	Text
577	Analog board (CH1) calibration failed
581	Invalid state. Cal secured
582	Invalid secure code
583	Secure code too long
584	Failed to calibrate voltage DAC
585	Failed to calibrate voltage ADC
586	Failed to calibrate OVP
587	Failed to calibrate current DAC
588	Failed to calibrate current ADC
589	Sanity check on calibration constants failed
590	Invalid Calibration sequence
591	Failed to calibrate low range current
592	Action not allowed as calibration incomplete
595	Cal program constants out of range
596	Cal AUX IMON constants out of range
597	Cal measure constants out of range
598	Cal AUX VLOC constants out of range
599	Cal trim dac not centered (prog0)
600	Cal trim dac not centered (prog1)
601	Calibration is not allowed when parallel is enabled
602	Multiple channels selection is not allowed during calibration
603	Multiple channels not allowed during calibration

Self–test error codes

The following errors indicate failures that may occur during a self–test.

Code	Text
530	(CH1) Analog bias output 12V test failed
532	(CH1) System ADC test failed
534	(CH1) System DAC test failed
536	(CH1) Incorrect Analog board model number
538	(CH1) Precision DAC test failed
540	(CH1) Auxiliary DAC test failed
542	(CH1) Incorrect DPM board model number
550	3.3V power lost
551	5.0V power lost
552	12V power lost
553	Real time clock failed
554	Real time clock battery low

Reset and Non-volatile Settings

The following tables show the reset and non-volatile settings. These parameters are set to the indicated default values at power-on or after *RST.

Reset (*RST) settings

The instrument's reset settings are listed below:

SCPI command	Default value	
	Power Supply mode	Load mode
APPLy	"0.000000,2.000000"	*Not applicable*
CHANnel | INSTrument:SELect	CH1	CH1
CHANel | INSTrument:NSELect	1	1
CHANel | INSTrument:LOAD	*Not applicable*	1
CURRent	2	MIN (0.01)
CURRent:STEP	Minimum current calibration resolution	*Not applicable*
CURRent:TRIGgered	MIN (0)	MIN (0.01)
CURRent:LIMit	*Not applicable*	MAX (40.8)
CURRent:PROTection:STATe	OFF	OFF
CURRent:PROTection:DELay	0.05 s	0.02 s
CURRent:PROTection:DELay:STARt	SCH	SCH
CURRent:MODE	FIX	FIX
CURRent:RANGe	*Not applicable*	MAX (40.8)
CURRent:SLEW	*Not applicable*	9.9E+37
CURRent:SLEW:COUPle	*Not applicable*	OFF
CURRent:SLEW:MAX	*Not applicable*	ON
CURRent:SLEW:NEGative	*Not applicable*	9.9E+37
CURRent:SLEW:NEGative:MAX	*Not applicable*	ON
CURRent:TLevel	*Not applicable*	0.01
DIGital:OUTPut:DATA	0	0
DIGital:TOUTput:BUS	OFF	OFF
DISPlay	ON	ON
DISPlay:TEXT	"" (empty)	"" (empty)
DISPlay:VIEW	METER1	METER1
FUNCtion | MODE	*Not applicable*	CURR
INITiate:CONTinuous	OFF	OFF
INPut|OUTPut:RElay	OFF	*Not applicable*

	Default value	
SCPI command	**Power Supply mode**	**Load mode**
INPut|OUTPut:STATe	OFF	OFF
INPut|OUTPut:STATe:DELay:FALL	0	0
INPut|OUTPut:STATe:DELay:RISE	0	0
INPut|OUTPut:STATe:PMODE	VOLT	*Not applicable*
INPut|OUTPut:SHORt	*Not applicable*	OFF
LIST:CURRent	2	0.01
LIST:VOLTage	0	0.02
LIST:POWer	*Not applicable*	1.5
LIST:RESistance	*Not applicable*	4000
LIST:COUNt	1	1
LIST:DWELl	0	0.001 s
LIST:STEP	AUTO	AUTO
LIST:TERMinate:LAST	OFF	OFF
LIST:TOUTput:BOSTep	OFF	OFF
LIST:TOUTput:EOSTep	OFF	OFF
POWer	*Not applicable*	1.5
POWer:TRIGgered	*Not applicable*	1.5
POWer:MODE	*Not applicable*	FIX
POWer:RANGe	*Not applicable*	255
POWer:SLEW	*Not applicable*	9.9E+37
POWer:SLEW:COUPle	*Not applicable*	OFF
POWer:SLEW:MAX	*Not applicable*	ON
POWer:SLEW:NEGative	*Not applicable*	9.9E+37
POWer:SLEW:NEGative:MAX	*Not applicable*	ON
POWer:PROTection:DELay	*Not applicable*	0.02 s
POWer:PROTection:STATe	*Not applicable*	OFF
POWer:TLEVel	*Not applicable*	1.5
RESistance	*Not applicable*	4000
RESistance:TRIGgered	*Not applicable*	4000
RESistance:MODE	*Not applicable*	FIX
RESistance:RANGe	*Not applicable*	4000
RESistance:SLEW	*Not applicable*	9.9E+37
RESistance:SLEW:COUPle	*Not applicable*	OFF
RESistance:SLEW:MAX	*Not applicable*	ON
RESistance:SLEW:NEGative	*Not applicable*	9.9E+37

	Default value	
SCPI command	Power Supply mode	Load mode
RESistance:SLEW:NEGative:MAX	*Not applicable*	ON
RESistance:TLEVel	*Not applicable*	4000
SENSe:DLOG:FUNCtion:CURRent	OFF	OFF
SENSe:DLOG:FUNCtion:MINM	OFF	OFF
SENSe:DLOG:FUNCtion:VOLTage	ON	ON
SENSe:DLOG:OFFSet	-	0
SENSe:DLOG:PERiod	0.2 s	0.2 s
SENSe:DLOG:TIME	30 s	30 s
SENSe:DLOG:TINTerval	0.2 s	0.2 s
SENSe:FUNCtion:CURRent	*Not applicable*	ON
SENSe:FUNCtion:VOLTage	*Not applicable*	ON
SENSe:SWEep:POINts	*Not applicable*	2440
SENSe:SWEep:OFFSet:POINts	*Not applicable*	0
SENSe:SWEep:TINTerval	*Not applicable*	0.00004096 s
SYSTem:COMMunicate:RLSTate	LOC	LOC
TRANsient:DCYCle	*Not applicable*	50%
TRANsient:FREQuency	*Not applicable*	10000
TRANsient:MODE	*Not applicable*	LIST
TRANsient:TWIDth	*Not applicable*	0.0005 s
TRANsient:COUNt	*Not applicable*	1
TRIGger:ACQuire:CURRent	*Not applicable*	0.01
TRIGger:ACQuire:CURRent:SLOPe	*Not applicable*	POS
TRIGger:ACQuire:SOURce	*Not applicable*	BUS
TRIGger:ACQuire:VOLTage	*Not applicable*	0.02
TRIGger:ACQuire:VOLTage:SLOPe	*Not applicable*	POS
TRIGger:DLOG:CURRent	*Not applicable*	0
TRIGger:DLOG:CURRent:SLOPe	*Not applicable*	POS
TRIGger:DLOG:SOURce	IMM	IMM
TRIGger:DLOG:VOLTage	*Not applicable*	0
TRIGger:DLOG:VOLTage:SLOPe	*Not applicable*	POS
TRIGger:DELay	0	0
TRIGger:SOURce	BUS	BUS
VOLTage	0	0.02
VOLTage:TRIGgered	0	0.02
VOLTage:MODE	FIX	FIX

SCPI command	Default value	
	Power Supply mode	**Load mode**
VOLTage:PROTection	33	*Not applicable*
VOLTage:RANGe	*Not applicable*	61.2
VOLTage:SENSe	INT	INT
VOLTage:SLEW	9.9E+37	9.9E+37
VOLTage:SLEW:COUPle	*Not applicable*	OFF
VOLTage:SLEW:MAX	ON	ON
VOLTage:SLEW:NEGative|FALLing	9.9E+37	9.9E+37
VOLTage:SLEW:NEGative|FALLing:MAX	ON	ON
VOLTage:STEP	Minimum voltage calibration resolution	*Not applicable*
VOLTage:TLEVel	*Not applicable*	0.02
VOLTage:INHibit:VON	*Not applicable*	0.02
VOLTage:INHibit:VON:MODE	*Not applicable*	OFF

Non-volatile settings

The following table shows the as-shipped settings of the non-volatile parameters. These are not affected by power cycling or *RST.

SCPI command	Default value
INPut | OUTPut:COUPle:CHANnel (channel grouping)	NONE
INPut | OUTPut: INHibit:MODE (Output Inhibit mode)	OFF
INPut | OUTPut:PON:STATE	*RST
DIGital:PIN<1-3>:FUNCtion (digital port function)	DINP
DIGital:PIN<1-3>:POLarity (digital port polarity)	POS
CALibration:ASAVE	OFF
CALibration:DATE	-
CALibration:SECure:CODE	E36731A
CALibration:SECure:STATe	ON
CALibration:STRing	-
EMULation	PSUP
SYSTem:COMMunicate:GPIB:ADDRess	5
SYSTem:BEEPer:STATe	ON
LXI:IDENtify:STATe	OFF
LXI:MDNS:STATe	ON
DISPlay:BRIGhtness	100

SCPI command	Default value
SYSTem:DATE	-
SYSTem:TIME	-

Non-volatile LAN settings

The instrument's non-volatile LAN settings are listed below:

SCPI command	Default value
Get IP Address	Automatic
IP Address	192.168.10.1
Subnet Mask	255.255.255.0
Default Gateway	192.168.10.1
Obtain DNS server from DHCP	Enabled
DNS server	Blank
Host name	K-E36731A-xxxxx
Dynamic DNS naming service	Enabled
Domain name	Blank
Web password	Keysight

SCPI Status Registers

This section provides a detailed description of the individual registers and register groups. The status diagram at the end of this topic shows how the status registers and groups are interconnected.

Status Registers

Operation Status Group

Questionable Status Group

Standard Event Status Group

Status Byte Register

Error and Input Queues

Status Diagram

Status Registers

The Operation and Questionable status groups use four different type of registers to track qualify, flag, and enable instrument events.

- A Condition register continuously monitors the state of the instrument. The bits in the condition register are updated in real time and the bits are not latched or buffered

- An PTR/NTR register qualifies the signal that passes to the event register. When a PTR bit is set, signals with positive edge transition pass to the event register. When an NTR bit is set, signals with a negative edge transition pass to the event register. When both bits are set, all signal pass. When neither bits are set, no signals pass.

- An Event register latches the various events from the condition register. There is no buffering in this register; while an event bit is set, subsequent events corresponding to that bit are ignored. This is a read-only register

- An Enable register defines which bits in the event register will be reported to the Status Byte register group. You can write to or read from an enable register.

To program individual bits in any register group, you must send a value that corresponds to the binary-weighted value of all the bits that you wish to enable. For example, to enable bit 2 (decimal value = 4) and bit 4 (decimal value = 16), the corresponding decimal value would be 20 (4 + 16).Similarly, any register queries return the binary-weighted value of the bits that have been set. For example, with bit 3 (value 8) and bit 5 (value 32) being set, the query returns +40.

Operation Status Group

These registers record signals that occur during normal operation. The group consists of a Condition, PTR/NTR, Event, and Enable register. The outputs of the Operation Status register group are logically-ORed into the OPERation summary bit (7) of the Status Byte register. Refer to Status Registers for a description of each register. The following table describes the bit assignments.

Bit	Bit Name	Decimal Value	Definition
0	CV	1	Input/Output is in constant voltage.
1	CC	2	Input/Output is in constant current.
2	CR	4	Input is in constant resistance mode.
3	CP	8	Input is in constant power mode.
4	OFF	16	Input/Output is programmed off.
5	SH	32	Load input terminals are shorted.
6	WTG Meas	64	Measurement system is waiting for a trigger.
7	WTG Tran	128	List and transient system is waiting for a trigger.
8	WTG Dlog	256	Data logging system is waiting for trigger.
9	MEAS Active	512	Measurement system is initiated.
10	TRAN Active	1024	Transient system is initiated.
11	DLOG Active	2048	Data logging system is initiated.
12	CAL	4096	The instrument is currently performing a calibration.
13-15	not used	not used	0 is returned.

Questionable Status Group

These register groups record signals that indicate abnormal operation. The group consists of a Condition, PTR/NTR, Event, and Enable register. The outputs of the Questionable Status group are logically-ORed into the QUEStionable summary bit (3) of the Status Byte register. Refer to **Status Registers** for a description of each register. The following table describes the bit assignments.

Bit	Bit Name	Decimal Value	Definition
0	OV	1	Input/Output is disabled by the over-voltage protection.
1	OC	2	Input/Output is disabled by the over-current protection.
2	Not used	Not used	0 is returned.
3	CP+	8	Input is limited (or disabled) by the positive power limit.
4	OT	16	Over-temperature protection has tripped.
5	OV–	32	Negative over-voltage protection has tripped.
6	LIM+	64	In CV mode, the input is in negative current limit. In CC mode, the input is in negative voltage limit. In CR and CP modes, the input is in positive current limit.
7	UNR	128	Input/output is unregulated.
8	INH	256	Input/output is inhibited by an external INHibit signal.
9	UVP	512	Input is disabled by the under-voltage inhibit protection.
10	PROT	1024	Input has been disabled because it is coupled to a protection condition that occurred on another channel.
11-15	not used	not used	0 is returned

Standard Event Status Group

These registers are programmed by Common commands. The group consists of an Event and Enable register.The Standard Event event register latches events relating to communication status. It is a read-only register that is cleared when read. The Standard Event enable register functions similarly to the enable registers of the Operation and Questionable status groups. Refer to Status Registers for a description of each register. The following table describes the bit assignments.

Bit	Bit Name	Decimal Value	Definition
0	Operation Complete	1	All commands before 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, a new command line was received before a previous query has been read, or both input and output buffers are full.
3	Device-Specific Error	8	A device-specific error, including a selftest error, calibration error or other device-specific error occurred. See Error Messages.
4	Execution Error	16	An execution error occurred. See Error Messages.
5	Command	32	A command syntax error occurred. See Error Messages.
6	not used	not used	0 is returned
7	Power On	128	Power has been cycled since the last time the event register was read or cleared.

Status Byte Register

This register summarizes the information from all other status groups as defined in the IEEE 488.2 Standard Digital Interface for Programmable Instrumentation. The following table describes the bit assignments.

Bit	Bit Name	Decimal Value	Definition
0	not used	not used	0 is returned
1	not used	not used	0 is returned
2	Error Queue	4	One or more errors in the Error Queue. Use SYSTem:ERRor? to read and delete errors.
3	Questionable Status Summary	8	One or more bits are set in the Questionable Data Register. Bits must be enabled, see STATus:QUEStionable:ENABle.
4	Message Available	16	Data is available in the instrument's output buffer.
5	Event Status Summary	32	One or more bits are set in the Standard Event Register. Bits must be enabled, see *ESE.
6	Master Status Summary	64	One or more bits are set in the Status Byte Register and may generate a Service Request. Bits must be enabled, see *SRE.
7	Operation Status Summary	128	One or more bits are set in the Operation Status Register. Bits must be enabled, see STATus:OPERation:ENABle.

MSS and RQS Bits

MSS is a real-time (unlatched) summary of all Status Byte register bits that are enabled by the Service Request Enable register. MSS is set whenever the instrument has one or more reasons for requesting service. *STB? reads the MSS in bit position 6 of the response but does not clear any of the bits in the Status Byte register.

The RQS bit is a latched version of the MSS bit. Whenever the instrument requests service, it sets the SRQ interrupt line true and latches RQS into bit 6 of the Status Byte register. When the controller does a serial poll, RQS is cleared inside the register and returned in bit position 6 of the response. The remaining bits of the Status Byte register are not disturbed.

Error and Output Queues

The Error Queue is a first-in, first-out (FIFO) data register that stores numerical and textual description of an error or event. Error messages are stored until they are read with **SYSTem:ERRor?** If the queue overflows, the last error/event in the queue is replaced with error -350,"Queue overflow".

The Output Queue is a first-in, first-out (FIFO) data register that stores instrument-to-controller messages until the controller reads them. Whenever the queue holds messages, it sets the MAV bit (4) of the Status Byte register.

Status Diagram

2   SCPI Programming

ABORt Subsystem

APPLy Subsystem

CALibration Subsystem

CHANnel | INSTrument Subsystem

CURRent Subsystem

DIGital Subsystem

DISPlay Subsystem

EMULation Subsystem

FETCh Subsystem

FUNCtion | MODE Subsystem

HCOPy Subsystem

IEEE-488.2 Common Commands

INITiate Subsystem

INPut | OUTput Subsystem

LIST Subsystem

LXI Subsystem

MEASure Subsystem

MMEMory Subsystem

POWer Subsystem

RESistance Subsystem

Keysight E36731A Programming Guide

This chapter describes the subsystem commands available to the E36731A battery emulator.

> **NOTE** For shared commands (used for both power supply and load), the load input is referred to as "output" throughout this document.

ABORt Subsystem

ABORt:ACQuire [(@<chanlist>)] `Load Mode only`

The command cancels any pending triggered measurements and returns the trigger system to idle. This command also resets the WTG-meas bit in the Operation Condition Status register.

Parameter	Typical return
(@<chanlist>)	(none)
Cancels the triggered measurement of channel 1: ABOR:ACQ (@1)	

Remarks

- ABORt:ACQuire is also executed at power-on and upon execution of the *RST command.

ABORt:DLOG

The command stops the current data logging session similar to pressing the **Run/Stop** key on the instrument.

Parameter	Typical return
(none)	(none)
Stops the current data logging session: ABOR:DLOG	

ABORt[:TRANsient] [(@<chanlist>)]

The command cancels any pending triggered actions and returns the trigger system to idle. This command also resets the WTG-tran bit in the Operation Condition Status register.

Parameter	Typical return
(@<chanlist>)	(none)
Cancels the triggered action of channel 1: ABOR (@1)	

Remarks

- ABORt:TRANsient is also executed at power-on and upon execution of the *RST command.

- Abort:TRANsient does not turn off continuous triggers if INITiate:CONTinuous:TRANsient ON has been programmed. In this case, the trigger system will automatically re-initiate.

APPLy Subsystem

APPLy CH1 [,<voltage> | DEFault | MINimum | MAXimum [,<current> | DEFault | MINimum | MAXimum]] `P.Supply Mode only`
APPLy? [CH1]

The command is combination of INSTrument:SELect, [SOURce:]VOLTage, and [SOURce:]CURRent commands. The values of the voltage and current of the specified output will change as soon as the command is executed.

For the voltage and current parameters of the APPLy command, the ranges depend on the output currently selected. You can substitute "MINimum", "MAXimum", or "DEFault" in place of a specific value for the voltage and current parameters. MIN selects the lowest voltage and current values allowed for the selected output. MAX selects the highest voltage and current values allowed. The default voltage value is 0 V. The default current value is 2 A. The default voltage and current values are exactly the same as the *RST values. If you specify only one value for the parameter, the power supply regards it as voltage setting value. If you do not specify any value for the parameter, the APPLy command only selects the output specified and acts as the INSTrument command.

The query returns the instrument present voltage and current values for each output as a quoted string as shown in the sample string below (the quotation marks are returned as part of the string). If any output identifier is not specified, the voltage and the current of the currently selected output are returned.

"5.00000,1.00000"

Referring to the above string, the first number 5.00000 is the voltage limit value and the second number 1.00000 is the current limit value for the specified output.

Output	Range of values
<voltage>	MAX = 30.9 V | MIN = 0 V | DEF = 0 V
<current>	MAX = 20.6 A | MIN = 0 A | DEF = 2 A

Parameter	Typical return
<voltage> | DEF | MIN | MAX, <current> | DEF | MIN | MAX	<voltage>, <current>
*RST<DEF in Range of values>	
Sets the maximum voltage and current of channel 1 output : APPL CH1, MAX, MAX	

CALibration Subsystem

<table>
<tr><td>NOTE</td><td>The calibration can only be done one channel at a time, hence the channel list for all calibration commands will only accept one channel.</td></tr>
</table>

CALibration:ASAVE ON | OFF | 1 | 0
CALibration:ASAVE?

The command enables or disables automatic saving of calibration constants. If Auto Save feature is enabled, the calibration data will automatically save into the non-volatile memory whenever a point is successfully calibrated and the CALibration:COUNt value is increased by 1.

The query returns 0 (OFF) or 1 (ON).

Parameter	Typical return
ON	OFF	1	0	0 or 1
Enables the CAL auto save feature: CAL:ASAVE 1	

Remarks

- System date will be used as calibration date and automatically store into the non-volatile memory when calibration constants are stored. You can overwrite the calibration date using CAL:DATE.

- This setting is non-volatile; it will not be changed by power cycling or after a Factory Reset (*RST).

CALibration:COUNt?

The query returns the number of times the battery emulator has been calibrated. Your instrument was calibrated before it left the factory. When you receive your instrument, read the count to determine its initial value.

If auto save is enabled, the value increments by one for each calibration point. If CAL:SAVE is used, the value increments by one for each channel calibration.

Parameter	Typical return
(none)	<count>
Returns the calibration count: CAL:COUN?	

Remarks

- This setting is non-volatile; it will not be changed by power cycling or after a Factory Reset (*RST).

CALibration:DATE ["<string>"]
CALibration:DATE?

The command stores the date that the battery emulator was last calibrated in nonvolatile memory. If the input string parameter is not specified, the system date will be stored. This command can saves up to 20 characters.

The query returns the date. If no date is stored, an empty quoted string ("") is returned.

Parameter	Typical return
"<string>"	"<string>"
Enters the calibration date: CAL:DATE "4/22/17"	

Remarks

– This setting is non-volatile; it will not be changed by power cycling or after a Factory Reset (*RST).

