

Keysight EasyEXPERT Software



User's Guide
Volume 2

Notices

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Measurement Resources

The measurement resources supported by Keysight B1500 series are shown below. For reading this manual, ignore the information about the unsupported resources.

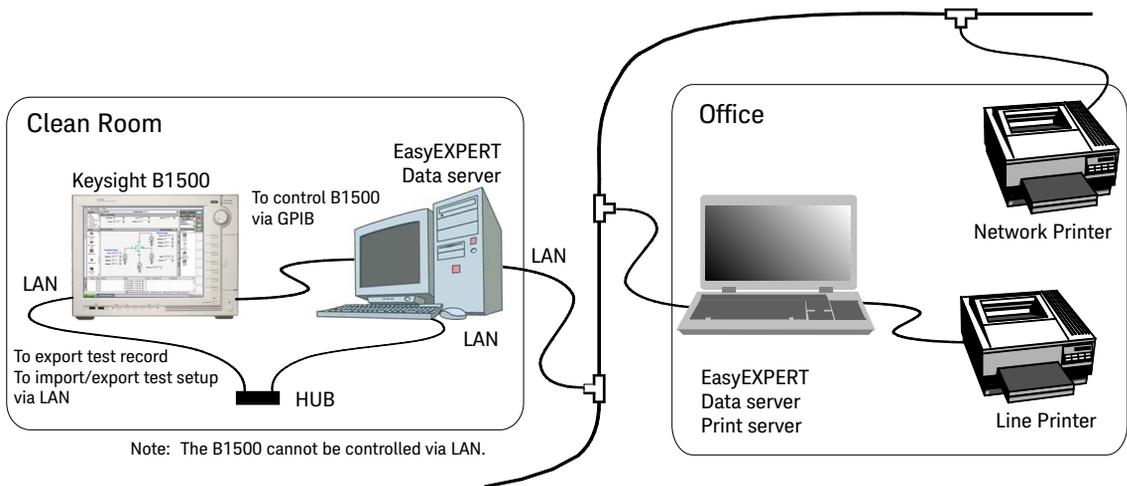
Resource	B1500A	B1505A	B1506A	B1507A
HPSMU	Yes	Yes		
MPSMU	Yes	Yes	Yes (B1511B)	Yes (B1511B)
MCSMU	Yes	Yes	Yes	
MFCMU	Yes	Yes	Yes	Yes
HRSMU	Yes			
HVSPGU	Yes			
HVSMU		Yes	Yes (B1513C)	Yes (B1513C)
HVMCU		Yes		
HCSMU		Yes	Yes for H20/H21	
UHCU		Yes	Yes for H50/H51/H70/H71	
UHVU		Yes		

- HPSMU High power source/monitor unit (B1510A)
 - MPSMU Medium power source/monitor unit (B1511A/B)
 - MCSMU Medium current source/monitor unit (B1514A)
 - MFCMU or CMU Multi frequency capacitance measurement unit (B1520A)
 - HRSMU High resolution source/monitor unit (B1517A)
 - HVSPGU or SPGU High voltage semiconductor pulse generator unit (B1525A)
 - HVSMU High voltage source/monitor unit (B1513A/B/C)
 - HVMCU High voltage medium current unit (N1266A with one B1513A/B/C and two B1514A/B1512A)
 - HCSMU High current source/monitor unit (B1512A)
 - UHCU Ultra high current unit (N1265A with two B1514A/B1512A)
 - UHVU Ultra high voltage unit (N1268A with two B1514A/B1512A)
-

EasyEXPERT Software

The EasyEXPERT software is installed in the Keysight B1500 for the measurement execution and the measurement data analysis. And you can use the EasyEXPERT for an external PC and that provides the following additional advantages to the B1500, allowing you to minimize the amount of offline tasks performed on the B1500 and increase the working ratio for measurements.

- Allows the B1500, B2900, 4155, 4156, E5260, or E5270 to be controlled from an external computer while online.
- Allows test setup to be created on an external computer while offline.
- Allows data analysis to be performed on an external computer while offline.



For the information on installation of EasyEXPERT to the external PC, see [“Using EasyEXPERT on External PC”](#) on page 7-1.