CALibration:SAVE

The command saves calibration constants in non-volatile memory after the calibration procedure has been completed. When you exit (CALibration:STATe OFF) without saving, the previous constants are restored. If the Auto Save feature is not enabled, you need to send CAL:SAVE command to store the new CAL data to non-volatile memory.

Parameter	Typical return
(none)	(none)
Saves calibration constants: CAL:SAVE	

Remarks

– System date will be used as calibration date and automatically store into the non-volatile memory when calibration constants are stored. You can overwrite the calibration date using CAL:DATE.

CALibration:SECure:CODE <new passcode>

The command enters a new security passcode. To change the passcode, first unsecure the battery emulator using the old passcode. Then, enter the new passcode. The passcode is case-insensitive and can be set up to 12 characters. The first character must be a letter (A-Z), remaining may contains letters, numbers (0-9), or underscore "_". Blank spaces are not allowed.

Parameter	Typical return
<new code>	(none)
Sets the new security passcode to E36731A: CAL:SEC:CODE e36731a	

Remarks

– When you first receive your instrument, it is secured, and the default security code is set to "E36731A".

– This setting is non-volatile; it will not be changed by power cycling or after a Factory Reset (*RST).

– If you forget your security code, you can override the security feature. For more information, see *E36731A Service Guide*.

CALibration:SECure:STATe ON | OFF | 1 | 0, <passcode>
CALibration:SECure:STATe?

The command unsecures or secures the battery emulator for calibration, using the passcode specified by CALibration:SECure:CODE.

The query returns 0 (calibration unsecured) or 1 (calibration secured).

Parameter	Typical return
ON	OFF	1	0, <passcode>	0 or 1
Secures the battery emulator for calibration: CAL:SEC:STAT ON, E36731A	

Remarks

– When you first receive your instrument, it is secured, and the default security code is set to "E36731A".

– This setting is non-volatile; it will not be changed by power cycling or after a Factory Reset (*RST).

CALibration:STRing "<string>"
CALibration:STRing?

The command saves up to 40 characters of information, such as the calibration message, the next calibration due date, or the battery emulator's serial number. You must unsecure the instrument before saving the string, but you can read the string regardless of the security status.

The query returns a quoted string.

Parameter	Typical return
"<string>"	"<string>"
Sets the string to "4/22/17": CAL:STR "4/22/17"	

Remarks

- If no calibration message has been specified, an empty quoted string ("") is returned.

- Storing a calibration message will overwrite any message previously stored in calibration memory.

- This setting is non-volatile; it will not be changed by power cycling or after a Factory Reset (*RST).

CURRent Subsystem

Current commands program the output current and current protection functions. The SOURce keyword is optional in the following commands.

[SOURce:]CURRent[:LEVel][:IMMediate][:AMPLitude] <current> | MINimum | MAXimum | DEFault| UP| DOWN[, (@<chanlist>)]
[SOURce:]CURRent[:LEVel][:IMMediate][:AMPLitude]? [MINimum | MAXimum | DEFault,] [(@<chan-list>)]

The command sets the immediate current level when the output is in constant current mode. Units are in amperes. The immediate level is the current limit value of the output selected with the INSTrument command.

This command also increases or decreases the immediate current level using the ''UP'' or ''DOWN'' parameter by a predetermined amount. Note that "UP" and "DOWN" parameters are only supported in Power Supply mode. The command CURRent:STEP sets the amount of increase or decrease.

The query returns the programmed current level in the form +n.nnnnnnnE+nn for each channel specified. Multiple responses are separated by commas.

Parameter	Typical return
minimum - maximum	MIN	MAX	DEF	UP	DOWN (Values are range and mode dependent. See Programming Range)	<current level>
*RST MIN	
Sets the output current level to 3 A: CURR 3, (@1)	

[SOURce:]CURRent[:LEVel][:IMMediate]:STEP[:INCRement] <current> | DEFault, [(@<chanlist>)]

`P.Supply Mode only`

[SOURce:]CURRent[:LEVel][:IMMediate]:STEP[:INCRement]? [DEFault,] [(@<chanlist>)]

The command sets the step size for current programming with the CURRent UP and CURRent DOWN commands.

To set the step size to the minimum resolution, set the step size to ''DEFault''. The CURR:STEP? DEF returns the minimum resolution of your instrument. The immediate current level increases or decreases by the value of the step size. For example, the output current will increase or decrease 10 mA if the step size is 0.01.

This command is useful when you program the power supply to the allowed minimum resolution. At *RST, the step size is the value of the minimum resolution.

The query returns a number in the form +n.nnnnnnnnE+nn for each channel specified.

Parameter	Typical return
minimum - maximum | DEF (See Programming Range)	<current level>
*RST MIN	
Sets the output current step size to 3 A: CURR:STEP 3, (@1)	

[SOURce:]CURRent[:LEVel]:TRIGgered[:AMPLitude] <current>| MINimum | MAXimum[, (@<chanlist>)
[SOURce:]CURRent[:LEVel]:TRIGgered[:AMPLitude]? [MINimum | MAXimum,] [(@<chanlist>)]

The command sets the triggered current level when the output is in constant current mode. The triggered level is a stored value that will be programmed when a Step transient is triggered. Units are in amperes.

The query returns the programmed current level in the form +n.nnnnnnnnE+nn for each channel specified. Multiple responses are separated by commas.

Parameter	Typical return
minimum - maximum | MIN | MAX (Values are range and mode dependent. See Programming Range)	<current level>
*RST MIN	
Sets the triggered current to 1 A on channel 1: CURR:TRIG 1, (@1)	

[SOURce:]CURRent:LIMit[:POSitive][:IMMediate][:AMPLitude] <current> | MINimum | MAXimum[, (@<chanlist>)] `Load Mode only`

[SOURce:]CURRent:LIMit[:POSitive][:IMMediate][:AMPLitude]? [MINimum | MAXimum,] [(@<chan-list>)]

The command sets the current limit when in CV mode. Units are in amperes. The minimum value is the most negative value.

Parameter	Typical return
minimum - maximum | MIN | MAX (Values are range dependent. See Programming Range)	<+ current limit>
*RST MAX	
Sets the current limit to 2 A: CURR:LIM 2 (@1)	

Remarks

– MIN is the most negative value of the range. MAX is the least negative value of the range.

– The query returns the programmed current limit in the form +n.nnnnnnE+nn for each channel specified. Multiple responses are separated by commas.

[SOURce:]CURRent:MODE FIXed | STEP | LIST[, (@<chanlist>)]
[SOURce:]CURRent:MODE? [(@<chanlist>)]

The command determines what happens to the output current when the transient system is initiated and triggered.

The query returns the current mode for each channel specified. Multiple responses are separated by commas.

Mode	Description
FIXed	Nothing happens. The input current remains at its immediate value.
STEP	The output goes to the triggered level when a trigger occurs.
LIST	The output follows the list values when a trigger occurs.

Parameter	Typical return
FIX | STEP | LIST	FIX, STEP, or LIST
*RST FIX	
Sets the current mode of channel 1 to Step: CURR:MODE STEP, (@1)	

[SOURce:]CURRent:PROTection:CLEar [(@<chanlist>)] `P.Supply Mode only`

The command clears an overcurrent protection event.

Parameter	Typical return
(none)	(none)
Clears an overcurrent protection event for channel 1: CURR:PROT:CLE (@1)	

[SOURce:]CURRent:PROTection:DELay[:TIME] <time> | MINimum | MAXimum[, (@<chanlist>)]
[SOURce:]CURRent:PROTection:DELay[:TIME]? [MINimum | MAXimum,] [(@<chanlist>)]

The command sets the over-current protection delay time in seconds. The over-current protection function will not be triggered during the delay time. After the delay time has expired, the over-current protection function will be active. This prevents momentary changes in output status from triggering the over-current protection function. Delay time can be programmed from 0 to 0.255 seconds (Load mode) or from 0 to 3600 seconds (Power Supply mode), with a resolution of 1 millisecond.

The query returns the overcurrent protection delay in seconds in the form +n.nnnnnnnnE+nn.

Parameter	Typical return
Power Supply mode: 0 - 3600 | MIN | MAX *RST 0.05	<delay value>
Load mode: 0 – 0.255 | MIN | MAX *RST 0.02	
Sets the protection delay to 0.2 seconds for channel 1: CURR:PROT:DEL 0.2, (@1)	

Remarks

– The operation of over-current protection is affected by the setting of the current protection delay start event, which is specified by CURRent:PROTection:DELay:STARt.

[SOURce:]CURRent:PROTection:DELay:STARt SCHange | CCTRans[, (@<chanlist>)]
[SOURce:]CURRent:PROTection:DELay:STARt? [(@<chanlist>)]

The command specifies the condition that starts the overcurrent protection delay timer.

Mode	Description
SCHange	Transitions into constant current mode are automatically ignored during a programmed settings change in voltage, current, or input state. At the end of the settings change, the delay timer starts, allowing additional protection delay time. There is no protection delay outside of these time windows.
CCTRans	The overcurrent protection delay timer is started by any transition of the output into constant current mode.

The query returns SCH or CCTR.

Parameter	Typical return
SCH	CCTR	SCH or CCTR
*RST SCH	
Sets CCTRans as the current protection delay mode for channel 1: CURR:PROT:DEL:STAR CCTR, (@1)	

[SOURce:]CURRent:PROTection:STATe ON | OFF | 1 | 0[, (@<chanlist>)]
[SOURce:]CURRent:PROTection:STATe? [(@<chanlist>)]

The command enables or disables overcurrent protection, which causes the instrument to go into a protected state when the output status is in constant current mode for a time longer than the OCP delay. Output will be OFF after OCP is tripped.

The query returns 1 (ON) or 0 (OFF) for the over current protection state.

Parameter	Typical return
ON	OFF	1	0	0 or 1
*RST OFF	
Enables the current protection state: CURR:PROT:STAT ON, (@1)	

[SOURce:]CURRent:PROTection:TRIPped? [(@<chanlist>)]

The query indicates whether an overcurrent protection occurred (1) or not (0). This is reset to 0 by CURRent:PROTection:CLEar.

Parameter	Typical return
(none)	1 or 0
Indicates whether an overcurrent protection occurred: CURR:PROT:TRIP?	

[SOURce:]CURRent:RANGe ‹current› | MINimum | MAXimum[, (@‹chanlist›)] `Load Mode only`
[SOURce:]CURRent:RANGe? [MINimum | MAXimum,] [(@‹chanlist›)]

The command sets the current range. The value that you enter must be the highest value in amperes that you expect to input. The instrument selects the range with the best resolution for the value entered. The following current ranges are available for the battery emulator:

	E36731A
High range	from 0.01 A to 40.8 A
Low range	from 0.001 A to 4.08 A

The query returns the maximum current that can be programmed on the range that is presently set. The current is in the form +n.nnnnnnnnE+nn for each channel specified. Multiple responses are separated by commas.

Parameter	Typical return
minimum - maximum	MIN	MAX (Values are range dependent. See Programming Range)	‹current range›
*RST MAX	
Sets the low current range (from 0.001 A to 4.08 A): CURR:RANG 3, (@1)	

Remarks

- This command is coupled with [SOURce:]CURRent. This means that if a range command places an input on a range with a lower maximum current than the present current level, an out of range error occurs. This also occurs if a current is programmed that is too large for the present range. Errors can be avoided by sending both level and range commands in the same SCPI message. When the range and level information is received as a set, no range/setting conflict occurs.

- If a programmed range change occurs while the input is enabled, the input will be temporarily disabled while the range switch occurs. The transition from on–to–off and then from off–to–on will also be delayed by the settings of INPut:DELay:FALL and INPut:DELay:RISE.

[SOURce:]CURRent:SENSe:LOW ON | OFF | 1 | 0 `P.Supply Mode only`
[SOURce:]CURRent:SENSe:LOW?

The command enables or disables the low range current measurement.

The query returns 1 (ON) or 0 (OFF) for the low range current measurement state.

Parameter	Typical return
ON	OFF	1	0	0 or 1
Default: ON	
Enables the low range current measurement: CURR:SENS:LOW ON	

[SOURce:]CURRent:SLEW[:POSitive|RISing][:IMMediate] <slew rate> | MINimum | MAXimum | INFinity
[, (@<chanlist>)] **Load Mode only**

[SOURce:]CURRent:SLEW[:POSitive|RISing][:IMMediate]? [MINimum | MAXimum,] [(@<chanlist>)]

[SOURce:]CURRent:SLEW:NEGative|FALLing[:IMMediate] <slew rate> | MINimum | MAXimum | INFin-
ity[, (@<chanlist>)] **Load Mode only**

[SOURce:]CURRent:SLEW:NEGative|FALLing[:IMMediate]? [MINimum | MAXimum,] [(@<chanlist>)]

The command sets the current slew rate. The slew rate is set in amps per second and affects all programmed current changes, including those due to the input state turning on or off. The slew rate can be set to any value between the minimum value and 9.9E+37. For very large values, the slew rate will be limited by the analog performance of the output circuit. The keywords MAX or INFinity set the slew rate to maximum.

Parameter	Typical return
0 - 9.9E+37 | MIN | MAX | INF	<slew rate>
*RST MAX	

Sets the positive input slew rate to 1 A per second: CURR:SLEW 1, (@1)
Sets the negative input slew rate to 1 A per second: CURR:SLEW:NEG 1, (@1)

Remarks

– The query returns the value that was sent. If the value is less than the minimum slew rate, only the minimum value is returned. The resolution of the slew setting is also the minimum value, which can be queried using CURRent:SLEW? MIN. The exact value varies slightly based on calibration.

– The query returns the programmed slew rate in the form +n.nnnnnnE+nn for each channel specified. Multiple responses are separated by commas. If a slew rate of 9.9E+37 is returned, it means that the maximum or fastest slew rate has been set.

[SOURce:]CURRent:SLEW[:POSitive|RISing]:MAXimum ON | OFF | 1 | 0[, (@<chanlist>)] `Load Mode only`
[SOURce:]CURRent:SLEW[:POSitive|RISing]:MAXimum? (@<chanlist>)

[SOURce:]CURRent:SLEW:NEGative|FALLing:MAXimum ON | OFF | 1 | 0[, (@<chanlist>)] `Load Mode only`
[SOURce:]CURRent:SLEW:NEGative|FALLing:MAXimum? [(@<chanlist>)]

The command enables/disables the maximum slew rate override. When enabled, the slew rate is set to its maximum value. When disabled, the slew rate is set to the immediate value set by the CURRent:SLEW command. Use CURRent:SLEW? MAX to query the maximum slew rate.

Parameter	Typical return
ON	OFF	1	0	0 or 1
*RST ON	
Disables the positive maximum slew rate: CURR:SLEW:MAX OFF, (@1)	
Disables the negative maximum slew rate: CURR:SLEW:NEG:MAX OFF, (@1)	

Remark

– The CURRent:SLEW:MAX command is coupled to the CURRent:SLEW command. If the CURRent:SLEW command sets the slew rate to MAX or INFinity, CURRent:SLEW:MAX is enabled. If the slew rate is set to any other value, CURRent:SLEW:MAX is disabled.

[SOURce:]CURRent:SLEW:COUPle ON | OFF | 1 | 0[, (@<chanlist>)] `Load Mode only`
[SOURce:]CURRent:SLEW:COUPle? [(@<chanlist>)]

The command sets the current slew tracking state.

Parameter	Typical return
ON	OFF	1	0	0 or 1
*RST OFF	
Enables the current slew tracking state: CURR:SLEW:COUP ON, (@1)	

[SOURce:]CURRent:TLEVel <transient level> | MINimum | MAXimum[, (@<chanlist>)] `Load Mode only`
[SOURce:]CURRent:TLEVel? [MINimum | MAXimum,] [(@<chanlist>)]

The command specifies the transient of the input current. The transient function switches between the immediate setting and the transient level. Units are in amperes.

The query returns a number in the form +n.nnnnnnnnE+nn for each channel specified.

Parameter	Typical return
minimum - maximum | MIN | MAX (Values are range dependent. See Programming Range)	<transient level>
*RST MIN	

Sets the transient input current to 5 A: CURR:TLEV 5, (@1)

CHANnel | INSTrument Subsystem

These commands program the channel selection capability of the battery emulator. The CHANnel and INSTrument commands are equivalent.

CHANnel | INSTrument[:SELect] CH1
CHANnel | INSTrument[:SELect]?

The command selects the output to be programmed. The CHANnel | INSTrument command provides a mechanism to identify and select an output.

The query returns the currently selected output by the CHANnel | INSTrument[:SELect] or CHANnel | INSTrument:NSELect command.

Parameter	Typical return
CH1	CH1
*RST CH1	
Selects channel 1 to be programmed: INST CH1 or CHAN CH1	

CHANnel | INSTrument:NSELect 1
CHANnel | INSTrument:NSELect?

The command selects the output to be programmed by a numeric value instead of the output identifier used in the INSTrument[:SELect] command. "1" selects CH1 output.

The query returns the currently selected output by the INSTrument:NSELect or INSTrument[:SELect] command. The returned parameter is "1" for CH1 output.

Parameter	Typical return
1	1
*RST 1	
Selects channel 1 to be programmed: INST:NSEL 1 or CHAN:NSEL 1	

CHANnel | INSTrument:LOAD 1 `Load Mode only`

CHANnel | INSTrument:LOAD? [MAXimum]

The command selects input from the instrument (when in load mode) to which all subsequent input-specific commands will be directed.

The query returns the currently selected input by the INSTrument:LOAD command. If MAX parameter is used, the query returns the number of inputs in the instrument. The returned parameter is "1" for one input.

Parameter	Typical return
1	1

Selects one input to be programmed: INST 1 or CHAN 1

Returns the number of input in the instrument: INST? MAX or CHAN? MAX

DIGital Subsystem

[SOURce:]DIGital:INPut:DATA?

The query reads the state of the digital control port. Returns the binary-weighted value of the state of pins 1 through 3 in bits 0 through 2 respectively.

Parameter	Typical return
(none)	‹bit value›
Reads the state of the digital control port: DIG:INP:DATA?	

[SOURce:]DIGital:OUTPut:DATA ‹value›
[SOURce:]DIGital:OUTPut:DATA?

The command sets the output data on the digital control port when that port is configured for Digital I/O operation. The port has three signal pins and a digital ground pin. In the binary-weighted value that is written to the port, the pins are controlled according to the following bit assignments:

Pin	1	2	3
Bit number	0	1	2
Decimal value	1	2	4

The query returns the state of the digital control port pins.

Parameter	Typical return
0 - 7	‹bit value›
*RST 0	
Programs pins 1 and 3 with bit number 0 = 1 and bit number 2 = 4: DIG:OUTP:DATA 5	

[SOURce:]DIGital:PIN<1-3>:FUNCtion DIO | DINPut | TOUTput | TINPut | FAULt | INHibit | ONCouple | OFFCouple | RELay
[SOURce:]DIGital:PIN<1-3>:FUNCtion?

The command sets the functions of the digital port pins. The pin functions are saved in non-volatile memory.

The query returns the setting of pins 1, 2, or 3.

Function	Description
DIO	The pin is a general-purpose ground-referenced digital input/output. The output can be set with [SOURce:]DIGital:OUTPut:DATA.
DINPut	The pin is in digital input-only mode. The digital output data of the corresponding pin is ignored.
TOUTput	The pin is configured as a trigger output. When configured as a trigger output, the pin will only generate output triggers if the List transient system has been configured to generated trigger signals. See [SOURce:]STEP:TOUTput, [SOURce:]LIST:TOUTput:BOSTep, and [SOURce:]LIST:TOUTput:EOSTep.
TINPut	The pin is configured as a trigger input. When configured as a trigger input, the pin can be selected as the source for transient trigger signals. See TRIGger[:SEQuence]:SOURce.
FAULt	Applies only to pin 1. Setting FAULt means that pin 1 functions as an isolated fault output. The fault signal is true when any output is in a protected state (from OC, OV, OT, INH). Note also that Pin 2 serves as the isolated common for pin 1. When pin 1 is set to the FAULt function, the instrument ignores any commands to program pin 2. Queries of pin 2 will return FAULt. If pin 1 is changed from FAULt to another function, pin 2 is set to DINPut.
INHibit	Applies only to pin 3. When pin 3 is configured as an inhibit input, a true signal at the pin will disable all input or output channels.
ONCouple	When configured as an On control, the pin will synchronize the output On state between battery emulators. Only one pin can be configured as an On control. The pin will function as both an input and an output. The polarity of the pin is fixed and cannot be programmed.
OFFCouple	When configured as an Off control, the pin will synchronize the output Off state between battery emulators. Only one pin can be configured as an Off control. The pin will function as both an input and an output. The polarity of the pin is fixed and cannot be programmed.
RELay	The pin is configured as an output relay. See OUTPut:RELay. **P.Supply Mode only**

Parameter	Typical return
DIO	DINP	TOUT	TINP	FAUL	INH	ONC	OFFC	REL	DIO, DINP, TOUT, TINP, FAUL, INH, ONC, OFFC, or REL
*RST DINP	
Sets pin 1 to Fault mode: `DIG:PIN1:FUNC FAUL`	

[SOURce:]DIGital:PIN<1-3>:POLarity POSitive | NEGative
[SOURce:]DIGital:PIN<1-3>:POLarity?

The command sets the polarity of the digital port pins. The pin polarities are saved in non-volatile memory.

The query returns the polarity, POS or NEG.

Polarity	Description
POSitive	Setting a polarity to POSitive means that a logical true signal is a voltage high at the pin. For trigger inputs and outputs, POSitive means a rising edge.
NEGative	Setting the polarity NEGative means that a logical true signal is a voltage low at the pin. For trigger inputs and outputs, NEGative means a falling edge.

Parameter	Typical return
POS	NEG	POS or NEG
*RST POS	
Sets pin 1 to negative polarity: DIG:PIN1:POL NEG	

[SOURce:]DIGital:TOUTput:BUS[:ENABle] ON | OFF | 1 | 0
[SOURce:]DIGital:TOUTput:BUS[:ENABle]?

The command enables/disables BUS triggers on digital port pins. This allows a BUS trigger to be sent to any digital port pin that has been configured as a trigger output. The state is either ON (1) or OFF (0). A trigger is generated when the state is True (ON). A trigger is not generated when the state is False (OFF). A BUS trigger is generated using the *TRG command.

The query returns 0 (OFF) if the trigger signal will not be generated when a BUS trigger command occurs, and 1(ON) if a trigger signal will be generated when a BUS trigger command occurs.

Pins 1 to 3 must be configured as trigger outputs before they can generate a trigger signal. See [SOURce:]DIGital:PIN<1-3>:FUNCtion and [SOURce:]DIGital:PIN<1-3>:POLarity.

Parameter	Typical return
ON	OFF	1	0	0 or 1
*RST OFF	
Enables BUS-generated trigger signals on the digital pins: DIG:TOUT:BUS ON	

DISPlay Subsystem

DISPlay:BRIGhtness <brightness level>

The command sets the brightness level of the LCD display.

Parameter	Typical return
10 - 100	<brightness level>
Default: 100	
Sets the LCD display brightness to the maximum: `DISP:BRIG 100`	

Remarks

– This setting is non-volatile; it will not be changed by power cycling or after a Factory Reset (***RST**).

DISPlay[:WINDow][:STATe] ON | OFF | 1 | 0
DISPlay[:WINDow][:STATe]?

The command turns the front-panel display off or on. When the display is turned off, outputs are not sent to the display and all annunciators except ERROR are disabled. The display state is automatically turned on when you return to the local mode. Press **Lock/Unlock** key to return to the local mode.

The query returns 0 (OFF) or 1 (ON).

Parameter	Typical return
ON	OFF	1	0	0 or 1
*RST ON	
Turns the front panel display off: `DISP OFF`	

DISPlay[:WINDow]:TEXT[:DATA] "<string>"
DISPlay[:WINDow]:TEXT[:DATA]?

The command displays a message of up to 30 characters on the front panel. Additional characters are truncated.

The query returns the quoted string.

Parameter	Typical return
"<string>"	"<string>"
Sets the string displayed on the front panel to "Keysight": `DISP:TEXT "Keysight"`	

DISPlay[:WINDow]:TEXT:CLEar

The command clears the message displayed on the front panel.

Parameter	Typical return
none	none

Clears the message displayed on the front panel: `DISP:TEXT:CLE`

DISPlay[:WINDow]:VIEW METER1
DISPlay[:WINDow]:VIEW?

The command selects the output channel view of the front panel display. METER1 displays one output channel.

The query returns METER1.

Parameter	Typical return
METER1	METER1
*RST METER1	

Sets the front panel to display one channel: `DISP:VIEW METER1`

EMULation Subsystem

[SOURce:]EMULation PSUPply | LOAD
[SOURce:]EMULation?

The command sets the emulation type. It forces *RST command before the selected mode is entered.

Mode	Description
PSUPply	Power supply. This mode emulates a power supply operation.
LOAD	Electronic load. This mode emulates an electronic load operation.

Parameter	Typical return
PSUP| LOAD	PSUP or LOAD
Selects power supply as the emulation type: EMUL PSUP	

Remarks

– This setting is non-volatile; it will not be changed by power cycling or after a Factory Reset (*RST).

FETCh Subsystem `Load Mode only`

Fetch commands return measurement data that has been previously acquired by a MEASurement command or triggered acquisition. FETCh queries do not generate a new measurement, but allow additional measurement calculations from the same acquired data. The data is valid until the next MEASure or INITiate command occurs.

FETCh[:SCALar]:CURRent[:DC]? [CH1] [(@<chanlist>)]

FETCh[:SCALar]:VOLTage[:DC]? [CH1] [(@<chanlist>)]

FETCh[:SCALar]:POWer[:DC]? [CH1] [(@<chanlist>)]

The query returns the averaged measurement. Values are either in amperes, volts, or watts. The reading is in the form +n.nnnnnnE+nn for each channel specified. Multiple responses are separated by commas.

Parameter	Typical return
(none)	<DC value>

Returns the averaged current FETC:CURR? (@1)
Returns the averaged voltage FETC:VOLT? (@1)
Returns the averaged power FETC:POW? (@1)

FETCh[:SCALar]:CURRent:ACDC? [(@<chanlist>)]

FETCh[:SCALar]:VOLTage:ACDC? [(@<chanlist>)]

The query returns the RMS measurement (AC + DC). Values returned are either in amperes, or volts. The reading is in the form +n.nnnnnnE+nn for each channel specified. Multiple responses are separated by commas.

Parameter	Typical return
(none)	<ACDC value>

Returns the measured RMS current FETC:CURR:ACDC? (@1)
Returns the measured RMS voltage FETC:VOLT:ACDC? (@1)

FETCh[:SCALar]:CURRent:MAXimum? [(@<chanlist>)]

FETCh[:SCALar]:VOLTage:MAXimum? [(@<chanlist>)]

FETCh[:SCALar]:POWer:MAXimum? [(@<chanlist>)]

FETCh[:SCALar]:CURRent:MINimum? [(@<chanlist>)]

FETCh[:SCALar]:VOLTage:MINimum? [(@<chanlist>)]

FETCh[:SCALar]:POWer:MINimum? [(@<chanlist>)]

The query returns the maximum or minimum value. Values returned are either in amperes, volts, or watts. The reading is in the form +n.nnnnnnE+nn for each channel specified. Multiple responses are separated by commas.

Parameter	Typical return
(none)	<MIN value>
	<MAX value>
Returns the measured minimum current FETC:CURR:MIN? (@1)	
Returns the measured minimum voltage FETC:VOLT:MIN? (@1)	
Returns the measured minimum power FETC:POW:MIN? (@1)	
Returns the measured maximum current FETC:CURR:MAX? (@1)	
Returns the measured maximum voltage FETC:VOLT:MAX? (@1)	
Returns the measured maximum power FETC:POW:MAX? (@1)	

FETCh:ARRay:CURRent[:DC]? [(@<chanlist>)]

FETCh:ARRay:VOLTage[:DC]? [(@<chanlist>)]

FETCh:ARRay:POWer[:DC]? [(@<chanlist>)]

The query returns an array of measurement data. Values are either in amperes, volts, or watts.

Parameter	Typical return
(none)	<value> [,<value>] or <Block>

Returns the measured current array FETC:ARR:CURR? (@1)
Returns the measured voltage array FETC:ARR:VOLT? (@1)
Returns the measured power array FETC:ARR:POW? (@1)

Remarks

– The sampling rate is set by SENSe:SWEep:TINTerval. The position of the trigger relative to the beginning of the data buffer is determined by SENSe:SWEep:OFFSet. The number of points returned is set by SENSe:SWEep:POINts.

FETCh[:SCALar]:DLOG? <number>[, (@<chanlist>)]

The query returns the specified number of logged data from channel that is enabled with voltage and/or current data logging. The data is fetched start from the data next to the last fetched data in the previous fetch.

Parameter	Typical return
0 - 65536	<value> [,<value>] or <Block>

Returns 10 logged data from channel 1: FETC:DLOG? 10, (@1)

FUNCtion | MODE Subsystem

These commands set the input priority mode. Function and Mode command are equivalent.

[SOURce:]FUNCtion | MODE CURRent | VOLTage | POWer | RESistance[, (@<chanlist>)] `Load Mode only`
[SOURce:]FUNCtion | MODE? [(@<chanlist>)]

The command sets the input regulation mode.

Mode	Description
CURRent	Constant current (CC) mode
VOLTage	Constant voltage (CV) mode
POWer	Constant power (CP) mode
RESistance	Constant resistance (CR) mode

In CV mode, the input is controlled by a bi-polar constant voltage feedback loop, which maintains the input voltage at its positive or negative programmed setting.

In CC mode, the input is controlled by a bi-polar constant current feedback loop, which maintains the input sourcing or sinking current at its programmed setting.

In CP and CR modes, the constant current along with the constant voltage feedback loops maintain the input power and resistance at their programmed settings.

Parameter	Typical return
CURR	VOLT	POW	RES	CURR, VOLT, POW, or RES
*RST CURR	
Selects the constant current mode: FUNC CURR, (@1)	

HCOPy Subsystem

HCOPy commands return the front panel display image.

HCOPy:SDUMp:DATA?

The query returns the front panel display image ("screen shot").

Parameter	Typical return
(none)	(A definite-length binary block containing the image.) Definite-length block data allows any type of device-dependent data to be transmitted as a series of 8-bit binary data bytes. This is particularly useful for transferring large quantities of data or 8-bit extended ASCII codes.
Capture and return the display image: HCOP:SDUM:DATA?	

Remarks

-   The image format (PNG or BMP) is specified by **HCOPy:SDUMp:DATA:FORMat**.

HCOPy:SDUMp:DATA:FORMat PNG | BMP
HCOPy:SDUMp:DATA:FORMat?

The command specifies the image format for images returned by **HCOPy:SDUMp:DATA?**.

Parameter	Typical return
PNG	BMP Default: BMP	BMP
Specify BMP as the image format: HCOP:SDUM:DATA:FORM BMP	

IEEE–488.2 Common Commands

*CLS

The command clears all event registers, the Status Byte and the Error Queue.

Parameter	Typical return
(none)	(none)
Clears all event registers, the Status Byte and the Error Queue: *CLS	

*ESE <enable value>
*ESE?

The command enables bits in the Standard Event Enable register. The selected bits are then reported to the Status Byte.

The query returns the decimal value of the binary-weighted sum of all bits in the Standard Event enable register.

Parameter	Typical return
A decimal value that corresponds to the binary-weighted sum of the bits in the register.	<bit value>
Default: 0	
Enable bit 3 and 4 in the enable register: *ESE 24	

Standard event status enable register

Bit	Bit Name	Decimal Value	Definition
0	Operation Complete	1	All commands before 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, a new command line was received before a previous query has been read, or both input and output buffers are full.
3	Device-Specific Error	8	A device-specific error, including a selftest error, calibration error or other device-specific error occurred. See Error Messages.
4	Execution Error	16	An execution error occurred. See Error Messages.
5	Command Error	32	A command syntax error occurred. See Error Messages.
6	not used	not used	0 is returned
7	Power On	128	Power has been cycled since the last time the event register was read or cleared.

Remarks

– Use *PSC to control whether the Standard Event Enable register is cleared at power on. For example, *PSC 0 preserves the enable register contents through power cycles.

– *CLS clears the event register, but does not clear the enable register.

– This setting is non-volatile; it does not change after a Factory Reset (*RST), Status Preset (STATus:PRESet) or Clear Status (*CLS).

*ESR?

The query returns the decimal value of the binary-weighted sum of all bits in the Standard Event register.

The event register is a read-only register that latches events from the condition register. While an event bit is set, subsequent events corresponding to that bit are ignored.

Parameter	Typical return
(none)	<bit value>

Read event status enable register: *ESR?

Remarks

- In order to be reported to the Status 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 execution of the Clear Status (*CLS).

*IDN?

The query returns the instrument's identification string. An example is shown below.

Keysight Technologies,E36731A,MY00000001,K-XX.XX.XX-XX.XX-XX.XX-XX.XX

The four comma-separated fields are the manufacturer's name, the model number, the serial number, and the revision code. The first "K-XX.XX.XX" in the revision code is the Keysight Pathwave revision; the second is the front panel firmware revision; the third is the controller firmware revision; and the fourth is the power board firmware revision.

Parameter	Typical return
(none)	<ASCII string with comma-separated fields>

Return the instrument's identification string: *IDN?

*OPC
*OPC?

The command sets the "Operation Complete" bit (bit 0) of the Standard Event register after the command is executed.

The query returns 1 to the output buffer after the command is executed.

Parameter	Typical return
(none)	1

Sets the Operation Complete bit: *OPC

Return a 1 when the command is complete: *OPC?

*PSC 0 | 1
*PSC?

The command clears the Status Byte and the Standard Event register enable masks when power is turned on (*PSC 1). When *PSC 0 is in effect, the Status Byte and Standard Event register enable masks are not cleared when power is turned on.

The query returns a 0 (*PSC 0) or a 1 (*PSC 1).

Parameter	Typical return
0	1	0 or 1
Default: 1	
Clear the Status Byte and Standard Event register enable masks: *PSC 1	

Remarks

– This setting is non-volatile; it does not change after a Factory Reset (*RST), Status Preset (STATus:PRESet) or Clear Status (*CLS).

*RCL 0 | 1 | 2 | 3 | 4

The command recalls a previously stored state from one of five non-volatile storage locations. To recall a stored state, you must use the same memory location used previously to store the state. If an empty memory location is recalled, power-on default states will be applied to the battery emulator.

Parameter	Typical return
0 - 4	(none)
Recall the state from location 1: *RCL 1	

*RST

The command resets the instrument to its power-on default state. Refer to Factory Reset State for a complete listing of the instrument's factory configuration. It does not clear any of the status registers or the error queue. It also does not affect any interface error conditions.

*RST also forces the ABORt commands. This cancels any output trigger actions presently in process and resets the WTG bits in the Status Questionable Instrument Summary Registers.

Parameter	Typical return
(none)	(none)
Reset the instrument: *RST	

*SAV 0 | 1 | 2 | 3 | 4

The command saves the current instrument state using one of five non-volatile storage locations.

The instrument states includes:

Power supply mode

– Voltage, current, OVP, OCP delay, OCP state, and OCP delay start

– Voltage slew, output preference, and sense

– Output state, and couple trigger channel

– Output on/off sequencing

– List/Sequencer settings

– Trigger settings

– Digital I/O output data and bus setting

– Data logger trigger source

Load mode

– Voltage, current, resistance, power, range, slew, mode, sense, short and current limit

– OCP delay, OCP state, OCP delay start, OPP state, OPP delay and UVI

– Input state

– Input on/off sequencing

– List/Sequencer settings

– Trigger settings

– Digital I/O output data and bus setting

– Scope and data logger trigger source

Saving a state overwrites the previous state (if any) stored in that location.

When shipped from the factory, storage locations 0 through 4 are empty.

Refer to Factory Reset Settings for a list of instrument settings that can be saved.

Parameter	Typical return
0 - 4	(none)
Save the state to location 1: *SAV 1	

*SRE <enable value>
*SRE?

The command enables the bits in the Status Byte Enable register.

The query returns the decimal value of the binary-weighted sum of all bits set in the register.

Parameter	Typical return
A decimal value that corresponds to the binary-weighted sum of the bits in the register.	<bit value>
Enable bit 3 and 4 in the enable register: *SRE 24	

Remarks

- To enable specific bits, specify the decimal value corresponding to the binary-weighted sum of the bits in the register. The selected bits are summarized in the "Master Summary" bit (bit 6) of the Status Byte Register. If any of the selected bits change from 0 to 1, the instrument generates a Service Request signal.

- *CLS command clears the event register, but does not clear the enable register. An event register is a read-only register that latches events from the condition register. While an event bit is set, subsequent events corresponding to that bit are ignored.

- Use *PSC to control whether the Status Byte enable register is cleared at power-on. For example, *PSC 0 preserves the enable register contents through power cycles.

- The <enable> setting is non-volatile; it does not change after a Factory Reset (*RST) , Status Preset (STATus:PRESet) or Clear Status (*CLS).

*STB?

The query queries the Status Byte Summary register and returns the same result as a serial poll but the "Request Service" bit (bit 6) is not cleared if a serial poll has occurred.

Parameter	Typical return
(none)	<bit value>
Read the status byte: *STB?	

*TRG

The command generates an event trigger to the trigger system when the trigger system has a BUS (software) trigger as its trigger source (TRIG:SOUR BUS). If the trigger system is not initiated, the *TRG command is simply ignored.

Parameter	Typical return
(none)	(none)
Generates an immediate trigger: *TRG	

*TST?

The query returns a 0 if the self-test passes or a non-zero value if it fails. If the self-test fails, the instrument also generates an error message with additional information on why the test failed. Use **SYSTem:ERRor?** to read the error queue. See **SCPI Error Messages** for more information.

Parameter	Typical return
(none)	0 or 1
Performs an instrument self-test: *TST?	

*WAI

The command waits for all pending operations to complete before executing any additional remote interface commands. This command is used only in the triggered mode to wait for a pending delayed trigger.

Parameter	Typical return
(none)	(none)
Waits for all pending operations to complete: *WAI	

INITiate Subsystem

INITiate[:IMMediate]:ACQuire [(@<chanlist>)] `Load Mode only`

The command initiates the measurement trigger system. When a measurement trigger is initiated, an event on a selected trigger source causes the specified triggering action to occur. If a trigger occurs before the trigger system is ready for it, the trigger will be ignored. Check the WTG-meas bit in the operation status register to know when the instrument is ready to receive a trigger after initiating.

Parameter	Typical return
(none)	(none)
Initiates the trigger system on channel 1: INIT:ACQ (@1)	

Remarks

– It takes a few milliseconds for the battery emulator to be ready to receive a trigger signal after receiving the INITiate:ACQuire command, and it can take longer if the value of SENSe:SWEep:OFFSet is negative.

– Use the appropriate ABORt command to return the instrument to the idle state.

INITiate[:IMMediate]:DLOG <"filename">

The command initiates the internal or external data logging session. The filename in which to save the data should be the full path and filename. For internal data logging session, you will have to specify the exact file name, which is either Internal:/log1.dlog or Internal:/log2.dlog. Any other filename is not accepted for the internal data logging session.

Note that the supported path specifier — "External"/"Ext" and "Internal"/"Int" are not case-sensitive.

Parameter	Typical return
<"filename">	(none)
Sets the setting to log the data as "log_1.dlog" file in the drive "External": INIT:DLOG "External:/log_1.dlog" or INIT:DLOG "ext:/log_1.dlog"	

INITiate[:IMMediate][:TRANsient] [(@<chanlist>)]

The command initiates the transient trigger system. When initiated, an event on the selected trigger source causes the specified triggered action to occur. If a trigger occurs before the trigger system is ready for it, the trigger will be ignored. Check the WTG-meas bit in the operation status register to know when the instrument is ready to receive a trigger after initiating.

Parameter	Typical return
(none)	(none)
Initiates the transient trigger system on channel 1: INIT:TRAN (@1)	

INITiate:CONTinuous[:TRANsient] ON | OFF | 1 | 0[, (@<chanlist>)]
INITiate:CONTinuous[:TRANsient]? [(@<chanlist>)]

The command continuously initiates the transient trigger system. This allows multiple triggers to generate multiple input transients with no intermediate commands. The enabled state is ON (1); the disabled state is OFF (0). With continuous triggering disabled, the trigger system must be initiated for each trigger using the INITiate:TRANsient command.

The query returns 0 if continuous transients are disabled (OFF), and 1 if continuous transients are enabled (ON).

Parameter	Typical return
ON	OFF	1	0	1 or 0
*RST OFF	
Initiates the trigger system on channel 1 continuously: INIT:CONT:TRAN ON, (@1)	

Remark

- **ABORt:TRANsient** does not abort continuous triggers if INITiate:CONTinuous:TRANsient ON has been programmed. In this case, the trigger system will automatically re-initiate.

INPut | OUTPut Subsystem

These commands control the power supply output, load input, power-on and protection clear function. The INPut and OUTput commands are equivalent.

INPut | OUTPut[:STATe] ON | OFF | 1 | 0[, (@<chanlist>)]
INPut | OUTPut[:STATe]? [(@<chanlist>)]

The command enables or disables the output. The state of a disabled output is a condition of zero output voltage and zero source current. A query returns 0 if the output is off or 1 if it is on. At *RST, the output state is off.

The query returns the output state of the battery emulator. The returned value is "0" (OFF) or "1" (ON).

Parameter	Typical return
ON	OFF	1	0	0 or 1
*RST OFF	
Turns the output off: OUTP OFF, (@1)	

INPut | OUTPut[:STATe]:COUPle:CHANNel ALL | NONE | CH1
INPut | OUTPut[:STATe]:COUPle:CHANNel?

The command specifies which output channel is controlled by the output synchronization function. The output channel that have been synchronized or coupled will turn on and off together when any one of them is turned on or off, or when a signal is received from a digital connector pin that has been configured as an On couple or an Off couple pin.

There can be only one set of coupled channel; setting a new coupling replaces an existing coupling.

The query returns the channels that are coupled. Multiple responses are separated by commas.

> **NOTE** When this command is sent, the output channel goes to the output OFF state. This parameter is non-volatile and not affected by *RST.

Parameter	Typical return
ALL	NONE	CH1	<coupled channel>
Couples channel 1: OUTP:COUP:CHAN CH1	

INPut | OUTPut[:STATe]:DELay:FALL <*delay*> | MINimum | MAXimum[, (@<chanlist>)]
INPut | OUTPut[:STATe]:DELay:FALL? [MINimum|MAXimum,] [(@<chanlist>)]

This command sets the delay in seconds that the instrument waits before disabling the specified output. This allows multiple output channels to turn off in sequence. Each output will not turn off until its delay time has elapsed. This command effects on-to-off transitions including changes in the OUTPut[:STATe]. It does NOT affect transitions to off caused by protection functions. Delay times can be programmed from 0 to 1023 seconds (Load mode) or from 0 to 3600 seconds (Power Supply mode) with the resolution of one millisecond.

The query returns the parameter in the form +n.nnnnnnnE+nn. The parameter returned is the programmed delay time.