In This Manual

This manual describes the reference information of Keysight Technologies EasyEXPERT which is the system software of Keysight Technologies precision current-voltage analyzer series. This manual covers the following topics.

6. "Remote Control Interface"

Explains about the EasyEXPERT remote control interface which is a command set used to control EasyEXPERT by a program.

7. "Using EasyEXPERT on External PC"

Explains how to run EasyEXPERT on an external PC.

8. "Utilities"

Introduces the utility programs.

9. "Application Library"

Lists the furnished application tests. Also describes the maximum measurement value and accuracy for the result data measured by using the QSCV[2] application test.

10. "If You Have a Problem"

Introduces how to solve a problem you may encounter. Also describes how to perform the system recovery and the data backup/recovery.

11. "Error Message"

Lists error codes and error messages.

A. "Appendix"

Shows useful reference information for the use of the EasyEXPERT.

User's Guide Vol. 1 consists of the following chapters.

1. "Main GUI"
 2. "Classic Test Definition"
 3. "Application Test Definition"
 4. "Function Details"
 5. "Built-in Programming Tool"
-

NOTE

To get the latest firmware/software/manual/specifications/support information, go to <http://www.keysight.com/find/easyexpert>.

NOTE

The information is subject to change without notice due to the future enhancement. The actual screen image of EasyEXPERT may be different from the image shown in this manual.

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Contents

This chapter explains about the EasyEXPERT remote control interface which is a command set used to control EasyEXPERT by using a program via LAN, and consists of the following sections.

- “Introduction”
- “Notational Convention and Command Summary”
- “Common Commands”
- “BENCH Subsystem”
- “CALibration Subsystem”
- “RESult Subsystem”
- “STANDby Subsystem”
- “SYSTem Subsystem”
- “WORKspace Subsystem”
- “Error Messages”

NOTE

The following conventions are used in this chapter.

- For Windows 7/8.1/10 64 bit version
 <program folder>: <system drive>\Program Files (x86)
- For Windows XP, Vista, 7/8.1/10 32 bit version
 <program folder>: <system drive>\Program Files
 <system drive>: Drive the EasyEXPERT has been installed

NOTE**Sample programs**

Sample programs for using the EasyEXPERT remote control interface are stored in the following folder. See the program code for your reference of programming.

<program folder>\Agilent\B1500\EasyEXPERT\Samples\Remote Control

NOTE**About socket services**

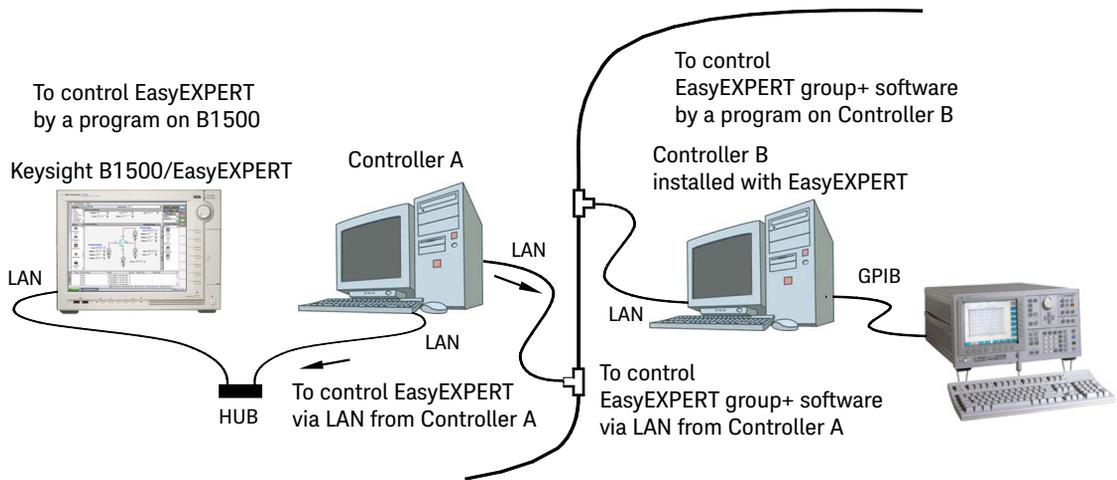
Keysight instruments are standardized on using port 5025 for socket services. A data socket on this port can be used to send and receive commands, queries, and query responses. All commands must be terminated with a newline for the message to be parsed. All query responses will also be terminated with a newline.