Parameter	Typical return
Power supply mode: 0 - 3600	MIN	MAX *RST 0	<delay value>
Load mode: 0 - 1023	MIN	MAX *RST 0	
Sets a delay of 0.5 s before turning off the output of Channel 1: OUTP:DEL:FALL 0.5, (@1)	

INPut | OUTPut[:STATe]:DELay:RISE <*delay*> | MINimum | MAXimum[, (@<chanlist>)]
INPut | OUTPut[:STATe]:DELay:RISE? [MINimum|MAXimum,] [(@<chanlist>)]

This command sets the delay in seconds that the instrument waits before enabling the specified output. This allows multiple output channels to turn on in sequence. Each output will not turn on until its delay time has elapsed. This command affects all off-to-on transitions including changes in the OUTPut[:STATe] as well as transitions due to OUTPut:PROTection:CLEar. Delay times can be programmed from 0 to 1023 seconds (Load mode) or from 0 to 3600 seconds (Power Supply mode) with the resolution of one millisecond.

The query returns the parameter in the form +n.nnnnnnnE+nn. The parameter returned is the programmed delay time.

Parameter	Typical return
Power supply mode: 0 - 3600	MIN	MAX *RST 0	<delay value>
Load mode: 0 - 1023	MIN	MAX *RST 0	
Sets a delay of 0.5 s before turning on the output of Channel 1: OUTP:DEL:RISE 0.5, (@1)	

INPut | OUTPut[:STATe]:PMODe:VOLTage | CURRent[, (@<chanlist>)] `P.Supply Mode only`
INPut | OUTPut[:STATe]:PMODe? [(@<chanlist>)]

This command sets the preferred mode for output on or output off transitions. It allows output state transitions to be optimized for either constant voltage or constant current operation. Turn-on and turn-off overshoots are minimized for the preferred mode of operation.

The query returns VOLT or CURR.

Mode	Description
VOLTage	Output on/off voltage overshoots in constant voltage operation are minimized.
CURRent	Output on/off current overshoots in constant current operation are minimized.

Parameter	Typical return
VOLTage	CURRent	VOLT	CURR
*RST VOLTage	
Sets the preferred mode of channel 1 to CURRent:: OUTP:PMOD CURR, (@1)	

INPut | OUTPut:INHibit:MODE LATChing | LIVE | OFF
INPut | OUTPut:INHibit:MODE?

The command sets the operating mode of the Inhibit input (INH) digital pin. The inhibit function shuts down the output in response to an external signal on the Inhibit input pin.

If an output channel has been turned off by OUTPut[:STATe], the inhibit function does not affect the output channel while it is in the OFF state. The Inhibit mode setting is stored in non-volatile memory.

The query returns LATC, LIVE, or OFF.

Mode	Description
LATChing	A transition to True on the Inhibit input disables all outputs, and they remain disabled until the Inhibit input goes False and the latched INH status bit is cleared by OUTPut:PROTection:CLEar or a front-panel protection clear.
LIVE	The enabled outputs follow the state of the Inhibit input. Outputs are disabled if Inhibit is true and enabled if Inhibit is false.
OFF	The Inhibit input is ignored.

Parameter	Typical return
LATC	LIVE	OFF	LATC, LIVE, or OFF
Sets the Inhibit input to latching mode: OUTP:INH:MODE LATC	

INPut | OUTPut:PON:STATe RST | RCL0 | RCL1 | RCL2 | RCL3 | RCL4
INPut | OUTPut:PON:STATe?

This determines whether the power-on state is set to the *RST state (RST) or the state stored in one of the five memory locations. Instrument states can be stored using the *SAV command. This parameter is saved in non-volatile memory.

Parameter	Typical return
RST	RCL0	RCL1	RCL2	RCL3	RCL4	RST, RCL0, RCL1, RCL2, RCL3, or RCL4
Sets the power-on state to the *RST state: OUTP:PON:STAT RST	
Sets the power-on state stored in memory location 1 at power on: OUTP:PON:STAT RCL1	

INPut | OUTPut:PROTection:CLEar [(@<chanlist>)]
INPut | OUTPut:PROTection:CLEar [(@<chanlist>)]

This clears the latch that disables the output when a protection condition occurs. The output is restored to the state it was in before the protection condition occurred.

Parameter	Typical return
(none)	(none)
Clears the latched protection status: INP:PRO:CLE (@1)	

INPut | OUTPut:RElay ON | OFF | 1 | 0 [, (@<chanlist>)] **P.Supply Mode only**
INPut | OUTPut:RELay? [(@<chanlist>)]

When the output of the power supply is turned off, it is implemented by setting the output to 0 volts and 0.02 amps. This gives a zero-output voltage without actually disconnecting the output. To disconnect the output an external relay must be connected between the output and the load. A TTL signal of either low true or high true is provided to control an external relay. This signal can only be controlled with the remote command OUTPut:RELay OFF | ON. The TTL output is available on the Digital IO pin 1 for channel 1. When the OUTPut:RELay state is "ON" on channel 1, the TTL output of pin 1 is high if the Polarity is positive and pin 1 is low if the Polarity is negative. The levels are reversed when the OUTPut:RELay state is "OFF".

The query returns the repay state of the power supply. The returned value is "0" (OFF) or "1" (ON).

Parameter	Typical return
ON	OFF	1	0	0 or 1
*RST OFF	
Turns on the relay state of the power supply: OUTP:REL ON	

INPut | OUTPut:SHORt[:STATe] ON | OFF | 1 | 0 **Load Mode only**

INPut | OUTPut:SHORt[:STATe]?

The command simulates a short circuit on the input. It works in all operating modes and temporarily overrides output and slew settings. The actual value of the short depends on the mode and range that are active when the short is programmed.

In CV mode, a short is equivalent to programming zero volts.
In CC mode, a short is equivalent to programming full-scale current for the present current range.
In CR mode, a short is equivalent to programming the minimum resistance for the present resistance range.

Turning the short circuit on does not affect the programmed settings, and the input will return to the previously programmed values when the short is turned off.

The query returns the input short state of the instrument. The returned value is "0" (OFF) or "1" (ON).

Parameter	Typical return
ON	OFF	1	0	0 or 1
*RST OFF	
Simulate a short on the input terminals: INP:SHOR ON	

LIST Subsystem

List commands program an output sequence of multiple current, voltage, power, or resistance settings. A comma-delimited list of up to 512 steps may be programmed.

[SOURce:]LIST:COUNt <count> | MINimum | MAXimum | INFinity[, (@<chanlist>)]
[SOURce:]LIST:COUNt? [MINimum | MAXimum | INFinity,] [(@<chanlist>)]

The command sets the number of times that the list is executed before it is completed. The list count range is 1 to 9999.

The query returns the list count for each channel specified. Multiple responses are separated by commas. If a repeat count of 9.9E37 is returned, it means the list is set to repeat continuously.

NOTE	Use the INFinity parameter to execute a list continuously.
	Use ABORt to stop the list at any time. When the list is aborted, the input returns to the settings that were in effect before the list started.

Parameter	Typical return
1 - 9999	MIN	MAX	INF	<list count>
*RST 1	
Sets the list count for channel 1 to 10: LIST:COUN 10, (@1)	

[SOURce:]LIST:CURRent[:LEVel] <value>{,<value >}[, (@<chanlist>)]
[SOURce:]LIST:CURRent[:LEVel]]? [(@<chanlist>)]

The command specifies the current setting for each list step in amperes. A comma-delimited list of up to 512 steps may be programmed.

The query returns the programmed current level in the form +n.nnnnnnnnE+nn. Multiple responses are separated by commas.

NOTE	The order in which the current values are entered determines the sequence when the list executes. To create a valid list, the Voltage, Current, Power, Resistance, BOST, EOST, and Dwell lists must either all be the same length, or have a length of 1, which is interpreted as having the same length as the list with the maximum length.
	The command overwrites any previously programmed current list; it does not append to the previous list.

Parameter	Typical return
minimum - maximum (Values are range and mode dependent. See Programming Range)	‹list value 1›, ‹list value 2›, ‹list value 3›...
*RST 1 step set to the minimum programmable value.	
Programs a current list containing 5 steps for channel 1: LIST:CURR 5,4,3,2,1, (@1)	

[SOURce:]LIST:CURRent:POINts? [(@‹chanlist›)]

The query returns the number of points (steps) in the current list, not the point values. Multiple responses are separated by commas.

Parameter	Typical return
(none)	‹points›
Returns the number of points in the current list for channel 1: LIST:CURR:POIN? (@1)	

[SOURce:]LIST:DWELl ‹value›{,‹value ›}[, (@‹chanlist›)]
[SOURce:]LIST:DWELl? [(@‹chanlist›)]

The command specifies the dwell time for each list step. A comma-delimited list of up to 512 steps may be programmed. Dwell time is the time that the output will remain at a specific step.

The programmable dwell time are 0.01 s to 3600 s (power supply mode) and 0.001 s to 268.435 s (Load mode), with the resolution of 1 millisecond. Units are in seconds.

The query returns the programmed dwell time in the form +n.nnnnnnnE+nn. Multiple responses are separated by commas.

> **NOTE** At the end of the dwell time, the output state of the unit depends upon the [SOURce:]LIST:STEP program settings. The order in which the dwell values are entered determines the sequence when the list executes.
>
> To create a valid list, the Voltage, Current, Power, Resistance, BOST, EOST, and Dwell lists must either all be the same length, or have a length of 1, which is interpreted as having the same length as the list with the maximum length.
>
> This command overwrites any previously programmed dwell list; it does not append to the previous list.

Parameter	Typical return
Power supply mode: 0.01 - 3600	‹list value 1›, ‹list value 2›, ‹list value 3›...
*RST 0.01	
Load mode: 0.001 – 268.435	
*RST 0.001	
Programs a dwell list containing 5 steps for channel 1: LIST:DWEL 0.2,0.8,1.5,0.8,0.2, (@1)	

[SOURce:]LIST:DWELl:POINts? [(@<chanlist>)]

The query returns the number of points (steps) in the dwell list, not the point values. Multiple responses are separated by commas.

Parameter	Typical return
(none)	<points>
Returns the number of points in the dwell list: LIST:DWEL:POIN? (@1)	

[SOURce:]LIST:POWer[:LEVel] <value>{,<value >}[, (@<chanlist>)] `Load Mode only`
[SOURce:]LIST:POWer[:LEVel]]? [(@<chanlist>)]

The command specifies the power setting for each list step in watts. A comma-delimited list of up to 512 steps may be programmed.

The query returns the programmed power level in the form +n.nnnnnnnnE+nn. Multiple responses are separated by commas.

> **NOTE** The order in which the power values are entered determines the sequence when the list executes. To create a valid list, the Voltage, Current, Power, Resistance, BOST, EOST, and Dwell lists must either all be the same length, or have a length of 1, which is interpreted as having the same length as the list with the maximum length.
>
> The command overwrites any previously programmed power list; it does not append to the previous list.

Parameter	Typical return
minimum to maximum	<list value 1>,
(Values are range and mode dependent. See Programming Range)	<list value 2>, <list value 3>...
*RST 1 step set to the minimum programmable value.	
Programs a power list containing 3 steps for channel 1: LIST:POW 20,10,5, (@1)	

[SOURce:]LIST:POWer:POINts? [(@<chanlist>)] `Load Mode only`

The query returns the number of points (steps) in the power list, not the point values. Multiple responses are separated by commas.

Parameter	Typical return
(none)	<points>
Returns the number of points in the power list for channel 1: LIST:POW:POIN? (@1)	

[SOURce:]LIST:RESistance[:LEVel] <value>{,<value >}[, (@<chanlist>)] `Load Mode only`
[SOURce:]LIST:RESistance[:LEVel]]? [(@<chanlist>)]

The command specifies the resistance setting for each list step in ohms. A comma-delimited list of up to 512 steps may be programmed.

The query returns the programmed resistance level in the form +n.nnnnnnnnE+nn. Multiple responses are separated by commas.

> **NOTE** The order in which the resistance values are entered determines the sequence when the list executes. To create a valid list, the Voltage, Current, Power, Resistance, BOST, EOST, and Dwell lists must either all be the same length, or have a length of 1, which is interpreted as having the same length as the list with the maximum length.
>
> The command overwrites any previously programmed resistance list; it does not append to the previous list.

Parameter	Typical return
minimum - maximum (Values are range and mode dependent. See Programming Range)	<list value 1>, <list value 2>, <list value 3>...
*RST 1 step set to the minimum programmable value.	
Programs a resistance list containing 3 steps for channel 1: LIST:RES 20,50,100, (@1)	

[SOURce:]LIST:RESistance:POINts? [(@<chanlist>)] `Load Mode only`

The query returns the number of points (steps) in the resistance list, not the point values. Multiple responses are separated by commas.

Parameter	Typical return
(none)	<points>
Returns the number of points in the resistance list for channel 1: LIST:RES:POIN? (@1)	

[SOURce:]LIST:STEP AUTO | ONCE[, (@<chanlist>)]
[SOURce:]LIST:STEP? [(@<chanlist>)]

The command specifies how the list responds to triggers.

The query returns the list step setting. Multiple responses are separated by commas.

Step	Description
AUTO	The output automatically advances to each step, after the receipt of an initial starting trigger. The steps are paced by the dwell list. As each dwell time elapses, the next step is immediately output. This specifies a dwell-paced list.
ONCE	The output remains at the present step until a trigger advances it to the next step. Triggers that arrive during the dwell time are ignored. This specifies a trigger-paced list.

Parameter	Typical return
AUTO | ONCE	AUTO or ONCE
*RST AUTO	
Sets the list step setting of channel 1 to ONCE: LIST:STEP ONCE, (@1)	

[SOURce:]LIST:TERMinate:LAST ON | OFF | 1 | 0[, (@<chanlist>)]
[SOURce:]LIST:TERMinate:LAST? [(@<chanlist>)]

The command specifies the output value when the list terminates. The state is either 1 (ON) or 0 (OFF). When ON, the output remains at the last step value, and that value becomes the IMMediate value when the list completes. When OFF, or when the list is aborted, the output returns to the settings that were in effect before the list started. The query returns 0 (OFF) or 1 (ON).

Parameter	Typical return
ON | OFF | 1 | 0	0 or 1
*RST OFF	
Sets the list to terminate output at the last step value: LIST:TERM LAST ON, (@1)	

Keysight E36731A Programming Guide

[SOURce:]LIST:TOUTput:BOSTep[:DATA] ON | OFF | 1 | 0{,ON | OFF | 1 | 0}[, (@<chanlist>)]
SOURce:]LIST:TOUTput:BOSTep[:DATA]? [(@<chanlist>)]

The command specifies which list steps generate a trigger signal at the beginning of the step (BOSTep). A comma-delimited list of up to 512 steps may be programmed. The state is either ON (1) or OFF (0).

A trigger is only generated when the state is set to ON. The trigger signal can be used as a trigger source for transients of other channels, and for digital port pins configured as trigger outputs.

The query returns 0 if no trigger is generated, and 1 if a trigger is generated. Multiple responses are separated by commas.

NOTE	The order in which the BOSTep values are entered determines the sequence when the list executes.
	To create a valid list, the Voltage, Current, Power, Resistance, BOST, EOST, and Dwell lists must either all be the same length, or have a length of 1, which is interpreted as having the same length as the list with the maximum length.
	This command overwrites any previously programmed BOSTep list; it does not append to the previous list.

Parameter	Typical return
ON	OFF	1	0	<list value 1>,
*RST 1 step with a value of OFF	<list value 2>, <list value 3>...
Specifies that triggers will be generated at the beginning of the second step of a 5-step list for channel 1: LIST:TOUT:BOST 1,1,1,1,1, (@1)	

[SOURce:]LIST:TOUTput:BOSTep:POINts? [(@<chanlist>)]

The query returns a comma-separated list of the number of points (steps) in the beginning of the step trigger list (BOSTep), not the point values for the specified channels.

Parameter	Typical return
(none)	<points>
Returns the number of points in the BOSTep list for channel 1: LIST:TOUT:BOST:POIN? (@1)	

[SOURce:]LIST:TOUTput:EOSTep[:DATA] ON | OFF | 1 | 0{,ON | OFF | 1 | 0}[, (@<chanlist>)]
[SOURce:]LIST:TOUTput:EOSTep[:DATA]? [(@<chanlist>)]

The command specifies which list steps generate a trigger signal at the end of the step (EOSTep). A comma-delimited list of up to 512 steps may be programmed. The state is either ON (1) or OFF (0).

A trigger is only generated when the state is set to ON. The trigger signal can be used as a trigger source for transients of other channels, and for digital port pins configured as trigger outputs.

The query returns 0 if no trigger is generated, and 1 if a trigger is generated. Multiple responses are separated by commas.

NOTE	The order in which the EOSTep values are entered determines the sequence when the list executes.
	To create a valid list, the Voltage, Current, Power, Resistance, BOST, EOST, and Dwell lists must either all be the same length, or have a length of 1, which is interpreted as having the same length as the list with the maximum length.
	This command overwrites any previously programmed EOSTep list; it does not append to the previous list.

Parameter	Typical return
ON	OFF	1	0	<list value 1>,
	<list value 2>,
*RST 1 step with a value of OFF	<list value 3>...

Specifies that triggers will be generated at the end of the second step of a 5-step list for channel 1:
LIST:TOUT:EOST 1,1,1,1,1, (@1)

[SOURce:]LIST:TOUTput:EOSTep:POINts? [(@<chanlist>)]

The query returns a comma-separated list of the number of points (steps) in the end of the step trigger list (EOSTep), not the point values for the specified channels.

Parameter	Typical return
(none)	<points>

Returns the number of points in the EOSTep list for channel 1: LIST:TOUT:EOST:POIN? (@1)

[SOURce:]LIST:VOLTage[:LEVel] <value> {,<value >}[, (@<chanlist>)]
[SOURce:]LIST:VOLTage[:LEVel]? [(@<chanlist>)]

The command specifies the voltage setting for each list step in volts. A comma-delimited list of up to 512 steps may be programmed.

NOTE	The order in which the voltage values are entered determines the sequence when the list executes.
	To create a valid list, the Voltage, Current, Power, Resistance, BOST, EOST, and Dwell lists must either all be the same length, or have a length of 1, which is interpreted as having the same length as the list with the maximum length.
	This command overwrites any previously programmed voltage list; it does not append to the previous list.

The query returns the programmed voltage level in the form +n.nnnnnnnnE+nn for each channel specified. Multiple responses are separated by commas.

Parameter	Typical return
minimum - maximum (Values are range and mode dependent. See Programming Range)	<list value 1>, <list value 2>, <list value 3>…
*RST 1 step set to the minimum programmable value.	
Programs a voltage list containing 3 steps for channel 1: LIST:VOLT 20,10,5, (@1)	

[SOURce:]LIST:VOLTage:POINts? [(@<chanlist>)]

The query returns the number of points (steps) in the voltage list, not the point values. Multiple responses are separated by commas.

Parameter	Typical return
(none)	<points>
Returns the number of points in the voltage list for channel 1: LIST:VOLT:POIN? (@1)	

LXI:IDENtify[:STATe] ON | OFF | 1 | 0
LXI:IDENtify[:STATe?]

The command allows you to set the property to ON to change the LXI status indicator to the "Identify" state. Setting this property OFF changes the LXI status indicator to "No Fault".

The query returns the state of the LXI status indicator.

Parameter	Typical return
ON | OFF | 1 | 0	0 or 1
*RST OFF	
Sets the LXI status indicator to "No Fault": LXI:IDEN 0	

LXI:MDNS:ENABle ON | OFF | 1 | 0
LXI:MDNS:ENABle?

The command enables (On) or disables (Off) the multicast Domain Name System (mDNS), which provides the capabilities of a DNS server for service discovery in a small network that without a DNS server.

The query returns the state of the mDNS service.

Parameter	Typical return
ON | OFF | 1 | 0 Default: ON	0 or 1
Enables mDNS service: LXI:MDNS:ENAB 1	

Remarks

- This setting is non-volatile; it will not be changed by power cycling or after a Factory Reset (*RST).

- This parameter is set to its default value when the instrument is shipped from the factory.

LXI:MDNS:HNAMe[:RESolved]?

The query returns the resolved (unique) mDNS hostname in the form "K-<model number>-<serial>-N", where <serial> is the last 5 digits of the instrument's serial number. The N is an integer appended if necessary to make the name unique.

The desired name may be truncated, if necessary, to make room for the appended integer.

Parameter	Typical return
(none)	"K-E36731A-yyyyy", where yyyyy is the last five digits of the serial number.
Returns the resolved mDNS hostname: LXI:MDNS:HNAMe:RESolved?	

LXI:MDNS:SNAMe:DESired "<name>"
LXI:MDNS:SNAMe:DESired?

The command sets the desired mDNS service name.

The query returns the mDNS service name.

Parameter	Typical return
<name> = Quoted string of up to 63 characters.	"Keysight E36731A Battery Emulator"
Sets the desired mDNS service name: LXI:MDNS:SNAM:DES "E36731A"	

Remarks

- This setting is non-volatile; it will not be changed by power cycling or after a Factory Reset (*RST).

- This parameter is set to its default value when the instrument is shipped from the factory.

LXI:MDNS:SNAMe[:RESolved]?

The resolved mDNS service name will be the desired service name (LXI:MDNS:SNAMe:DESired command), possibly with "(<N>)" appended. The N is an integer appended if necessary to make the name unique. The desired name may be truncated, if necessary, to make room for the appended integer.

Parameter	Typical return
(none)	"Keysight E36731A Battery Emulator - MY00000001"
Returns the resolved mDNS service: LXI:MDNS:SNAMe:RESolved?	

LXI:MDNS[:STATe] ON | OFF | 1 | 0
LXI:MDNS[:STATe]?

The command enables (On) or disables (Off) the multicast Domain Name System (mDNS), which provides the capabilities of a DNS server for service discovery in a small network without a DNS server.

The query returns the state of the mDNS service.

Parameter	Typical return
ON	OFF	1	0 Default: ON	0 or 1
Enables mDNS service: LXI:MDNS ON	

Remarks

– This setting is non-volatile; it will not be changed by power cycling or after a Factory Reset (*RST).

– This parameter is set to its default value when the instrument is shipped from the factory.

LXI:RESet

The command resets LAN interface to a known operating state, beginning with DHCP, and clears the Web Interface password. If DHCP fails, it uses Auto-IP.

Parameter	Typical return
(none)	(none)
Resets the LAN interface: LXI:RES	

Remarks

– Depending on your network, the LAN interface may take several seconds to restart after this command is sent.

LXI:RESTart

The command restarts the LAN interface with the current settings as specified by the SYSTem:COMMunicate:LAN commands.

Parameter	Typical return
(none)	(none)
Restarts the LAN interface: LXI:REST	

Remarks

– Depending on your network, the LAN interface may take several seconds to restart after this command is sent.

MEASure Subsystem

Measure commands measure the input voltage, current, or power. The MEASure queries start a new measurement immediately. They are not synchronized to any trigger event.

Use the INITiate, TRIGger, and FETCh commands if a synchronized measurement is necessary.

MEASure[:SCALar]:CURRent[:DC]? [CH1] [(@<chanlist>)]

MEASure[:SCALar]:VOLTage[:DC]? [CH1] [(@<chanlist>)]

MEASure[:SCALar]:POWer[:DC]? [CH1] [(@<chanlist>)] `Load Mode only`

The query returns the averaged input measurement. Values are either in amperes, volts, or watts.The reading is in the form +n.nnnnnnE+nn for each channel specified. Multiple responses are separated by commas.

Parameter	Typical return
(none)	<DC value>

Returns the averaged current: MEAS:CURR? (@1)
Returns the averaged power: MEAS:POW? (@1)
Returns the averaged voltage: MEAS:VOLT? (@1)

MEASure[:SCALar]:CURRent:ACDC? [(@<chanlist>)] `Load Mode only`

MEASure[:SCALar]:VOLTage:ACDC? [(@<chanlist>)] `Load Mode only`

The query returns the total RMS measurement (AC + DC). Values returned are either in amperes, or volts.The reading is in the form +n.nnnnnnE+nn for each channel specified. Multiple responses are separated by commas.

Parameter	Typical return
(none)	<ACDC value>

Returns the measured RMS current: MEAS:CURR:ACDC? (@1)
Returns the measured RMS voltage: MEAS:VOLT:ACDC? (@1)

MEASure[:SCALar]:CURRent:MAXimum? [(@<chanlist>)] `Load Mode only`

MEASure[:SCALar]:VOLTage:MAXimum? [(@<chanlist>)] `Load Mode only`

MEASure[:SCALar]:POWer:MAXimum? [(@<chanlist>)] `Load Mode only`

MEASure[:SCALar]:CURRent:MINimum? [(@<chanlist>)] `Load Mode only`

MEASure[:SCALar]:VOLTage:MINimum? [(@<chanlist>)] `Load Mode only`

MEASure[:SCALar]:POWer:MINimum? [(@<chanlist>)] `Load Mode only`

The query returns the maximum or minimum values of a measurement. Values returned are either in amperes, volts, or watts. The reading is in the form +n.nnnnnE+nn for each channel specified. Multiple responses are separated by commas.

Parameter	Typical return
(none)	<MIN value>
	<MAX value>
Returns the measured minimum current: MEAS:CURR:MIN? (@1) Returns the measured minimum voltage: MEAS:VOLT:MIN? (@1) Returns the measured minimum power: MEAS:POW:MIN? (@1)	
Returns the measured maximum current: MEAS:CURR:MAX? (@1) Returns the measured maximum voltage: MEAS:VOLT:MAX? (@1) Returns the measured maximum power: MEAS:POW:MAX? (@1)	

MEASure:ARRay:CURRent[:DC]? [(@<chanlist>)] `Load Mode only`

MEASure:ARRay:VOLTage[:DC]? [(@<chanlist>)] `Load Mode only`

MEASure:ARRay:POWer[:DC]? [(@<chanlist>)] `Load Mode only`

The query returns an array containing measurement of instantaneous input samples. Values are either in amperes, volts, or watts.

The sampling rate is set by SENSe:SWEep:TINTerval. The position of the trigger relative to the beginning of the data buffer is determined by SENSe:SWEep:OFFSet:POINts. The number of points returned is set by SENSe:SWEep:POINts.

Parameter	Typical return
(none)	<value> [,<value>] or <Block>
Returns the measured current array MEAS:ARR:CURR? (@1) Returns the measured power array: MEAS:ARR:POW? (@1) Returns the measured voltage array: MEAS:ARR:VOLT? (@1)	

Keysight E36731A Programming Guide

MMEMory Subsystem

MMEMory:EXPort:DLOG <"filename">

The command saves the logged data in CSV format into the path and filename specified in the <"filename">. This command does not change the saved path and filename settings.

Note that the supported path specifier — "External"/"Ext" and "USB" are not case-sensitive.

Parameter	Typical return
<"filename">	(none)

Exports the logged data into "External:\datalog.csv": MMEM:EXP:DLOG "Ext:\datalog.csv"
Exports the logged data into "usb:\datalog.csv": MMEM:EXP:DLOG "usb:\datalog.csv"

POWer Subsystem `Load Mode only`

POWer commands program the input power and power protection function. The SOURce keyword is optional in the following commands.

[SOURce:]POWer[:LEVel][:IMMediate][:AMPLitude] <power>| MINimum | MAXimum | DEFault[, (@<chanlist>)]
[SOURce:]POWer[:LEVel][:IMMediate][:AMPLitude]? [MINimum | MAXimum | DEFault,] [(@<chanlist>)]

The command sets the immediate power level when the input is in constant power mode. Units are in watts.

The query returns the programmed power in the form +n.nnnnnnE+nn for each channel specified. Multiple responses are separated by commas.

Parameter	Typical return
minimum - maximum | MIN | MAX | DEF (Values are range dependent. See Programming Range)	<power level>
*RST MIN	
Sets the input power level to 50 watts: POW 50, (@1)	

[SOURce:]POWer[:LEVel]:TRIGgered[:AMPLitude] <power| MINimum | MAXimum[, (@<chanlist>)]
[SOURce:]POWer[:LEVel]:TRIGgered[:AMPLitude]? [MINimum | MAXimum,] [(@<chanlist>)]

The command sets the triggered power level when the input is in constant power mode. The triggered level is a stored value that is transferred to the input when an input step is triggered. Units are in watts.

The query returns the programmed power in the form +n.nnnnnnE+nn for each channel specified. Multiple responses are separated by commas.

Parameter	Typical return
minimum - maximum | MIN | MAX (Values are range dependent. See Programming Range)	<power level>
*RST MIN	
Sets the triggered power level to 75 watts: POW:TRIG 75, (@1)	

[SOURce:]POWer:MODE FIXed | STEP | LIST[, (@<chanlist>)]
[SOURce:]POWer:MODE? [(@<chanlist>)]

The command sets the transient mode. This determines what happens to the power when the transient system is initiated and triggered.

Mode	Description
FIXed	Nothing happens. The input power remains at the immediate value.
STEP	The input goes to the triggered level when a trigger occurs.
LIST	The input follows the list values when a trigger occurs.

Parameter	Typical return
FIXed	STEP	LIST	FIXed, STEP, or LIST
*RST FIXed	
Sets the input power mode to Step: POW:MODE STEP, (@1)	

[SOURce:]POWer:PROTection:DELay[:TIME] <time> | MINimum | MAXimum[, (@<chanlist>)]
[SOURce:]POWer:PROTection:DELay[:TIME]? [MINimum | MAXimum,] [(@<chanlist>)]

| NOTE | This command is the same as INPut:PROTection:DELay. |

The command sets the over-power protection delay. The over-power protection function will not be triggered during the delay time. This prevents momentary changes in input status from triggering the over-power protection function. If the input is regulating in power limit longer than the programmable delay time, the OPP will trip, and the input will be turned off. Programmed values can range from 0 to 0.255 seconds with a resolution of 1 millisecond.

Parameter	Typical return
0 - 0.255	MIN	MAX	<delay value>
*RST 0.020	
Sets the protection delay to 0.2 seconds: POW:PROT:DEL 0.2, (@1)	

[SOURce:]POWer:PROTection:STATe ON | OFF | 1 | 0[, (@<chanlist>)]
[SOURce:]POWer:PROTection:STATe?[MINimum | MAXimum,] [(@<chanlist>)]

The command enables/disables the over-power protection. When the input power exceeds the power rating of the battery emulator by 10%, the input is disabled and the Questionable Condition status register CP+ bit is set.

Parameter	Typical return
ON	OFF	1	0	0 or 1
*RST OFF	
Enables the power protection state: POW:PROT:STAT ON, (@1)	

[SOURce:]POWer:RANGe <power> | MINimum | MAXimum[, (@<chanlist>)]
[SOURce:]POWer:RANGe? [MINimum | MAXimum,] [(@<chanlist>)]

The command sets the power range. The value that you enter must be the highest value in watts that you expect to input. The instrument selects the range with the best resolution for the value entered. The following ranges are available for the battery emulator.

	E36731A (load mode)
High range	from 1.5 W to 255 W
Medium range	from 0.15 to 25.5 W
Low range	from 0.02 W to 5.1 W

The query returns the maximum power that can be programmed on the range that is presently set. The power is in the form +n.nnnnnE+nn for each channel specified. Multiple responses are separated by commas.

Parameter	Typical return
minimum - maximum	MIN	MAX (Values are range dependent. See Programming Range)	<power range>
*RST MAX	
Sets the medium power range (from 0.2 W to 30.6 W): POW:RANG 30, (@1)	

Remarks

- This command is coupled with [SOURce:]POWer. This means that if a range command places an input on a range with a lower maximum power than the present power level, an out of range error occurs. This also occurs if a power level is programmed that is too large for the present range. Errors can be avoided by sending both level and range commands in the same SCPI message. When the range and level information is received as a set, no range/setting conflict occurs.

- If a programmed range change occurs while the input is enabled, the input will be temporarily disabled while the range switch occurs. The transition from on-to-off and then from off-to-on will also be delayed by the settings of INPut:DELay:FALL and INPut:DELay:RISE.

[SOURce:]POWer:SLEW[:POSitive|RISing][:IMMediate] <value> | MINimum | MAXimum | INFinity[, (@<chanlist>)]
[SOURce:]POWer:SLEW[:POSitive|RISing][:IMMediate]? [MINimum | MAXimum,] [(@<chanlist>)]

[SOURce:]POWer:SLEW:NEGative|FALLing[:IMMediate] <value> | MINimum | MAXimum | INFinity[, (@<chanlist>)]
[SOURce:]POWer:SLEW:NEGative|FALLing[:IMMediate]? [MINimum | MAXimum,] [(@<chanlist>)]

The command sets the input power slew rate. The slew rate is set in watts per second and affects all programmed power changes, including those due to the input state turning on or off. The slew rate can be set to any value between 0 and 9.9E+37. For very large values, the slew rate will be limited by the analog performance of the input circuit. The keywords MAX or INFinity set the slew rate to maximum.

Parameter	Typical return
minimum – 9.9E+37	MIN	MAX	INFinity	<slew rate>
*RST MAX	

Sets the slew rate to 10 watts per second: POW:SLEW 10, (@1)
Sets the negative slew rate to 10 watts per second: POW:SLEW:NEG 10, (@1)

Remarks

- The query returns the value that was sent. If the value is less than the minimum slew rate, only the minimum value is returned. The resolution of the slew setting is also the minimum value, which can be queried using POWer:SLEW? MIN. The exact value varies slightly based on calibration.

- The query returns the programmed slew rate in the form +n.nnnnnnE+nn for each channel specified. Multiple responses are separated by commas. If a slew rate of 9.9E37 is returned, it means that the maximum or fastest slew rate has been set.

[SOURce:]POWer:SLEW:COUPle ON | OFF | 1 | 0[, (@<chanlist>)]
[SOURce:]POWer:SLEW:COUPle? [(@<chanlist>)]

The command sets the input power slew tracking state.

Parameter	Typical return
ON	OFF	1	0	0 or 1
*RST OFF	

Enables the input power slew tracking state: RES:SLEW COUP ON, (@1)

[SOURce:]POWer:SLEW[:POSitive|RISing]:MAXimum ON | OFF | 1 | 0[, (@<chanlist>)]
[SOURce:]POWer:SLEW[:POSitive|RISing]:MAXimum? [(@<chanlist>)]

[SOURce:]POWer:SLEW:NEGative|FALLing:MAXimum ON | OFF | 1 | 0[, (@<chanlist>)]
[SOURce:]POWer:SLEW:NEGative|FALLing:MAXimum? [(@<chanlist>)]

The command enables/disables the maximum slew rate override. When enabled, the slew rate is set to its maximum value. When disabled, the slew rate is set to the immediate value set by POWer:SLEW. Use POWer:SLEW? MAX to query the maximum slew rate.

Parameter	Typical return
ON	OFF	1	0,	0 or 1
*RST ON	
Enables the maximum slew rate override: POW:SLEW:MAX ON, (@1)	
Enables the negative maximum slew rate: POW:SLEW:NEG:MAX ON, (@1)	

Remarks

– The POWer:SLEW:MAX command is coupled to the POWer:SLEW command. If the POWer:SLEW command sets the slew rate to MAX or INFinity, POWer:SLEW:MAX is enabled. If the slew rate is set to any other value, POWer:SLEW:MAX is disabled.

[SOURce:]POWer:TLEVel <*value*> | MINimum | MAXimum[, (@<chanlist>)]
[SOURce:]POWer:TLEVel? [MINimum | MAXimum,] [(@<chanlist>)]

The command specifies the transient level of the input power. The transient function switches between the immediate setting and the transient level. Units are in watts.

Parameter	Typical return
minimum - maximum	MIN	MAX (Values are range dependent. See Programming Range)	<transient level>
*RST MIN	
Sets the transient input power to 5 W: POW:TLEV 5, (@1)	

RESistance Subsystem `Load Mode only`

RESistance commands program the input resistance. The SOURce keyword is optional in the following commands.

[SOURce:]RESistance[:LEVel][:IMMediate][:AMPLitude] <resistance> | MINimum | MAXimum | DEFault
[, (@<chanlist>)]
[SOURce:]RESistance[:LEVel][:IMMediate][:AMPLitude]? [MINimum | MAXimum | DEFault,] [(@<chan-list>)]

The command sets the immediate resistance level when the input is in constant resistance mode. Units are in ohms.

The query returns the programmed resistance in the form +n.nnnnnnE+nn for each channel specified. Multiple responses are separated by commas.

Parameter	Typical return
minimum - maximum	MIN	MAX	DEF (Values are range dependent. See Programming Range)	<resistance level>
*RST MAX	
Sets the input resistance level to 0.5 ohms: RES 0.5, (@1)	

[SOURce:]RESistance[:LEVel]:TRIGgered[:AMPLitude] <resistance> | MINimum | MAXimum[, (@<chan-list>)]
[SOURce:]RESistance[:LEVel]:TRIGgered[:AMPLitude]? [MINimum | MAXimum,] [(@<chanlist>)]

The command sets the triggered resistance level when the input is in constant resistance mode. The triggered level is a stored value that will be programmed when a Step transient is triggered. Units are in ohms.

The query returns the programmed resistance in the form +n.nnnnnnE+nn for each channel specified. Multiple responses are separated by commas.

Parameter	Typical return
minimum - maximum	MIN	MAX (Values are range dependent. See Programming Range)	<resistance level>
*RST MAX	
Sets the triggered resistance level to 1 ohm: RES:TRIG 1, (@1)	

[SOURce:]RESistance:MODE FIXed | STEP | LIST[, (@<chanlist>)]
[SOURce:]VOLTage:MODE? [(@<chanlist>)]

The command sets the transient mode. This determines what happens to the resistance when the transient system is initiated and triggered.

Mode	Description
FIXed	Nothing happens. The input resistance remains at the immediate value.
STEP	The input goes to the triggered level when a trigger occurs.
LIST	The input follows the list values when a trigger occurs.

Parameter	Typical return
FIXed	STEP	LIST	FIXed, STEP, or LIST
*RST FIXed	
Sets the resistance mode to Step: RES:MODE STEP, (@1)	

[SOURce:]RESistance:RANGe <resistance> | MINimum | MAXimum[, (@<chanlist>)]
[SOURce:]RESistance:RANGe? [MINimum | MAXimum,] [(@<chanlist>)]

The command sets the resistance range. The value that you enter must be the highest value in ohms that you expect to input. The instrument selects the range with the best resolution for the value entered. The following overlapping resistance ranges are available for the battery emulator:

	E36731A (load mode)
High range	from 100 Ω to 4 kΩ
Medium range	from 10 Ω to 1.25 kΩ
Low range	from 0.08 Ω to 30 Ω

The query returns the maximum resistance that can be programmed on the range that is presently set. The resistance is in the form +n.nnnnnnE+nn for each channel specified. Multiple responses are separated by commas.

Parameter	Typical return
minimum - maximum	MIN	MAX (Values are range dependent. See Programming Range)	<resistance range>
*RST MAX	
Sets the medium resistance range (from 10 to 1.25 kΩ): RES:RANG 100, (@1)	

Remarks

- This command is coupled with [SOURce:]RESistance. This means that if a resistance value is programmed that does not fall within the presently selected range, the range command automatically selects the correct range for the new resistance value. An out of range error occurs if a resistance value is less than the low-range minimum, or greater than the high-range maximum.

- The resistance level value always takes precedence over the resistance range value. Therefore, an out of range error occurs if a resistance range is changed when the presently selected resistance value does not fall within the new range. Errors can be avoided by sending both level and range commands in the same SCPI message. When the range and level information is received as a set, no range/setting conflict occurs.

- If a programmed range change occurs while the input is enabled, the input will be temporarily disabled while the range switch occurs. The transition from on-to-off and then from off-to-on will also be delayed by the settings of INPut:DELay:FALL and INPut:DELay:RISE.

[SOURce:]RESistance:SLEW[:POSitive|RISing][:IMMediate] <value> | MINimum | MAXimum | INFinity[, (@<chanlist>)]
[SOURce:]RESistance:SLEW[:POSitive|RISing][:IMMediate]? [MINimum | MAXimum,] [(@<chanlist>)]

[SOURce:]RESistance:SLEW:NEGative|FALLing[:IMMediate] <value> | MINimum | MAXimum | INFinity [, (@<chanlist>)]
[SOURce:]RESistance:SLEW:NEGative|FALLing[:IMMediate]? [MINimum | MAXimum,] [(@<chanlist>)]

The command sets the resistance slew rate. The slew rate is set in ohms per second and affects all programmed resistance changes, including those due to the input state turning on or off. The slew rate can be set to any value between the minimum value and 9.9E+37. For very large values, the slew rate will be limited by the analog performance of the output circuit. The keywords MAX or INFinity set the slew rate to maximum.

Parameter	Typical return
minimum - 9.9E+37 | MIN | MAX | INFinity	<slew rate>
*RST MAX	
Sets the slew rate to 50 ohms per second: RES:SLEW 50, (@1)	
Sets the negative slew rate to 25 ohms per second: RES:SLEW:NEG 25, (@1)	

Remarks

- The query returns the value that was sent. If the value is less than the minimum slew rate, only the minimum value is returned. The resolution of the slew setting is also the minimum value, which can be queried using RESistance:SLEW? MIN. The exact value varies slightly based on calibration.

- The query returns the programmed slew rate in the form +n.nnnnnnE+nn for each channel specified. Multiple responses are separated by commas. If a slew rate of 9.9E37 is returned, it means that the maximum or fastest slew rate has been set.

[SOURce:]RESistance:SLEW:COUPle ON | OFF | 1 | 0[, (@<chanlist>)]
[SOURce:]RESistance:SLEW:COUPle? [(@<chanlist>)]

The command sets the resistance slew tracking state.

Parameter	Typical return
ON | OFF | 1 | 0	0 or 1
*RST OFF	
Enables the resistance slew tracking state: RES:SLEW COUP ON, (@1)	

[SOURce:]RESistance:SLEW[:POSitive|RISing]:MAXimum ON | OFF | 1 | 0[, (@<chanlist>)]
[SOURce:]RESistance:SLEW[:POSitive|RISing]:MAXimum? [(@<chanlist>)]

[SOURce:]RESistance:SLEW:NEGative|FALLing:MAXimum ON | OFF | 1 | 0[, (@<chanlist>)]
[SOURce:]RESistance:SLEW:NEGative|FALLing:MAXimum? [(@<chanlist>)]

The command enables/disables the maximum slew rate override. When enabled, the slew rate is set to its maximum value. When disabled, the slew rate is set to the immediate value set by RESistance:SLEW. Use RESistance:SLEW? MAX to query the maximum slew rate.

Parameter	Typical return
ON	OFF	1	0,	0 or 1
*RST ON	
Disables the maximum slew rate override: RES:SLEW:MAX OFF, (@1)	
Disables the negative maximum slew rate: RES:SLEW:NEG:MAX OFF, (@1)	

Remarks

– The RESistance:SLEW:MAX command is coupled to the RESistance:SLEW command. If the RESistance:SLEW command sets the slew rate to MAX or INFinity, RESistance:SLEW:MAX is enabled. If the slew rate is set to any other value, RESistance:SLEW:MAX is disabled.

[SOURce:]RESistance:TLEVel <*value*> | MINimum | MAXimum[, (@<chanlist>)]
[SOURce:]RESistance:TLEVel? [MINimum | MAXimum,] [(@<chanlist>)]

The command specifies the transient level of the resistance. The transient function switches between the immediate setting and the transient level. Units are in ohms.