Introduction

The EasyEXPERT remote control interface is a software interface usable from the VISA/SICL library. And it is used for the following applications as examples via LAN using the socket service. See [Figure 6-1](#).

- To control EasyEXPERT by using a program which runs on an external computer (Controller A)
- To control EasyEXPERT by using a program which runs on the B1500
- To control EasyEXPERT which runs on a computer (Controller B) by using a program on Controller A
- To control EasyEXPERT on Controller B by using a program on Controller B

Figure 6-1 Image of EasyEXPERT Remote Control



Supported Operations

The EasyEXPERT remote control interface provides the subsystem commands listed below. Operations supported by these commands are shown in [Figure 6-2](#).

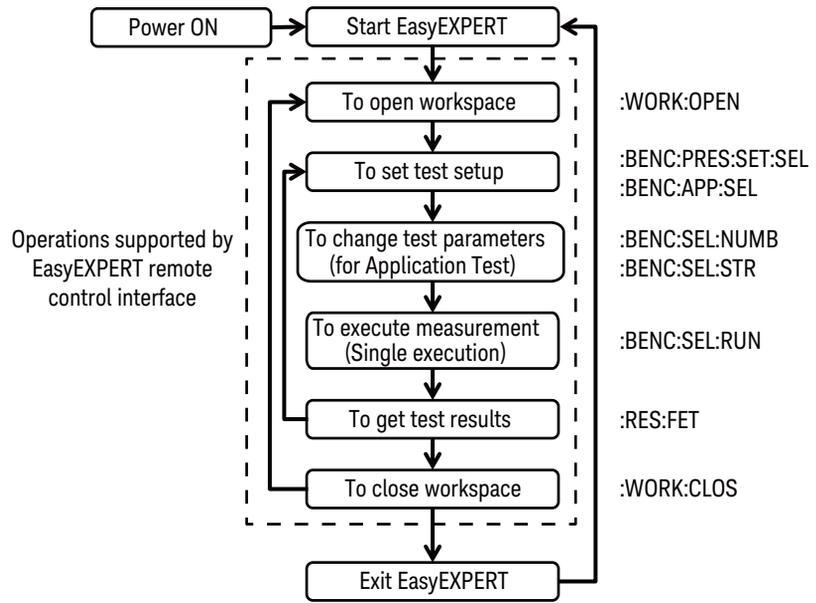
- **WORKspace Subsystem**
Opening/closing workspace
- **BENCH Subsystem**
Performing test setup and measurement
- **RESult Subsystem**
Getting test result data
- **CALibration Subsystem**
Using offset current cancel function
- **STANdby Subsystem**
Using standby function
- **SYSTEM Subsystem**
Checking errors

NOTE

To start remote control, the workspace selection screen must be displayed by EasyEXPERT.

Figure 6-2

Operations Supported by EasyEXPERT Remote Control Interface



Preparation for Communication

Communication between a computer and EasyEXPERT can be made as follows.

- Confirm the firewall of Windows for the communication between the computer and EasyEXPERT is set appropriately. See “[Checking Windows Firewall Setting](#)”.
- Prepare a computer installed with VISA/SICL library. They are included in Keysight IO Libraries Suite.
- Connect the computer to a LAN. And connect the B1500, or the computer installed with EasyEXPERT, to the same LAN. See [Figure 6-1](#) for example.
- Make a communication between the computer and EasyEXPERT using the socket service. Only one EasyEXPERT can be connected.

If you use Keysight IO Libraries Suite, launch the Connection Expert software and click the Add Instrument button to find and connect EasyEXPERT.

Checking Windows Firewall Setting

Click [Control Panel] > [System and Security] > [Allow a program through Windows Firewall]. Allowed programs are listed on the screen. Make sure that the EasyEXPERT is allowed.

If the list does not have the EasyEXPERT, allow it as follows:

1. As the administrator privileges, click the Change settings button.
2. Click the Allow another program... button.
A dialog box opens.
3. Click the Browse... button, and specify the path of the EasyEXPERT execution file.
The EasyEXPERT is added to the program list in the dialog box.
4. Click EasyEXPERT in the program list, and then click the Add button.
The EasyEXPERT is added to the list of the “Allowed programs and features”.
5. Click the check box of the EasyEXPERT with setting the properties, and then click the OK button.

Notational Convention and Command Summary

Table 6-1

Notational Convention

Notation	Description
Capital letters	Capital letters are the minimally required letters of the command or query program header. Lowercase letters are the long form (complete spelling), which you can omit if desired.
Vertical bar	Vertical bars separate alternative parameters. For example, ON OFF indicates that either “ON” or “OFF” can be used as a parameter.
Square brackets []	Items within square brackets are optional. The representation [:BENCh]:APPLication:SELEct means that :BENCh may be omitted.
NR1	Digits with an implied decimal point assumed at the right of the least-significant digit. Example: 273
NR2	Digits with an explicit decimal point. Example: 27.3
NR3	Digits with an explicit decimal point and an exponent. Example: 2.73E+02
NRf	Extended format that includes NR1, NR2, and NR3. Examples: 273, 27.3, 2.73E+02
Bool	Boolean data. Can be numeric (0, 1), or named (OFF, ON).
SPD	String program data. Programs string parameters enclosed in single or double quotes.
CPD	Character program data. Programs discrete parameters. Accepts both short form and long form.
SRD	String Query response data. Returns string parameters enclosed in single or double quotes.

Remote Control Interface
 Notational Convention and Command Summary

Notation	Description
CRD	Character Query response data. Returns discrete parameters. Only the short form of the parameter is returned.
AARD	Arbitrary ASCII Query response data. Permits the return of un-delimited 7-bit ASCII. This data type has an implied message terminator.
Block	Definite length arbitrary binary data

Table 6-2 Subsystem Command Summary

Command	Summary
WORKspace subsystem	
:WORKspace:CATalog?	Returns catalog of your own workspace and the Public workspace.
:WORKspace:CLOSe	Closes the workspace now opened.
:WORKspace:OPEN " <i>name</i> "	Opens the specified workspace. <i>name</i> =Workspace name
:WORKspace[:SElected]:NAME?	Returns the name of the workspace now opened.
:WORKspace:STATe?	Returns the status of the workspace.
BENCH subsystem	
[:BENCH]:APPLication:CATalog?	Returns catalog of the application test definitions.
[:BENCH]:APPLication:SElect " <i>name</i> "	Opens the specified application test definition. <i>name</i> =Name of an application test definition
[:BENCH]:COUNT <i>count</i> [:BENCH]:COUNT?	Sets or returns the value of the Count field. <i>count</i> =Value of the Count field
[:BENCH]:COUNT:RESet	Clears the value of the Count field.
[:BENCH]:LOAD[:SETup] <i>setup</i>	Loads and sets the test setup information included in the XTS or XTR data. <i>setup</i> =Test setup information, Block data

Command	Summary
<code>[:BENCh] :PRESet :CATalog?</code>	Returns catalog of the preset group (My Favorite).
<code>[:BENCh] :PRESet :OPEN "name"</code>	Opens the specified preset group (My Favorites). <i>name</i> =Preset group name
<code>[:BENCh] :PRESet [SElected] :NAME?</code>	Returns the name of the preset group (My Favorites) now opened.
<code>[:BENCh] :PRESet :SETup :CATalog?</code>	Returns catalog of the test setup included in the preset group (My Favorites) now opened.
<code>[:BENCh] :PRESet :SETup :SElect "name"</code>	Opens the specified test setup included in the preset group (My Favorites) now opened. <i>name</i> =Test setup name
<code>[:BENCh] [:SElected] :ABORt</code>	Aborts the single measurement now in progress.
<code>[:BENCh] [:SElected] :NAME "name"</code> <code>[:BENCh] [:SElected] :NAME?</code>	Sets or returns the value of the Setup Name field of the test setup now opened. <i>name</i> =Value of the Setup Name field
<code>[:BENCh] [:SElected] :NUMBer "name", value</code> <code>[:BENCh] [:SElected] :NUMBer? "name"</code>	Sets or returns the value of the specified numeric parameter defined in the application test now opened. <i>name</i> =Parameter name <i>value</i> =Value of the parameter
<code>[:BENCh] [:SElected] :RUN [:SINGle]</code>	Starts the single measurement of the test now opened.
<code>[:BENCh] [:SElected] :STRing "name", "value"</code> <code>[:BENCh] [:SElected] :STRing? "name"</code>	Sets or returns the value of the specified string parameter defined in the application test now opened. <i>name</i> =Parameter name <i>value</i> =Value of the parameter
<code>[:BENCh] :TAG "deviceid"</code> <code>[:BENCh] :TAG?</code>	Sets or returns the value of the Device ID field. <i>deviceid</i> =Value of the Device ID field
RESult subsystem	
<code>:RESult :FETch [:LATest]?</code>	Returns the latest test result data.