Parameter	Typical return
minimum - maximum	MIN	MAX (Values are range dependent. See Programming Range)	<transient level>
*RST MAX	
Sets the transient input resistance to 5 Ω: RES:TLEV 5, (@1)	

SENSe:DLOG:FUNCtion:CURRent ON | OFF | 1 | 0[, (@<chanlist>)]
SENSe:DLOG:FUNCtion:CURRent? [(@<chanlist>)]

The command enables or disables current data logging of the channels stated in (@<chanlist>).

The query returns the status (on or off) of the current data logging enable of the channels stated in (@<chanlist>).

Parameter	Typical return
ON	OFF	1	0	(none)
*RST OFF	
Enables current data logging of channel 1: SENS:DLOG:FUNC:CURR 1, (@1)	

SENSe:DLOG:FUNCtion:MINMax ON | OFF | 1 | 0
SENSe:DLOG:FUNCtion:MINMax?

The command enables or disables the logging of minimum and maximum values for each sample of data.

The query returns whether the logging of minimum and maximum values is enabled.

Parameter	Typical return
ON	OFF	1	0	(none)
*RST OFF	
Enables the logging of the minimum and maximum for each sample of data: SENS:DLOG:FUNC:MINM 1	

SENSe:DLOG:FUNCtion:VOLTage ON | OFF | 1 | 0[, (@<chanlist>)]
SENSe:DLOG:FUNCtion:VOLTage? [(@<chanlist>)]

The command enables or disables voltage data logging of the channels stated in (@<chanlist>).

The query returns the status (on or off) of the voltage data logging of the channels stated in (@<chanlist>).

Parameter	Typical return
ON	OFF	1	0	(none)
*RST ON	
Enables voltage data logging of channel 1: SENS:DLOG:FUNC:VOLT 1, (@1)	

SENSe:DLOG:OFFSet <offset percent>
SENSe:DLOG:OFFSet?

The command specifies the datalog trigger offset as a percent of the total datalog duration. This lets you specify the percent of pre-trigger data that will be logged to the datalog file.

A percent of 0 means the trigger occurs at the beginning of the running datalog, while 100 means that the trigger occurs at the end of the running datalog. Any value between 0 and 100 can be set.

The query returns the trigger offset in percent.

Parameter	Typical return
0 - 100	<offset percent>
*RST 0	
Specifies a trigger offset of 50%: SENS:DLOG:OFFS 50	

SENSe:DLOG:PERiod <time> | MINimum | MAXimum
SENSe:DLOG:PERiod? [MINimum | MAXimum]

The command sets the sample period, the entered value is in seconds.

In Load mode, the minimum sample period is 20.48 µs, the sample period has to be in integral of 20.48 µs. The entered value will be rounded to the nearest 20.48 µs integral.

In Power Supply mode, the minimum sample period is 200 ms, the sample period has to be in integral of 200 ms. The entered value will be rounded to the nearest 200 ms integral.

The maximum sample period for both mode is 60 seconds.

The query returns the sample period in seconds.

Parameter	Typical return
Power Supply mode: 0.2 - 60	MIN	MAX *RST 0.2	<time>
Load mode: 0.00002048 - 60	MIN	MAX *RST 0.2	
Sets the sample period to 400 ms: SENS:DLOG:PER 0.4	

NOTE   This command replaces the previous SENSe:DLOG:TINTerval command and should be used in new applications. SENSe:DLOG:TINTerval is still available for backward compatibility.

SENSe:DLOG:TIME <time> | MINimum | MAXimum
SENSe:DLOG:TIME? [MINimum | MAXimum]

The command sets the sample duration, the entered value is in seconds.

In Load mode, the maximum sample duration is about 10,000 hours (for single output, depending on the memory size) and up to 5MB of data.

In Power Supply mode, the maximum sample duration is about 21,845 hours and 20 minutes (for single output, depending on the memory size) and up to 5 MB of data.

The query returns the sample duration in seconds.

Parameter	Typical return
Power Supply mode: 1 - 78643200	MIN	MAX *RST 30	<time>
Load mode: 1 - 36,000,000	MIN	MAXX *RST 30	
Sets the sample duration to 2 minutes: SENS:DLOG:TIME 120	

SENSe:DLOG:TINTerval <time> | MINimum | MAXimum
SENSe:DLOG:TINTerval? [MINimum | MAXimum]

> **NOTE** This command has been superseded by SENSe:DLOG:PERiod, but is still available for backward compatibility.

This command sets the sample period, the entered value is in seconds.

In Load mode, the minimum sample period is 20.48 µs, the sample period has to be in integral of 20.48 µs. The entered value will be rounded to the nearest 20.48 µs integral.

In Power Supply mode, the minimum sample period is 200 ms, the sample period has to be in integral of 200 ms. The entered value will be rounded to the nearest 200 ms integral.

The query returns the sample period in seconds.

Parameter	Typical return
Power Supply mode: 0.2 - 60	MIN	MAX *RST 0.2	<time>
Load mode: 0.00002048 - 60	MIN	MAX *RST 0.2	
Sets the sample period to 400 ms: SENS:DLOG:TINT 0.4	

SENSe:FUNCtion:CURRent ON | OFF | 1 | 0[, (@<chanlist>)] `Load Mode only`
SENSe:FUNCtion:CURRent? [(@<chanlist>)]

SENSe:FUNCtion:VOLTage ON | OFF | 1 | 0[, (@<chanlist>)] `Load Mode only`
SENSe:FUNCtion:VOLTage? [(@<chanlist>)]

The command enables or disables the current or voltage measurement function.

The query returns the status (on or off) of the current or voltage measurement function.

Parameter	Typical return
ON	OFF	1	0	0 or 1
*RST ON	
Enables current measurement on channel 1: SENS:FUNC:CURR 1, (@1)	
Enables voltage measurement on channel 1: SENS:FUNC:VOLT 1, (@1)	

SENSe:SWEep:POINts <data point> | MINimum | MAXimum[, (@<chanlist>)] `Load Mode only`
SENSe:SWEep:POINts? [MINimum | MAXimum,] [(@<chanlist>)]

The command defines the number of points in a measurement. The number of points can be specified from 1 to 131,072. This command applies to both voltage and current measurement.

The number of samples (points) that can be specified depends on the number of measurement parameter selected. You can measure up to four parameters (voltage and current x 2 inputs).

 1 parameters : up to 128K points

 2 parameters: up to 64K points

 3 parameters: up to 32K points

 4 parameters; up to 16K points (K = 1024)

Parameter	Typical return
1 - 131,072	MIN	MAX	<data point>
*RST 2440	
Specifies 2048 points: SENS:SWE:POIN 2048, (@1)	

SENSe:SWEep:OFFSet:POINt <offset points> | MINimum | MAXimum[, (@<chanlist>)] **Load Mode only**
SENSe:SWEep:OFFSet:POINts? [MINimum | MAXimum,] [(@<chanlist>)]

The command defines the offset in a data sweep for triggered measurements. Positive values represent the delay after the trigger occurs but before the samples are acquired. Negative values represent data samples taken prior to the trigger.

Parameter	Typical return
-131,071 - 2,000,000,000	MIN	MAX	<offset points>
*RST 0	
Specifies -2048 offset points: SENS:SWE:OFFS:POIN -2048, (@1)	

SENSe:SWEep:TINTerval <time> | MINimum | MAXimum[, (@<chanlist>)] **Load Mode only**
SENSe:SWEep:TINTerval? [MINimum | MAXimum,] [(@<chanlist>)]

The command defines the time period between samples in seconds. Programmed values can range from 5.12 µs to 40,000 s. Note that the shortest time interval (fastest speed) that can be specified depends on the number of parameters that are being measured and the model that is doing the measuring. Values above 10.24 ms are rounded to the nearest 10.24 ms increment. Values above 20.48 ms are rounded to the nearest 20.48 ms increment.

5.12 microseconds: 1 parameter

10.24 microseconds: 1 or 2 parameters

20.48 microseconds: 3 or 4 parameters

Parameter	Typical return
0.00000512 - 40,000	MIN	MAX	<time interval>
*RST 0.00004096	
Specifies an interval of 1 ms between points: SENS:SWE:TINT 0.001, (@1)	

SOURce Subsystem

The Source subsystem programs the current, digital, list, power, resistance, transient, and voltage functions.

Subsystems Using the Optional SOURce Keyword

Because SOURce subsystem commands are often used without the SOURce keyword, these commands are listed by their individual subsystems, below:

CURRent

DIGital

EMULation

FUNCtion | MODE

LIST

POWer

RESistance

TRANsient

VOLTage

STATus Subsystem

Status commands let you determine the operating condition of the instrument at any time. The instrument has three groups of status registers; Operation, Questionable, and Standard Event. The Operation and Questionable status groups each consist of the Condition, Enable, and Event registers as well as NTR and PTR filters. Refer to SCPI Status Registers for more information

Instrument status is also programmed using the IEEE 488.2 Common commands: *CLS, *ESE, *ESR?, *OPC, *OPC?, *SRE, *STB? and *WAI discussed under IEEE 488.2 Common Commands.

STATus:OPERation[:EVENt]? [(@<chanlist>)]

The query returns the value of the event register for the Operation Status group. This is a read-only register, which stores (latches) all events that are passed by the Operation NTR and PTR filter. Reading the Operation Status Event register clears it.

Parameter	Typical return
(none)	<bit value>
Reads the operation status event register: STAT:OPER? (@1)	

Remarks

- – *RST has no effect on this register.
- – The value returned is the binary-weighted sum of all bits set in the register.

STATus:OPERation:CONDition? [(@<chanlist>)]

The query returns the value of the condition register for the Operation Status group. This is a read-only register, which holds the live (unlatched) operational status of the instrument. Reading the Operation Status Condition register does not clears it.

Parameter	Typical return
(none)	<bit value>
Reads the operation status condition register: STAT:OPER:COND? (@1)	

Remarks

- – The condition register bits reflect the current condition. If a condition goes away, the corresponding bit is cleared.
- – The value returned is the binary-weighted sum of all bits set in the register.

STATus:OPERation:ENABle <enable value>[, (@<chanlist>)]
STATus:OPERation:ENABle? [(@<chanlist>)]

The command sets bits in the **enable register** for the **Operation Status** group. The enable register is a mask for enabling specific bits from the Operation Event register to set the OPER (operation summary) bit of the Status Byte register. STATus:PRESet clears all bits in the enable register.

The query reads the enable register and returns a decimal value that corresponds to the binary-weighted sum of all bits set in the register.

Parameter	Typical return
A decimal value that corresponds to the binary-weighted sum of the bits in the register.	<bit value>
Default: 0	
Enable bit 9 in the enable register: STAT:OPER:ENAB 512, (@1)	

Remarks

– *CLS does not clear the enable register, but does clear the **event register**.

STATus:OPERation:NTRansition <*value*>[, (<@chanlist>)]
STATus:OPERation:NTRansition? [(<@chanlist>)]

The command sets and queries the value of the **NTR** (Negative-Transition) register.

This register serves as a polarity filter between the Operation Condition and Operation Event registers.

When a bit in the NTR register is set to 1, then a 1-to-0 transition of the corresponding bit in the Operation Condition register causes that bit in the Operation Event register to be set.

STATus:PRESet sets all bits in the PTR registers and clears all bits in the NTR registers.

Parameter	Typical return
A decimal value that corresponds to the binary-weighted sum of the bits in the register.	<bit value>
Default: 0	
Enable bit 3 and 4 in the NTR register: STAT:OPER:NTR 24, (@1)	

Remarks

– If the same bits in both NTR and PTR registers are set to 1, then any transition of that bit at the Operation Condition register sets the corresponding bit in the Operation Event register.

– If the same bits in both NTR and PTR registers are set to 0, then no transition of that bit at the Operation Condition register can set the corresponding bit in the Operation Event register.

– The value returned is the binary-weighted sum of all bits set in the register.

STATus:OPERation:PTRansition <*value*>[, (<@chanlist>)]
STATus:OPERation:PTRansition? [(<@chanlist>)]

The command sets and queries the value of the **PTR** (Positive-Transition) register.

This registers serves as a polarity filter between the Operation Condition and Operation Event registers.

When a bit in the PTR register is set to 1, then a 0-to-1 transition of the corresponding bit in the Operation Condition register causes that bit in the Operation Event register to be set.

STATus:PRESet sets all bits in the PTR registers and clears all bits in the NTR registers.

Parameter	Typical return
A decimal value that corresponds to the binary-weighted sum of the bits in the register.	<bit value>
Default: 8191	
Enable bit 3 and 4 in the PTR register:: STAT:OPER:PTR 24, (@1)	

Remarks

- If the same bits in both NTR and PTR registers are set to 1, then any transition of that bit at the Operation Condition register sets the corresponding bit in the Operation Event register.

- If the same bits in both NTR and PTR registers are set to 0, then no transition of that bit at the Operation Condition register can set the corresponding bit in the Operation Event register.

- The value returned is the binary-weighted sum of all bits set in the register.

STATus:PRESet

The command presets the OPERation and QUEStionable ENABle, PTRansition and NTRansition registers.

Operation register	Questionable register	Preset setting
STAT:OPER:ENAB	STAT:QUES:ENAB	0 - all defined bits are disabled
STAT:OPER:NTR	STAT:QUES:NTR	0 - all defined bits are disabled
STAT:OPER:PTR	-	8191 - all defined bits are enabled
-	STAT:QUES:PTR	2043 - all defined bits are enabled

Parameter	Typical return
(none)	(none)
Presets the Operation and Questionable registers: STAT:PRES	

STATus:QUEStionable:[:EVENt]? [(<@chanlist>)]

The query returns the value of the **event register** for the Questionable Status group. This is a read-only register, which stores (latches) all events that are passed by the Operation NTR and PTR filter. Reading the Questionable Status Event register clears it.

Parameter	Typical return
(none)	<bit value>

Reads the questionable status event register: STAT:QUES? (@1)

Remarks

– *RST has no effect on this register.

– The value returned is the binary-weighted sum of all bits set in the register.

STATus:QUEStionable:CONDition? [(<@chanlist>)]

The query returns the value of the **condition register** for the **Questionable Status** group. This is a read-only register, which holds the live (unlatched) operational status of the instrument. Reading the Questionable Status Condition register does not clear it.

Parameter	Typical return
(none)	<bit value>

Reads the condition register: STAT:QUES:COND? (@1)

Remarks

– The condition register bits reflect the current condition. If a condition goes away, the corresponding bit is cleared.

– The value returned is the binary-weighted sum of all bits set in the register.

STATus:QUEStionable:ENABle <*value*>[, (<@chanlist>)]
STATus:QUEStionable:ENABle? [(<@chanlist>)]

The command sets bits in the **enable register** for the **Questionable Status** group. The enable register is a mask for enabling specific bits from the Operation Event register to set the QUES (questionable summary) bit of the Status Byte register. STATus:PRESet clears all bits in the enable register.

The query reads the enable register and returns a decimal value that corresponds to the binary-weighted sum of all bits set in the register.

Parameter	Typical return
A decimal value that corresponds to the binary-weighted sum of the bits in the register.	<bit value>
Default: 0	
Enable bit 4 in the questionable enable register: STAT:QUES:ENAB 16, (@1)	

STATus:QUEStionable:NTRansition <*value*>[, (<@chanlist>)]
STATus:QUEStionable:NTRansition? [(<@chanlist>)]

The command sets and queries the value of the **NTR** (Negative-Transition) register.

This register serves as a polarity filter between the Questionable Condition and Questionable Event registers.

When a bit in the NTR register is set to 1, then a 1-to-0 transition of the corresponding bit in the Questionable Condition register causes that bit in the Questionable Event register to be set.

STATus:PRESet sets all bits in the PTR registers and clears all bits in the NTR registers.

Parameter	Typical return
A decimal value that corresponds to the binary-weighted sum of the bits in the register.	<bit value>
Default: 0	
Enable bit 3 and 4 in the NTR register: STAT:QUES:NTR 24, (@1)	

Remarks

– If the same bits in both NTR and PTR registers are set to 1, then any transition of that bit at the Questionable Condition register sets the corresponding bit in the Questionable Event register.

– If the same bits in both NTR and PTR registers are set to 0, then no transition of that bit at the Questionable Condition register can set the corresponding bit in the Questionable Event register.

– The value returned is the binary-weighted sum of all bits set in the register.

STATus:QUEStionable:PTRansition <*value*>[, (<@chanlist>)]
STATus:QUEStionable:PTRansition? [(<@chanlist>)]

The command sets and queries the value of the PTR (Positive-Transition) register.

This registers serves as a polarity filter between the Questionable Condition and Questionable Event registers.

When a bit in the PTR register is set to 1, then a 0-to-1 transition of the corresponding bit in the Questionable Condition register causes that bit in the Questionable Event register to be set.

STATus:PRESet sets all bits in the PTR registers and clears all bits in the NTR registers.

Parameter	Typical return
A decimal value that corresponds to the binary-weighted sum of the bits in the register.	<bit value>
Default: 2043	
Enable bit 3 and 4 in the PTR register:: STAT:QUES:PTR 24, (@1)	

Remarks

– If the same bits in both NTR and PTR registers are set to 1, then any transition of that bit at the Questionable Condition register sets the corresponding bit in the Questionable Event register.

– If the same bits in both NTR and PTR registers are set to 0, then no transition of that bit at the Questionable Condition register can set the corresponding bit in the Questionable Event register.

– The value returned is the binary-weighted sum of all bits set in the register.

SYSTem:BEEPer[:IMMediate]

The command issues a single beep immediately.

Parameter	Typical return
(none)	(none)
Issues a single beep immediately: SYST:BEEP	

Remarks

- – You can issue a beep with this command regardless of the current beeper state (**SYSTem:BEEPer:STATe** command).

SYSTem:BEEPer:STATe ON | OFF | 1 | 0
SYSTem:BEEPer:STATe?

The command enables or disables the beeper.

The query returns 0 (OFF) or 1 (ON).

Parameter	Typical return
ON	OFF	1	0	0 or 1
Turns on the beeper: SYST:BEEP:STAT ON	

Remarks

- – A beep is always emitted (even with beeper state OFF) when **SYSTem:BEEPer** is done.
- – This setting will not affect the front panel key click.
- – This setting is non-volatile; it will not be changed by power cycling or after a Factory Reset (***RST**).

SYSTem:COMMunicate:GPIB:ADDRess <address>
SYSTem:COMMunicate:GPIB:ADDRess?

The command assigns instrument's GPIB (IEEE-488) address. Each instrument on the GPIB interface must have a unique address.

Parameter	Typical return
0 to 30	+5
Set GPIB address to 5: SYST:COMM:GPIB:ADDR 5	

Remarks

- Your computer's GPIB interface card has its own address. Avoid using this address for any instrument on the GPIB bus.

- Cycle power for this command to take effect.

- This setting is non-volatile; it will not be changed by power cycling or after a Factory Reset (*RST).

- This parameter is set to its default value when the instrument is shipped from the factory and after SYSTem:SECurity:IMMediate.

SYSTem:COMMunicate:LAN:CONTrol?

The query reads and returns the control connection port number for Socket communications. Connection is used to send and receive commands and queries. If 0 is returned, the interface does not support a Socket Control connection.

Parameter	Typical return
(none)	+5000 (0 if sockets are not supported)
Returns the control connection port number: SYST:COMM:LAN:CONT?	

Remarks

- This query is only used when programming over Sockets.

- You can use the Socket Control connection to send a Device Clear to the instrument or to detect pending Service Request (SRQ) events.

SYSTem:COMMunicate:LAN:DHCP ON | OFF | 1 | 0
SYSTem:COMMunicate:LAN:DHCP?

The command enables (On) or disables (Off) the use of the Dynamic Host Configuration Protocol (DHCP) for the instrument.

ON: The instrument 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. If a DHCP server is not found, the instrument uses AutoIP to automatically configure its IP setting in the Automatic Private IP Addressing range (169.254.xxx.xxx).

OFF: The instrument will use the static IP address, Subnet Mask, and Default Gateway during power-on.

| NOTE | If you change this setting, you must execute a SYSTem:COMMunicate:LAN:UPDate command to activate the setting. |

Parameter	Typical return
ON	OFF	1	0	0 or 1
Disables DHCP: SYST:COMM:LAN:DHCP OFF SYST:COMM:LAN:UPD	

Remarks

- Most site LANs have a DHCP server.

- If a DHCP LAN address is not assigned by a DHCP server, then an AutoIP address static IP will be assumed after approximately two minutes.

- This setting is non-volatile; it will not be changed by power cycling or after a Factory Reset (*RST).

SYSTem:COMMunicate:LAN:DNS[1 | 2] "<address>"
SYSTem:COMMunicate:LAN:DNS[1 | 2]? [CURRent | STATic]

The command assigns static IP addresses of Domain Name System (DNS) servers. A primary and a secondary server address may be assigned. If DHCP is available and enabled, DHCP will auto-assign these server addresses. These auto-assigned server addresses take precedence over the static addresses assigned with this command. Contact your LAN administrator for details.

> **NOTE**   If you change this setting, you must execute a SYSTem:COMMunicate:LAN:UPDate command to activate the setting.

Parameter	Typical return
<address>: Four-byte dot notation ("nnn.nnn.nnn.nnn"), where "nnn" in each case is a byte value in the range of 0 through 255.	"198.105.232.4"
[CURRent	STATic] Default: CURRent	
Set a static primary DNS address: SYST:COMM:LAN:DNS "198.105.232.4" SYST:COMM:LAN:UPD	

Remarks

- **CURRent** - Returns address currently being used by the instrument.

- **STATic** - Returns address from non-volatile memory. This address is used if DHCP is disabled or unavailable.

- The assigned DNS address is used for the DNS server if DHCP is disabled. Otherwise, the DNS server address is auto-assigned by DHCP.

- This setting is non-volatile; it will not be changed by power cycling or after a Factory Reset (*RST).

SYSTem:COMMunicate:LAN:DOMain?