Remote Control Interface
Notational Convention and Command Summary

Command	Summary
:RESult:FETch[:LATest]:SIBLings?	Returns the latest test result data. For the application test result, this command returns the result data for all included tests.
:RESult:FORMat <i>mode</i> :RESult:FORMat?	Sets or returns the output format of the test result data. <i>mode</i> =TEXT XTR
:RESult:FORMat:ESCAPE <i>mode</i> :RESult:FORMat:ESCAPE?	Sets or returns the newline character type used in the test result data. <i>mode</i> =0 OFF 1 ON
:RESult:RECYcle:ALL	Adds all test result data to the Delete group.
:RESult:RECYcle[:LATest]	Adds the latest test result data to the Delete group.
STANDBY subsystem	
:STANDBY:STATe <i>mode</i> :STANDBY:STATe?	Sets or returns the SMU standby function ON/OFF status. <i>mode</i> =0 OFF 1 ON
SYSTEM subsystem	
:SYSTem:ERRor[:NEXT]?	Returns the top code and message in the error queue.
CALIBRATION subsystem	
:CALibration[:SMU]:ZERO:FULLrange "module", <i>mode</i> :CALibration[:SMU]:ZERO:FULLrange? "module"	Sets or returns the full range measurement ON/OFF status for the specified SMU+ASU. <i>module</i> =Identifier of the SMU <i>mode</i> =0 OFF 1 ON
:CALibration[:SMU]:ZERO:MEASure[:CURRent] :CALibration[:SMU]:ZERO:MEASure[:CURRent]? "module"	Starts the offset current measurement for the SMU set to the offset current cancel function ON. Or returns the offset current measurement data of the specified SMU. <i>module</i> =Identifier of the SMU
:CALibration[:SMU]:ZERO:OFF:ALL	Sets the all SMU to the offset current cancel function OFF.

Command	Summary
<pre>:CALibration[:SMU]:ZERO[:ON] "module1" [, "module2" [, ... "module"]] :CALibration[:SMU]:ZERO[:ON] ?</pre>	<p>Sets the specified SMU to the offset current cancel function ON. Or returns the identifier of the SMU set to the offset current cancel function ON.</p> <p><i>module</i>=Identifier of the SMU to be set to the offset current cancel function ON</p>
<pre>:CALibration[:SMU]:ZERO[:ON]:ALL</pre>	<p>Sets the all SMU to the offset current cancel function ON.</p>
<pre>:CALibration[:SMU]:ZERO:PLC "module", <i>plc</i> :CALibration[:SMU]:ZERO:PLC? "module"</pre>	<p>Sets or returns the integration time used for the offset current measurement of the specified SMU.</p> <p><i>module</i>=Identifier of the SMU <i>plc</i>=1 2 5 10 16 25 50 100</p>
<pre>:CALibration[:SMU]:ZERO:STATe?</pre>	<p>Returns the present status of the offset current cancel function ON/OFF.</p>

Common Commands

Describes common commands provided by the EasyEXPERT remote control interface.

*CLS

Clears the error queue.

Syntax

*CLS

*IDN?

Returns the EasyEXPERT identification string which contains four comma-separated fields.

Syntax

*IDN?

Query response

Agilent Technologies,Agilent EasyEXPERT,*hostname*,*revision* <newline>

hostname Host name of the computer which EasyEXPERT is running

revision EasyEXPERT revision number

Data type is AARD.

*OPC?

Starts to monitor run state of the commands sent before this command, and returns 1 if the instrument completes all pending operations.

Other commands cannot be executed until 1 is returned.

Syntax

*OPC?

Query response

1 <newline>

Data type is NR1.

BENCH Subsystem

Describes BENCH subsystem commands used for test setup and measurement.

[:BENCH]:APPLICATION:CATalog?

Returns catalog of the application test definitions. Returns all application test definitions regardless of the Category selection.

Syntax	<code>[:BENCH]:APPLICATION:CATalog?</code>
Query response	<code>"app def1"["app def2"[, ... "app def"]]<newline></code> Data type is SRD.
Example	<code>:APP:CAT?</code>

[:BENCH]:APPLICATION:SELEct

Opens the specified application test definition.

Syntax	<code>[:BENCH]:APPLICATION:SELEct "name"</code>
Parameter	<i>name</i> Name of an application test definition. Data type is SPD.
Example	<code>:APP:SEL "Bvcbo"</code>

[:BENCH]:COUNT

Sets or returns the value of the Count field.

Syntax	<code>[:BENCH]:COUNT <i>count</i></code> <code>[:BENCH]:COUNT?</code>
Parameter	<i>count</i> Value of the Count field. Data type is NR1.
Query response	<code><i>count</i><newline></code> Data type is NR1.

Remote Control Interface
BENCH Subsystem

Example :COUN 100
:COUN?

[[:BENCH]:COUNT:RESet

Clears the value of the Count field.

Syntax [[:BENCH]:COUNT:RESet

Example :COUN:RES

[[:BENCH]:LOAD[:SETup]

Loads and sets the test setup information included in the XTS or XTR data. If the XTR data contains multiple setup information, only the first setup information is loaded.

Syntax [[:BENCH]:LOAD[:SETup] *setup*

Parameter *setup* Test setup information. Data type is Block.

Example :LOAD #32229876543210 ... 987654321098<newline>
In this example, #3222 is followed by 222-byte length binary data.

[[:BENCH]:PRESet:CATalog?

Returns catalog of the preset group (My Favorite).

Syntax [[:BENCH]:PRESet:CATalog?

Query response "*preset1*"[, "*preset2*"[, ... "*preset*"]]<newline>
Data type is SRD.

Example :PRES:CAT?

[[:BENCH]:PRESet:OPEN

Opens the specified preset group (My Favorites).

Syntax [[:BENCH]:PRESet:OPEN "*name*"

Parameter *name* Preset group name. Data type is SPD.

Example :PRES:OPEN "BJT Tests"

[:BENCH]:PRESet[:SElected]:NAME?

Returns the name of the preset group (My Favorites) now opened.

Syntax [:BENCH]:PRESet[:SElected]:NAME?

Query response "*name*"<newline>

Data type is SRD.

Example :PRES:NAME?

[:BENCH]:PRESet:SETup:CATalog?

Returns catalog of the test setup included in the preset group (My Favorites) now opened.

Syntax [:BENCH]:PRESet:SETup:CATalog?

Query response "*setup1*"[, "*setup2*"[, ... "*setup*"]]<newline>

Data type is SRD.

Example :PRES:SET:CAT?

[:BENCH]:PRESet:SETup:SElect

Opens the specified test setup included in the preset group (My Favorites) now opened.

Syntax [:BENCH]:PRESet:SETup:SElect "*name*"

Parameter *name* Test setup name. Data type is SPD.

Example :PRES:SET:SEL "BC Diode Fwd"

[[:BENCH]][:SElected]:ABORt

Aborts the single measurement now in progress.

Syntax [:BENCH][:SElected]:ABORt

Example :ABOR

[[:BENCH]][:SElected]:NAME

Sets or returns the value of the Setup Name field of the test setup now opened.

Syntax [:BENCH][:SElected]:NAME "*name*"

[:BENCH][:SElected]:NAME?

Parameter *name* Value of the Setup Name field. Data type is SPD.

Query response "*name*"<newline>

Data type is SRD.