The query reads the current network domain name and returns an ASCII string enclosed in double quotes.

Parameter	Typical return
(none)	"example.com"
Returns the domain name being used by the instrument: SYST:COMM:LAN:DOM?	

Remarks

- If Dynamic Domain Name System (DNS) is available on your network and your instrument uses DHCP, the domain name is assigned by the Dynamic DNS service at power-on.

- If a domain name has not been assigned, a null string (" ") is returned.

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

The command assigns a default gateway for the instrument. 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 that are destined for a device not on the local subnet, as determined by the Subnet Mask setting. Contact your LAN administrator for details.

| NOTE | If you change this setting, you must execute a SYSTem:COMMunicate:LAN:UPDate command to activate the setting. |

Parameter	Typical return
<address>: Four-byte dot notation ("nnn.nnn.nnn.nnn"), where "nnn" in each case is a byte value in the range of 0 through 255. [CURRent | STATic] Default: CURRent	"198.105.232.4"
Set a default gateway address: SYST:COMM:LAN:GAT "198.105.232.4" SYST:COMM:LAN:UPD	

Remarks

− **CURRent** – Returns address currently being used by the instrument.

− **STATic** – Returns address from non-volatile memory. This address is used if DHCP is disabled or unavailable.

− If DHCP is enabled (SYSTem:COMMunicate:LAN:DHCP ON 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 is used.

− This setting is non-volatile; it will not be changed by power cycling or after a Factory Reset (*RST).

− A gateway value of "0.0.0.0" indicates that subnetting is not being used.

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

The command assigns a hostname to the instrument. A hostname is the host portion of the domain name, which is translated into an IP address. If Dynamic Domain Name System (Dynamic DNS) is available on your network and your instrument uses DHCP, the hostname is registered with the Dynamic DNS service at power-on. If DHCP is enabled (SYSTem:COMMunicate:LAN:DHCP ON), the DHCP server can change the specified hostname.

> **NOTE** If you change this setting, you must execute a SYSTem:COMMunicate:LAN:UPDate command to activate the setting.

Parameter	Typical return
<name>: A string of up to 15 characters. Must start with letter (A-Z) May contain letters, numbers (0-9), or dashes ("-") Default: "K-<instrument model number>-nnnnn", where "nnnnn" is the last five digits of the instrument's serial number.	"LAB1-E367311A"
[CURRent	STATic] Default: CURRent	
Define a hostname: SYST:COMM:LAN:HOST "LAB1-E36731A" SYST:COMM:LAN:UPD	

Remarks

- **CURRent** - Returns hostname currently being used by the instrument.

- **STATic** - Returns desired hostname from non-volatile memory, that may not be the actual name used by the instrument if DHCP is enabled.

- If host name has not been assigned, the query returns a null string ("").

- This setting is non-volatile; it will not be changed by power cycling or after a Factory Reset (*RST).

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

The command assigns a static Internet Protocol (IP) address for the instrument. If DHCP is enabled (**SYSTem:COMMunicate:LAN:DHCP ON**), the specified static IP address is not used. Contact your LAN administrator for details.

| NOTE | If you change this setting, you must execute a SYSTem:COMMunicate:LAN:UPDate command to activate the setting. |

Parameter	Typical return
<address>: Four-byte dot notation ("nnn.nnn.nnn.nnn"), where "nnn" in each case is a byte value in the range 0 through 255.	"198.105.232.4"
[CURRent	STATic] Default: CURRent	
Sets a static IP address: SYST:COMM:LAN:IPAD "198.105.232.4" SYST:COMM:LAN:UPD	

Remarks

– **CURRent** – Returns address currently being used by the instrument.

– **STATic** – Returns static address from non-volatile memory. This address is used if DHCP is disabled or unavailable.

– This setting is non-volatile; it will not be changed by power cycling or after a Factory Reset (*RST).

Keysight E36731A Programming Guide

SYSTem:COMMunicate:LAN:MAC?

The query returns the instrument's Media Access Control (MAC) address as an ASCII string of 12 hexadecimal characters (0-9 and A-F) enclosed in quotation marks.

> **NOTE**   Your network administrator may need the instrument's MAC address in order to assign a static IP address for this device.

Parameter	Typical return
(none)	"00:30:D3:00:10:41"
Returns the MAC address: SYST:COMM:LAN:MAC?	

Remarks

- Query reads the MAC address and returns an ASCII string enclosed in double quotes.

- The instrument's MAC address is unique to the instrument. It is set at the factory and cannot be changed.

- This setting is non-volatile; it will not be changed by power cycling or after a Factory Reset (*RST).

- MAC address also known as the link-layer 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.

SYSTem:COMMunicate:LAN:SMASk "<mask>"
SYSTem:COMMunicate:LAN:SMASk? [CURRent | STATic]

The command assigns a subnet mask for the instrument to use in determining whether 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 LAN administrator for details.

> **NOTE** If you change this setting, you must execute a SYSTem:COMMunicate:LAN:UPDate command to activate the setting.

Parameter	Typical return
<mask>: Four-byte dot notation ("nnn.nnn.nnn.nnn"), where "nnn" in each case is a byte value in the range 0 through 255. Default: "255.255.0.0"	"198.105.232.4"
[CURRent | STATic] Default: CURRent	
Sets the subnet mask: SYST:COMM:LAN:SMAS "255.255.254.0" SYST:COMM:LAN:UPDate	

Remarks

– **CURRent** – Returns subnet mask currently being used by the instrument.

– **STATic** – Returns subnet mask from non-volatile memory. This address is used if DHCP is disabled or unavailable.

– A value of "0.0.0.0" or "255.255.255.255" indicates that subnetting is not being used.

– This setting is non-volatile; it will not be changed by power cycling or after a Factory Reset (*RST).

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

The command sets the command prompt displayed when communicating the instrument with Telnet.

Parameter	Typical return
<string>: A string of up to 15 characters	"Command"
Defines the command prompt: SYST:COMM:LAN:TELN:PROM "Command"	

Remarks

- Query returns the command prompt as ASCII strings enclosed in double quotes.

- Instrument uses LAN port 5024 for SCPI Telnet sessions, and port 5025 for SCPI Socket sessions.

- Telnet port is an alternate way to send SCPI commands to the instrument.

- Telnet session can typically be started as follows from a host computer shell:

    telnet <IP_address> <port>

    For example:

    telnet 169.254.4.10 5024

    To exit a Telnet session, press <**Ctrl-D**>.

- This setting is non-volatile; it will not be changed by power cycling or after a Factory Reset (*RST).

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

The command sets the welcome message displayed when communicating the instrument with Telnet.

Parameter	Typical return
<string>: A string of up to 63 characters Default: "Welcome to Keysight's E36731A Battery Emulator"	"Welcome to the Telnet Session"
Define a welcome message: SYST:COMM:LAN:TELN:WMES "Welcome to the Telnet Session"	

Remarks

- Query returns the command prompt as ASCII strings enclosed in double quotes.

- Instrument uses LAN port 5024 for SCPI Telnet sessions and port 5025 for SCPI Socket sessions.

- This setting is non-volatile; it will not be changed by power cycling or after a Factory Reset (*RST).

SYSTem:COMMunicate:LAN:UPDate

The command stores any changes made to the LAN settings into non-volatile memory and restarts the LAN driver with the updated settings.

Parameter	Typical return
(none)	(none)
Configures the instrument to use statically assigned LAN settings (disables DHCP): SYST:COMM:LAN:DHCP OFF SYST:COMM:LAN:DNS "198.105.232.4" SYST:COMM:LAN:DNS2 "198.105.232.5" SYST:COMM:LAN:GAT "198.105.232.1" SYST:COMM:LAN:HOST "LAB1-E36731A" SYST:COMM:LAN:IPAD "198.105.232.101" SYST:COMM:LAN:UPD	
Configures the instrument back to use DHCP (enables DHCP): SYST:COMM:LAN:DHCP ON SYST:COMM:LAN.UPD	

Remarks

- Be very careful when you execute this command, because your instrument may not work on the LAN if you update the instrument with invalid LAN settings.

- If your instrument does not work after you execute this command, perform the LAN Reset through instrument's front panel softkey to restore the settings to reset values and reset the LAN, or use another I/O interface, such as USB, to correct the settings.

- This command must be sent after changing the settings for DHCP, DNS, gateway, hostname, IP address, or sub-net mask.

SYSTem:COMMunicate:RLSTate LOCal | REMote | RWLock
SYSTem:COMMunicate:RLSTate?

The command sets the battery emulator to remote or local mode. The REMote parameter is the same as SYSTem:REMote, and the RWLock parameter is the same as SYSTem:RWLock.

The query returns LOC, REM, or RWL.

Parameter	Typical return
LOC	REM	RWL	LOC, REM, or RWL
*RST LOC	
Sets the battery emulator to remote: SYST:COMM:RLST REM	

Remarks

– The LOCal parameter is different from **SYSTem:LOCal**. The LOCal parameter will force the instrument to change and stay in local mode. Sending any SCPI command after this will not set the instrument to remote mode.

SYSTem:COMMunicate:TCPip:CONTrol?

The command returns the initial socket control connection port number. After the control port number is obtained, a control socket connection can be opened.

Parameter	Typical return
(none)	5000 (0 if sockets are not suported)
Queries the control connection port number: SYST:COMM:TCP:CONT?	

> **NOTE** The control socket connection can only be used by a client to send a device clear to the instrument or to detect Service Request (SRQ) events.
>
> Refer to "Using Sockets" in the *User's Guide* for more information.

SYSTem:DATE \<yyyy\>,\<mm\>,\<dd\>
SYSTem:DATE?

The command sets the date of the real time clock in year (yyyy), month (mm), and day (dd). The range of values for the year is from 2000 to 2099.

The query returns comma-seperated values that correspond to the year, month, and day. For example: +2020,+1,+26.

Parameter	Typical return
\<yyyy\>,\<mm\>,\<dd\>	\<+yyyy,+mm,+dd\>
Sets the date to November 27, 2019: SYST:DATE 2019,11,27	

Remarks

– The real-time clock is battery-backed and retains the date and time when power is off.

– The real-time clock does not adjust itself for time zone changes or daylight savings time. Be sure to set the date and time when you first receive your instrument.

– This setting is non-volatile; it will not be changed by power cycling or after a Factory Reset (***RST**).

SYSTem:ERRor[:NEXT]?

The query returns the battery emulator error queue of up to 20 errors. The battery emulator beeps once (unless disabled by **SYSTem:BEEPer:STATe OFF**) and turns on the front-panel ERR annunciator when an error has been detected. Up to 20 errors can be stored in the error queue. See **Error Messages**.

NOTE	Errors are retrieved in first-in-first-out (FIFO) order. The ERR annunciator turns off after the last error is read. The battery emulator beeps once (unless disabled by **SYSTem:BEEPer:STATe OFF**) each time an error is generated.
	If more than 20 errors have occurred, the last error stored in the queue (the most recent error) is replaced with -350, "Queue overflow". No additional errors are stored until you remove errors from the queue. If no errors have occurred, the SYST:ERR? query returns +0, "No error".
	The error queue is cleared when power has been off or after a ***CLS** (clear status) command has been executed. The ***RST** (reset) command does not clear the error queue.

Parameter	Typical return
(none)	<+0,"No error">
Reads and clears the first error in error queue: SYST:ERR?	

SYSTem:LOCal

The command places the battery emulator in the local mode. All front-panel keys are fully functional.

Parameter	Typical return
(none)	(none)
Sets the battery emulator in the local mode: SYST:LOC	

Remarks

– This command will not explicitly set the instrument to local mode if the current instrument mode is in RWL mode. See **SYSTem:RWLock** for more details on how to set instrument mode to local.

SYSTem:REMote

The command places the battery emulator into remote mode for remote operation. All front-panel keys are disabled except for the **[Lock/Unlock]** key. You can unlock the front-panel keys by holding the **[Lock/Unlock]** key for a few seconds.

Parameter	Typical return
(none)	(none)
Sets to remote mode: SYST:REM	

SYSTem:RWLock

The command places the battery emulator in the remote mode. This command is the same as **SYSTem:REMote** except that all front-panel keys are disabled including the **[Lock/Unlock]** key. You can unlock the front-panel keys by using **SYSTem:COMMunicate:RLSTate LOCal** if you want the instrument to be forced into local mode, or you can use **SYSTem:LOCal** command after sending **SYSTem:REMote** command to set instrument into local mode.

Parameter	Typical return
(none)	(none)
Sets to remote mode disabling all front-panel keys: SYST:RWL	

SYSTem:SECurity:IMMediate

The command clears all user memory and reboots the instrument. This command is typically used to prepare the instrument for removal from a secure area. It sanitizes all user data by overwriting all addressable locations in flash memory with a single character and then performing a chip erase as per manufacturer's data sheet. For the EEPROM, it overwrites all locations with a random pattern, followed by binary zeros and binary ones. Identification data (instrument firmware, model number, serial number, MAC address and calibration data) is not erased. After the data is cleared, the instrument is rebooted.

This procedure is not recommended for use in routine applications because of the possibility of unintended loss of data.

Parameter	Typical return
(none)	(none)
Sanitizes the battery emulator: SYST:SEC:IMM	

SYSTem:SET <arbitrary_block_data>
SYSTem:SET?

The command sets the instrument state as defined by the data returned by SYSTem:SET? query.

Parameter	Typical return
<arbitrary_block_data>: The block data returned by SYSTem:SET? query.	#nN<instrument state> where the first digit after the # indicates the number of following digits. The following digits indicate the length of the data.

SYSTem:TIME <hh>,<mm>,<ss>
SYSTem:TIME?

The command sets the real time clock in hours (hh), minutes (mm), and seconds (ss). The values may range from 0,0,0 (midnight) to 23,59,59 (one second before midnight).

The query returns the real time clock in hours (hh), minutes (mm), and seconds (ss).

Parameter	Typical return
<0 - 23>,<0 - 59>,<0 - 59>	+<hh>,+<mm>,+<ss>
Sets the real time clock to 13:30:15: SYST:TIME 13,30,15	

Remarks

- The real-time clock is battery-backed and retains the date and time when power is off.

- The real-time clock does not adjust itself for time zone changes or daylight savings time. Be sure to set the date and time when you first receive your instrument.

- This setting is non-volatile; it will not be changed by power cycling or after a Factory Reset (*RST).

SYSTem:VERSion?

The query returns the present SCPI version of the battery emulator. The returned value is a string in the form of YYYY.V where "YYYY" represent the year of the version, and the "V" represents the current version number of the SCPI.

Parameter	Typical return
(none)	"<version>"
Returns the SCPI version:: SYST:VERS?	

TRANsient Subsystem `Load Mode only`

TRANsient commands program the transient generator of the load. The transient generator programs a second (transient) level at which the load can operate without changing the original programmed settings.

See also [SOURce:]CURRent:TLEVel, [SOURce:]RESistance:TLEVel, [SOURce:]POWer:TLEVel, and [SOURce:]VOLTage:TLEVel.

[SOURce:]TRANsient:COUNt <value> | MINimum | MAXimum | INFinity[, (@<chanlist>)]
[SOURce:]TRANsient:COUNt? [MIN | MAX | INFinity,] [(@<chanlist>)]

The command sets the number of times that the continuous mode is executed before it is completed. The transient count can be set to any value between 1 and 9999.

Parameter	Typical return
1 - 9999	MIN	MAX	INFinity	<transient count>
*RST 1	
Sets the transient count to 50: TRAN:COUN 50, (@1)	

[SOURce:]TRANsient:DCYCle <value> | MINimum | MAXimum[, (@<chanlist>)]
[SOURce:]TRANsient:DCYCle? [MINimum | MAXimum,] [(@<chanlist>)]

The command sets the duty cycle for each of the transients when the generator is in CONTinuous mode. Units are in percentage (%)

Parameter	Typical return
1.8 - 98.2	MIN	MAX	<duty cycle>
*RST 50	
Sets the duty cycle to 10.5%: TRAN:DCYC 10.5, (@1)	

[SOURce:]TRANsient:FREQuency <value> | MINimum | MAXimum[, (@<chanlist>)]
[SOURce:]TRANsient:FREQuency? [MINimum | MAXimum,] [(@<chanlist>)]

> **NOTE** This command is the same as INPut:PROTection:DELay.

The command sets the frequency of the transient when the generator is in CONTinuous mode. Units are in Hertz (Hz)

Parameter	Typical return
0.25 - 10000	MIN	MAX	<delay value>
*RST MAX	
Sets the frequency of transient to 50 Hz: TRAN:FREQ 50, (@1)	

[SOURce:]TRANsient:MODE CONTinuous | PULSe | TOGGle | LIST[, (@<chanlist>)]
[SOURce:]TRANsient:MODE? [(@<chanlist>)]

The command sets the operating mode of the transient generator.

Mode	Description
CONTinuous	The transient generator puts out a continuous pulse stream.
PULSe	The transient generator puts out a single pulse upon receipt of a trigger.
TOGGle	The transient generator toggles between two levels upon receipt of a trigger.
LIST	The transient generator switch to list mode.

Parameter	Typical return
CONT | PULS | TOGG | LIST	CONT, PULS, TOGG, or LIST
*RST LIST	
Sets the transient generator to continuous mode: TRAN:MODE CONT, (@1)	

[SOURce:]TRANsient:TWIDth <value> | MINimum | MAXimum[, (@<chanlist>)]
[SOURce:]TRANsient:TWIDth? [MINimum | MAXimum,] [(@<chanlist>)]

The command sets the pulse width of the transients when the generator is in PULSe mode. Units are in seconds.

Parameter	Typical return
0.0001 - 268,435 | MIN | MAX	<pulse width>
*RST 0.0005	
Sets the pulse width to 0.5 second: TRAN:TWID 0.5, (@1)	

TRIGger Subsystem

Trigger commands control the transient and acquisition subsystems.

TRIGger:ACQuire[:IMMediate] [(@<chanlist>)] (Load Mode only)

The command triggers the measurement immediately. This command overrides any selected trigger source and generate immediate triggers.

Parameter	Typical return
(none)	(none)
Generates an acquisition trigger immediately: TRIG:ACQ (@1)	

Remarks

- You must initiate the measurement trigger system before you can send any trigger.

- At acquire trigger completion, the WTG-meas bit in the Status Operation Condition register is cleared.

TRIGger:ACQuire:CURRent[:LEVel] <value> | MINimum | MAXimum[, (@<chanlist>)] (Load Mode only)
TRIGger:ACQuire:CURRent[:LEVel]? [MINimum | MAXimum,] [(@<chanlist>)]

The command sets the current triggered level of the input. Applies when the measurement trigger source is set to a level. Values are specified in amperes. The minimum and maximum values depend on the ratings of the unit.

Parameter	Typical return
minimum - maximum	MIN	MAX (The maximum values are 102% of the rating of the instrument.)	<triggered level>
*RST MIN	
Sets the triggered current level to 3 A: TRIG:ACQ:CURR 3, (@1)	

TRIGger:ACQuire:CURRent:SLOPe POSitive | NEGative[, (@<chanlist>)] `Load Mode only`
TRIGger:ACQuire:CURRent:SLOPe? [(@<chanlist>)]

The command sets the slope of the signal. Applies when the measurement trigger source is set to a level.

Slope	Description
POSitive	Specifies a rising slope of the output signal.
NEGative	Specifies a falling slope of the output signal.

Parameter	Typical return
POS	NEG	POS or NEG
*RST POS	
Sets the current slope to falling edge: TRIG:ACQ:CURR:SLOP NEG, (@1)	

TRIGger:ACQuire:SOURce BUS | CURRent<n> | EXTernal | IMMediate | VOLTage<n> | PIN<n>[, (@<chanlist>)] `Load Mode only`
TRIGger:ACQuire:SOURce? [(@<chanlist>)]

The command selects the trigger source for the acquisition system.

The query returns BUS, EXT, IMM, CURR<n>, VOLT<n>, or PIN<n>.

The following trigger sources can be selected:

Trigger Source	Description
BUS	Selects a remote interface trigger command.
EXTernal	Selects all connector pins configured as trigger sources.
IMMediate	Generates a trigger as soon as the trigger system is INITiated.
CURRent<n>	Selects the input current level of a channel.
VOLTage<n>	Selects the input voltage level of a channel.
PIN<n>	Selects a digital port pin configured as a trigger input, where <n> indicates the pin number.

Parameter	Typical return
BUS	CURR1	EXT	IMM	VOLT1	PIN<1-3>	BUS, CURR1, EXT, IMM, VOLT1, or PIN<n>
*RST BUS	
Selects a current level on channel 1 as the acquire trigger: TRIG:ACQ:SOUR CURR1, (@1)	

TRIGger:ACQuire:VOLTage[:LEVel] <value> | MINimum | MAXimum[, (@<chanlist>)]   `Load Mode only`
TRIGger:ACQuire:VOLTage[:LEVel]? [MINimum | MAXimum,] [(@<chanlist>)]

The command sets the voltage triggered level of the input. Applies when the measurement trigger source is set to a level. Values are specified in volts. The minimum and maximum values depend on the ratings of the unit.

Parameter	Typical return
minimum - maximum	MIN	MAX (The maximum values are 102% of the rating of the instrument.)	<triggered level>
*RST MIN	
Sets the triggered voltage level to 50 V: `TRIG:ACQ:VOLT 50, (@1)`	

TRIGger:ACQuire:VOLTage:SLOPe POSitive | NEGative[, (@<chanlist>)]   `Load Mode only`
TRIGger:ACQuire:VOLTage:SLOPe? [(@<chanlist>)]

The command sets the slope of the signal. Applies when the measurement trigger source is set to a level.

Positive specifies a rising slope of the input signal.

NEGative specifies a falling slope of the input signal.