Example :NAME "BC Diode Fwd (Device A)"

:NAME?

[[:BENCH]][:SElected]:NUMBER

Sets or returns the value of the specified numeric parameter defined in the application test now opened.

Syntax [:BENCH][:SElected]:NUMBER "*param_name*", *nvalue*

[:BENCH][:SElected]:NUMBER? "*param_name*"

Parameter *param_name* Parameter name. Data type is SPD.

nvalue Value of the parameter. Data type is Nrf.

Query response *nvalue*<newline>

Data type is Nrf.

Example :NUMB "VcStep", 0.1

:NUMB? "VcStep"

[:BENCH][:SElected]:RUN[:SINGLE]

Starts the single measurement of the test now opened. Use the *OPC? command to confirm the completion of the single measurement.

Syntax [:BENCH][:SElected]:RUN[:SINGLE]

Example :RUN

[:BENCH][:SElected]:STRing

Sets or returns the value of the specified string parameter defined in the application test now opened.

Syntax [:BENCH][:SElected]:STRing "*param_name*", "*svalue*"

[:BENCH][:SElected]:STRing? "*param_name*"

Parameter *param_name* Parameter name. Data type is SPD.
svalue Value of the parameter. Data type is SPD.

Query response "*svalue*"<newline>
Data type is SRD.

Example :STR "Base", "SMU1:HP"
:STR? "Base"

[:BENCH]:TAG

Sets or returns the value of the Device ID field.

Syntax

`[:BENCH]:TAG "deviceid"`

`[:BENCH]:TAG?`

Parameter

deviceid Value of the Device ID field. Data type is SPD.

Query response

`"deviceid"<newline>`

Data type is SRD.

Example

`:TAG "Device A"`

`:TAG?`

CALibration Subsystem

Describes CALibration subsystem commands used for the offset current cancel function.

:CALibration[:SMU]:ZERO:FULLrange

Sets or returns the full range measurement ON/OFF status for the specified SMU+ASU.

Syntax :CALibration[:SMU]:ZERO:FULLrange "*module*", *mode*
:CALibration[:SMU]:ZERO:FULLrange? "*module*"

Parameter

<i>module</i>	Identifier of the SMU. Data type is SPD.
<i>mode</i>	Full range measurement ON or OFF, 0 OFF 1 ON. Data type is Bool. 0 OFF: Full range measurement OFF 1 ON: Full range measurement ON

Query response *mode*<newline>
0 (OFF) or 1 (ON) is returned. Data type is Bool.

Example :CAL:ZERO:FULL "SMU4:HR/AS", 1
:CAL:ZERO:FULL? "SMU4:HR/AS"

:CALibration[:SMU]:ZERO:MEASure[:CURRent]

Starts the offset current measurement for the SMU set to the offset current cancel function ON. Or returns the offset current measurement data of the specified SMU. Use the *OPC? command to confirm the completion of the measurement.

Syntax :CALibration[:SMU]:ZERO:MEASure[:CURRent]
:CALibration[:SMU]:ZERO:MEASure[:CURRent]? "*module*"

Parameter *module* Identifier of the SMU. Data type is SPD.

Query response *current1[,current2[,current3[,current4]]]<newline>*
Data type is NRf.
current1: Offset current measurement data for the 1 nA range
current2: Offset current measurement data for the 100 pA range
current3: Offset current measurement data for the 10 pA range
current4: Offset current measurement data for the 1 pA range

Example :CAL:ZERO:MEAS
 :CAL:ZERO:MEAS? "SMU4:HR/AS"

:CALibration[:SMU]:ZERO:OFF:ALL

Sets the all SMU to the offset current cancel function OFF.

Syntax :CALibration[:SMU]:ZERO:OFF:ALL

Example :CAL:ZERO:OFF:ALL

:CALibration[:SMU]:ZERO[:ON]

Sets the specified SMU to the offset current cancel function ON. Or returns the identifier of the SMU set to the offset current cancel function ON.

Syntax :CALibration[:SMU]:ZERO[:ON] "*module1*"[, "*module2*"[, ... "*module*"]]
 :CALibration[:SMU]:ZERO[:ON]?

Parameter *module* Identifier of the SMU to be set to the offset current cancel function ON. Data type is SPD.