Parameter	Typical return
POSitive	NEGative	POS or NEG
*RST POS	
Sets the voltage slope to rising edge: `TRIG:ACQ:VOLT:SLOP POS, (@1)`	

TRIGger:DLOG[:IMMediate]

The command triggers the internal data logger immediately. This command overrides any selected trigger source and generate immediate triggers.

Parameter	Typical return
(none)	(none)
Triggers the data logger immediately: `TRIG:DLOG`	

Remarks

–   You must initiate the data logger before you can send any trigger.

TRIGger:DLOG:CURRent[:LEVel] <value> | MINimum | MAXimum[, (@<chanlist>)] `Load Mode only`
TRIGger:DLOG:CURRent[:LEVel]? [MINimum | MAXimum,] [(@<chanlist>)]

The command sets the current triggered level of the data logger. Applies when the data logger trigger source is set to a level. Values are specified in amperes. The minimum and maximum values depend on the ratings of the unit.

Parameter	Typical return
minimum - maximum | MIN | MAX (The maximum values are 102% of the rating of the instrument.)	<triggered level>
*RST MIN	
Sets the triggered current level to 3 A: TRIG:DLOG:CURR 3, (@1)	

TRIGger:DLOG:CURRent:SLOPe POSitive | NEGative[, (@<chanlist>)] `Load Mode only`
TRIGger:DLOG:CURRent:SLOPe? [(@<chanlist>)]

The command sets the slope of the signal. Applies when the data logger trigger source is set to a level.

Slope	Description
POSitive	Specifies a rising slope of the input signal.
NEGative	Specifies a falling slope of the input signal.

Parameter	Typical return
POS | NEG	POS or NEG
*RST POS	
Sets the current slope to falling edge: TRIG:DLOG:CURR:SLOP NEG, (@1)	

TRIGger:DLOG:VOLTage[:LEVel] <value> | MINimum | MAXimum[, (@<chanlist>)] `Load Mode only`
TRIGger:DLOG:VOLTage[:LEVel]? [MINimum | MAXimum,] [(@<chanlist>)]

The command sets the voltage triggered level of the data logger. Applies when the data logger trigger source is set to a level. Values are specified in volts. The minimum and maximum values depend on the ratings of the unit.

Parameter	Typical return
minimum - maximum | MIN | MAX (The maximum values are 102% of the rating of the instrument.)	<triggered level>
*RST MIN	
Sets the triggered voltage level to 50 V: TRIG:DLOG:VOLT 50, (@1)	

TRIGger:DLOG:VOLTage:SLOPe POSitive | NEGative[, (@<chanlist>)] `Load Mode only`
TRIGger:DLOG:VOLTage:SLOPe? [(@<chanlist>)]

The command sets the slope of the signal. Applies when the data logger trigger source is set to a level.

Positive specifies a rising slope of the input signal.

NEGative specifies a falling slope of the input signal.

Parameter	Typical return
POSitive	NEGative	POS or NEG
*RST POS	
Sets the voltage slope to rising edge: TRIG:DLOG:VOLT:SLOP POS, (@1)	

TRIGger:DLOG:SOURce BUS | EXTernal | IMMediate | CURRent<n> | VOLTage<n> | LRSKey | OOOKey
TRIGger:DLOG:SOURce?

The command selects the trigger source for the data logger.

The query returns BUS, EXT, IMM, CURR<n>, VOLT<n>, LRSK, or OOOK.

The following trigger sources can be selected:

Trigger Source	Description
BUS	Selects a remote interface trigger command.
EXTernal	Selects all connector pins that have been configured as trigger sources
IMMediate	Sets the trigger source to true. As soon as the data logger is INITiated, it will send the trigger immediately.
CURRent<n>	Selects the measured current level of a specific channel. <n> specifies a channel. `Load Mode only`
VOLTage<n>	Selects the measured voltage level of a specific channel. <n> specifies a channel. `Load Mode only`
LRSKey	Selects the List Run/Stop key. `Load Mode only`
OOOKey	Selects the Input On/Off key. `Load Mode only`

Parameter	Typical return
BUS	EXT	IMM	CURR1	VOLT1	LRSK	OOOK	BUS, EXT, IMM, CURR1, VOLT1, LRSK, or OOOK
*RST IMM	
Selects remote interface trigger command as the data log trigger source: TRIG:DLOG:SOUR BUS	

TRIGger[:TRANsient|SEQuence][:IMMediate] [(@<chanlist>)] `Load Mode only`

The command triggers the input immediately. This command overrides any selected trigger source and generate immediate triggers.

Parameter	Typical return
(none)	(none)
Generates a transient trigger immediately: TRIG:TRAN (@1)	

Remarks

- You must initiate the trigger system before you can send any trigger.

- At transient trigger completion, the WTG-tran bit in the Status Operation Condition register is cleared.

TRIGger[:TRANsient|SEQuence]:DELay <value> | MINimum | MAXimum[, (@<chanlist>)]
TRIGger[:TRANsient|SEQuence]:DElay? [MINimum | MAXimum,] [(@<chanlist>)]

The command sets the time delay between the detection of an event on the specified trigger source and the start of any corresponding trigger action on the battery emulator input. Programmed value can range from 0 to 0.255 seconds (Load mode) or from 0 to 3600 seconds (Power Supply mode).

Parameter	Typical return
Power Supply mode: 0 - 3600 | MIN | MAX *RST 0	<delay value>
Load mode: 0 - 0.255 | MIN | MAX *RST 0	
Sets the trigger time delay to 0.1 s: TRIG:TRAN:DEL 0.1, (@1)	

TRIGger[:TRANsient|SEQuence]:SOURce BUS | EXTernal | IMMediate | PIN1 | PIN2 | PIN3[, (@<chan-list>)]
TRIGger[:TRANsient|SEQuence]:SOURce? [(@<chanlist>)]

The command selects the trigger source for the output trigger system.

The query returns BUS, EXT, IMM or PIN<n>.

PIN<n> must be configured as trigger output before it can be used as a trigger source. See [SOURce:]DIGital:PIN<n>:FUNCtion and [SOURce:]DIGital:PIN<n>:POLarity.

Trigger Source	Description
BUS	Selects a remote interface trigger command.
EXTernal	Selects ALL connector pins that have been configured as trigger sources.
IMMediate	Sets the trigger source to true. As soon as the input is INITiated, it will send the trigger immediately.
PIN<n>	Selects a digital port pin configured as a trigger input where <n> indicates the pin number.

Parameter	Typical return
BUS	EXT	IMM	PIN1	PIN2	PIN3	BUS, EXT, IMM, PIN1, PIN2, or PIN3
*RST BUS	
Selects digital port pin 2 as the output trigger source: TRIG:SOUR PIN2, (@1)	

Triggering Commands

The instrument's triggering system allows you to change current, power, resistance, or voltage output when a trigger is received. The typical process is:

1. Select output with the INSTrument:SELect or CHANnel:SELect command.

2. Configure the triggered output levels by using CURRent:TRIGgered, POWer:TRIGgered, RESistance:TRIGgered, or VOLTage:TRIGgered.

3. Configure the current, power, resistance, or voltage mode to Step by using CURRent:MODE, POWer:MODE, RESistance:MODE, or VOLTage:MODE.

4. Specify the trigger source, either BUS, EXTernal, IMMediate, or PIN<n>.

5. If you are using the BUS trigger source, you may choose to set a time delay between the detection of the trigger and the start of any corresponding input change.

6. Send an INITiate[:IMMediate]command. If the IMMediate source is selected, the selected input is set to the triggered level immediately. If the BUS trigger source is selected, the input is set to the triggered level after the instrument receives the *TRG command.

VOLTage Subsystem

Voltage commands program the output voltage and voltage protection functions. The SOURce keyword is optional in the following commands.

[SOURce:]VOLTage[:LEVel][:IMMediate][:AMPLitude] <voltage>| MINimum | MAXimum | DEFault | UP | DOWN[, (@<chanlist>)]
[SOURce:]VOLTage[:LEVel][:IMMediate][:AMPLitude]? [MINimum | MAXimum | DEFault,] [(@<chanlist>)]

The command programs the immediate voltage level when the output is in constant voltage mode. Units are in volts. The immediate level is the voltage limit value of the selected output with the INSTrument command.

This command also increases or decreases the immediate voltage level using the "UP" or "DOWN" parameter by a predetermined amount. Note that "UP" and "DOWN" parameters are only supported in Power Supply mode. The command VOLTage:STEP sets the amount of increase or decrease.

The query returns the programmed voltage level in the form +n.nnnnnE+nn for each channel specified. Multiple responses are separated by commas. MAX and MIN return the highest and lowest programmable voltage levels respectively for the selected range.

Parameter	Typical return
minimum - maximum	MIN	MAX	DEF	UP	DOWN (Values are range and mode dependent. See Programming Range)	<voltage level>
*RST MIN	
Sets the input voltage level to 20 V: VOLT 20, (@1)	

[SOURce:]VOLTage[:LEVel][:IMMediate]:STEP[:INCRement] <voltage> | DEFault, (@<chanlist>)
P.Supply Mode only

[SOURce:]VOLTage[:LEVel][:IMMediate]:STEP[:INCRement]? [DEFault,] (@<chanlist>)

The command sets the step size for current programming with the VOLTage UP and VOLTage DOWN commands. To set the step size to the minimum resolution, set the step size to "DEFault". The VOLT:STEP? DEF returns the minimum resolution of your instrument. The immediate voltage level increases or decreases by the value of the step size. For example, the output voltage will increase or decrease 10 mV if the step size is 0.01.

This command is useful when you program the power supply to the allowed minimum resolution. At *RST, the step size is the value of the minimum resolution.

The query returns a number in the form +n.nnnnnnnE+nn for each channel specified.

Parameter	Typical return
minimum - maximum	DEF (See Programming Range)	<voltage level>
*RST DEF	

Parameter	Typical return
Sets the output voltage level to 5 V: VOLT:STEP 5, (@1)	

[SOURce:]VOLTage[:LEVel]:TRIGgered[:AMPLitude] <voltage>| MINimum | MAXimum[, (@<chanlist>)]
[SOURce:]VOLTage[:LEVel]:TRIGgered[:AMPLitude]? [MINimum | MAXimum,] [(@<chanlist>)]

The command programs the triggered voltage level when the output is in constant voltage mode. The triggered level is a stored value that is transferred to the output when an output step is triggered. Units are in volts.

The query returns the programmed voltage level in the form +n.nnnnnnE+nn for each channel specified. Multiple responses are separated by commas. MAX and MIN return the highest and lowest programmable voltage levels respectively for the selected range.

Parameter	Typical return
minimum - maximum | MIN | MAX (Values are range and mode dependent. See Programming Range)	<voltage level>
*RST MIN	
Sets the triggered voltage level to 5 V: VOLT:TRIG 5, (@1)	

[SOURce:]VOLTage:INHibit:VON[:LEVel] <voltage>| MAXimum | MINimum | DEFault[, (@<chanlist>)]

`Load Mode only`

[SOURce:]VOLTage:INHibit:VON[:LEVel]? [MINimum | MAXimum | DEFault,] [(@<chanlist>)]

When enabled, as specified by VOLTage:INHibit:VON:MODE, the load will not sink current until the input voltage rises above the voltage-on setting. Units are in volts.

Parameter	Typical return
minimum - 61.2	MIN	MAX	DEF	<voltage-on value>
*RST MIN	
Specifies a voltage-on of 4 volts: VOLT:INH:VON 4, (@1)	

[SOURce:]VOLTage:INHibit:VON:MODE LATChing | LIVE | OFF[, (@<chanlist>)] `Load Mode only`
[SOURce:]VOLTage:INHibit:VON:MODE? [(@<chanlist>)]

The command specifies the behavior of the under-voltage inhibit function. When enabled (not OFF), the instrument will not sink current until the input voltage rises above the voltage-on setting specified by VOLTage:INHibit:VON <value>.

Mode	Description
LATChing	Allows the load to sink current even if the voltage subsequently drops below the voltage-on setting.
LIVE	Turns the input off whenever the voltage drops below the voltage-on setting. Turns the input back on when the voltage reaches the voltage-on setting.
OFF	Turns the under-voltage inhibit function off.

Parameter	Typical return
LIVE	LATChing	OFF	LIVE, LATC, or OFF
*RST OFF	
Sets the inhibit mode to latching: VOLT:INH:VON:MODE LATC, (@1)	

Remarks

– The under-voltage inhibit function will ignore any programmed on/off delays.

– The under-voltage inhibit function is not available when battery emulators are grouped.

– The under-voltage inhibit function is not available in CV operating mode.

[SOURce:]VOLTage:MODE FIXed | STEP | LIST[, (@<chanlist>)]
[SOURce:]VOLTage:MODE? [(@<chanlist>)]

The command determines what happens to the output voltage when the transient system is initiated and triggered.

The query returns the voltage mode for each channel specified. Multiple responses are separated by commas.

Mode	Description
FIXed	Nothing happens. The output voltage remains at the immediate value.
STEP	The output goes to the triggered level when a trigger occurs.
LIST	The output follows the list values when a trigger occurs.

Parameter	Typical return
FIXed	STEP	LIST	FIX, STEP, or LIST
*RST FIX	
Sets the voltage mode to Step: VOLT:MODE STEP, (@1)	

[SOURce:]VOLTage:PROTection[:LEVel][:AMPLitude] <voltage> | MINimum | MAXimum[, (@<chan-list>)] `P.Supply Mode only`
[SOURce:]VOLTage:PROTection[:LEVel]? [MINimum | MAXimum,] [(@<chanlist>)]

The command sets the level at which overvoltage protection trips, in volts.

The query returns +n.nnnnnnnnE+nn in volts.

Parameter	Typical return
minimum – maximum	MIN	MAX (The maximum value is dependent on the voltage rating of the instrument, the maximum OVP is 110% more than maximum setting voltage)	<voltage level>
*RST 33	
Sets the level at which overvoltage protection trips to 20 V: VOLT:PROT 20, (@1)	

[SOURce:]VOLTage:PROTection:STATe ON | OFF | 1 | 0[, (@<chanlist>)] `P.Supply Mode only`
[SOURce:]VOLTage:PROTection:STATe? [(@<chanlist>)]

The command enables or disables overvoltage protection, which causes the instrument to go into a protected state when the output voltage exceeds the OVP level. Output will be OFF after OVP is tripped. An overvoltage condition can be cleared with the VOLT:PROT:CLE command after the condition that caused the OVP trip is removed.

The query returns 1 (ON) or 0 (OFF) or the overvoltage protection state.

Parameter	Typical return
ON | 1 | OFF | 0	1 or 0
*RST ON	
Enables voltage protection state: VOLT:PROT:STAT ON, (@1)	

[SOURce:]VOLTage:PROTection:CLEar [(@<chanlist>)] `P.Supply Mode only`

The command clears an overvoltage protection event.

Parameter	Typical return
(none)	(none)
Clears an overvoltage protection: VOLT:PROT:CLE (@1)	

[SOURce:]VOLTage:PROTection:TRIPped? [(@<chanlist>)] `P.Supply Mode only`

The query indicates whether an overvoltage protection occurred (1) or not (0). This is reset to 0 by VOLTage:PROTection:CLEar.

Parameter	Typical return
(none)	1 or 0
Indicates whether an overvoltage protection occurred: VOLT:PROT:TRIP? (@1)	

[SOURce:]VOLTage:RANGe <voltage> | MINimum | MAXimum[, (@<chanlist>)] `Load Mode only`
[SOURce:]VOLTage:RANGe? [MINimum | MAXimum,] [(@<chanlist>)]

The command sets the voltage range. The value that you enter must be the highest value in volts that you expect to input. The instrument selects the range with the best resolution for the value entered. The following ranges are available for the instrument.

	E36731A (Load mode)
High range	from 0.02 V to 61.2 V
Low range	from 0.005 V to 15.3 V

The query returns the maximum voltage that can be input on the range that is presently set. The voltage is in the form +n.nnnnnnE+nn for each channel specified. Multiple responses are separated by commas.

Parameter	Typical return
minimum – maximum | MIN | MAX (Values are range dependent. See Programming Range)	<voltage range>
*RST MAX	
Sets the high voltage range (from 0.02 V to 61.2 V): VOLT:RANG 30, (@1)	

Remarks

– This command is coupled with [SOURce:]VOLTage. This means that if a range command places an input on a range with a lower maximum voltage than the present voltage level, an out of range error occurs. This also occurs if a voltage is programmed that is too large for the present range. Errors can be avoided by sending both level and range commands in the same SCPI message. When the range and level information is received as a set, no range/setting conflict occurs.

– If a programmed range change occurs while the input is enabled, the input will be temporarily disabled while the range switch occurs. The transition from on-to-off and then from off-to-on will also be delayed by the settings of INPut:DELay:FALL and INPut:DELay:RISE.

[SOURce:]VOLTage:SLEW[:POSitive|RISing][:IMMediate] <slew rate> | MINimum | MAXimum | INFinity [, (@<chanlist>)]
[SOURce:]VOLTage:SLEW[:POSitive|RISing][:IMMediate]? [MINimum | MAXimum,] [(@<chanlist>)]

[SOURce:]VOLTage:SLEW:NEGative|FALLing[:IMMediate] <slew rate> | MINimum | MAXimum | INFinity[, (@<chanlist>)]
[SOURce:]VOLTage:SLEW:NEGative|FALLing[:IMMediate]? [MINimum | MAXimum,] [(@<chanlist>)]

The command sets the voltage slew rate. The slew rate is set in volts per second and affects all programmed voltage changes, including those due to the output state turning on or off. The slew rate can be set to any value between the minimum value and 9.9E+37. For very large values, the slew rate will be limited by the analog performance of the output circuit. The keywords MAX or INFinity set the slew rate to maximum.

Parameter	Typical return
minimum – 9.9E+37	MIN	MAX	INFinity	<slew rate>
*RST MAX	

Sets the positive output slew rate to 5 V per second: VOLT:SLEW 5, (@1)
Sets the negative output slew rate to 5 V per second: VOLT:SLEW:NEG 5, (@1)

Remarks

- The query returns the value that was sent. If the value is less than the minimum slew rate, only the minimum value is returned. The resolution of the slew setting is also the minimum value, which can be queried using VOLTage:SLEW? MIN. The exact value varies slightly based on calibration.

- The query returns the programmed slew rate in the form +n.nnnnnnE+nn for each channel specified. Multiple responses are separated by commas. If a slew rate of 9.9E+37 is returned, it means that the maximum or fastest slew rate has been set.

[SOURce:]VOLTage:SLEW:COUPle ON | OFF | 1 | 0[, (@<chanlist>)] Load Mode only
[SOURce:]VOLTage:SLEW:COUPle? [(@<chanlist>)]

Sets the voltage slew tracking state.

Parameter	Typical return
ON	1	OFF	0	1 or 0
*RST OFF	

Enables the voltage slew tracking state: VOLT:SLEW:COUP ON, (@1)

[SOURce:]VOLTage:SLEW[:POSitive|RISing]:MAXimum ON | OFF | 1 | 0[, (@<chanlist>)]
[SOURce:]VOLTage:SLEW[:POSitive|RISing]:MAXimum? [(@<chanlist>)]

[SOURce:]VOLTage:SLEW:NEGative|FALLing:MAXimum ON | OFF | 1 | 0[, (@<chanlist>)]
[SOURce:]VOLTage:SLEW:NEGative|FALLing:MAXimum? [(@<chanlist>)]

The command enables/disables the maximum slew rate override. When enabled, the slew rate is set to its maximum value. When disabled, the slew rate is set to the immediate value set by the VOLTage:SLEW command. Use VOLTage:SLEW? MAX to query the maximum slew rate.

Parameter	Typical return
ON	OFF	1	0	0 or 1
*RST ON	
Enables the positive maximum slew rate: VOLT:SLEW:MAX ON, (@1)	
Enables the negative maximum slew rate: VOLT:SLEW:NEG:MAX ON (@1)	

Remark

  – The VOLTage:SLEW:MAX command is coupled to the VOLTage:SLEW command. If the VOLTage:SLEW command sets the slew rate to MAX or INFinity, VOLTage:SLEW:MAX is enabled. If the slew rate is set to any other value, VOLTage:SLEW:MAX is disabled.

[SOURce:]VOLTage:SENSe[:SOURce] INTernal | EXTernal[, (@<chanlist>)]
[SOURce:]VOLTage:SENSe[:SOURce]? [(@<chanlist>)]

The command sets the state of the remote sense relays.

The query returns the selected state of the remote sense relay.

Sense	Description
INTernal	Sets the remote sense relays to local sensing. The front panel remote sense terminals are internally connected to the output terminals. The 4 wire indicator is off.
EXTernal	Sets the remote sense relays to remote sensing. The front panel remote sense terminals are not internally connected to the output terminals and must be connected to the external load. The 4 wire indicator is on.

NOTE	This command specifies whether the instrument uses remote or local sensing. The query returns 0 (INT) or 1 (EXT). The Internal setting closes a relay within the instrument to short the output and sense connectors. This means that only two wires are used, and remote sensing is disabled. The External setting opens the relay in order to separate the output and remote sensing inputs. The Internal setting displays 2wire on the upper display, and the External setting shows 4wire.

Parameter	Typical return
INT	EXT	INT or EXT
*RST INT	
Sets the sense mode to external (4-wire): VOLT:SENS:SOUR EXT, (@1)	

[SOURce:]VOLTage:TLEVel <value> | MINimum | MAXimum[, (@<chanlist>)] `Load Mode only`
[SOURce:]VOLTage:TLEVel? [MINimum | MAXimum,] [(@<chanlist>)]

The command specifies the transient level of the input voltage. The transient function switches between the immediate setting and the transient level. Units are in volts.

Parameter	Typical return
minimum – maximum	MIN	MAX (Values are range dependent. See Programming Range)	<slew rate>
*RST MIN	
Sets the transient input voltage to 5 V: VOLT:TLEV 5, (@1)	

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