Query response "*module1*"[, "*module2*"[, ... "*module*"]]<newline>
Identifier of the SMU set to the offset current cancel function ON. Data type is SRD.

Example :CAL:ZERO "SMU1:HP", "SMU2:MP", "SMU3:MP"
 :CAL:ZERO?

:CALibration[:SMU]:ZERO[:ON]:ALL

Sets the all SMU to the offset current cancel function ON.

Syntax :CALibration[:SMU]:ZERO[:ON]:ALL

Example :CAL:ZERO:ALL

:CALibration[:SMU]:ZERO:PLC

Sets or returns the integration time used for the offset current measurement of the specified SMU.

Syntax :CALibration[:SMU]:ZERO:PLC "*module*", *plc*

:CALibration[:SMU]:ZERO:PLC? "*module*"

Parameter *module* Identifier of the SMU. Data type is SPD.

plc Integration time, 1|2|5|10|16|25|50|100. This is the number of power line cycles (PLC). If the invalid value is specified, the maximum allowable value less than the specified value is set automatically. Data type is NR1

Query response *plc*<newline>

Data type is NR1.

Example :CAL:ZERO:PLC "SMU4:HR/AS", 25

:CAL:ZERO:PLC? "SMU4:HR/AS"

:CALibration[:SMU]:ZERO:STATe?

Returns the present status of the offset current cancel function ON/OFF.

Syntax :CALibration[:SMU]:ZERO:STATe?

Query response *mode*<newline>

0 (OFF) or 1 (ON) is returned. Data type is Bool.

Example :CAL:ZERO:STAT?

RESult Subsystem

Describes RESult subsystem commands used for getting/deleting the test result data, and so on.

:RESult:FETch[:LATest]?

Returns the latest test result data.

Syntax :RESult:FETch[:LATest]?

Query response *data*<newline>

Data type is Block.

Example: #32569876543210 ... 987654<newline>

In this example, #3256 is followed by 256-byte length binary data.

Example :RES:FET?

:RESult:FETch[:LATest]:SIBLings?

Returns the latest test result data. For the application test result, this command returns the result data for all included tests.

Syntax :RESult:FETch[:LATest]:SIBLings?

Query response *data*<newline>

Data type is Block.

Example: #39639876543210 ... 9876543210987<newline>

In this example, #3963 is followed by 963-byte length binary data.

Example :RES:FET:SIBL?

:RESult:FORMat

Sets or returns the output format of the test result data.

Syntax

:RESult:FORMat *mode*

:RESult:FORMat?

Parameter

mode Output format, TEXT|XTR. Data type is CPD.
TEXT: Text format, initial setting
XTR: EasyEXPERT test result data format

Query response

mode<newline>

TEXT or XTR is returned. Data type is CRD.

Example

:RES:FORM XTR

:RES:FORM?

:RESult:FORMat:ESCAPE

Sets or returns the newline character type used in the test result data.

Syntax

:RESult:FORMat:ESCAPE *mode*

:RESult:FORMat:ESCAPE?

Parameter

mode Type, 0|OFF|1|ON. Data type is Bool.
0 | OFF: ASCII code 0x0D (CR) and 0x0A (LF), initial setting
1 | ON: \r (CR) and \n (LF)

Query response

mode<newline>

0 (OFF) or 1 (ON) is returned. Data type is Bool.

Example

:RES:FORM:ESC ON

:RES:FORM:ESC?

Remote Control Interface
RESult Subsystem

:RESult:RECYcle:ALL

Adds all test result data to the Delete group.

Syntax :RESult:RECYcle:ALL

Example :RES:REC:ALL

:RESult:RECYcle[:LATest]

Adds the latest test result data to the Delete group. For the application test result, the result data for all included tests is subject.

Syntax :RESult:RECYcle[:LATest]

Example :RES:REC

STANDBy Subsystem

Describes STANDBy subsystem command used for the standby function.

:STANDBy:STATe

Sets or returns the SMU standby function ON/OFF status.

Syntax

:STANDBy:STATe *mode*

:STANDBy:STATe?

Parameter

mode Standby function ON or OFF, 0|OFF|1|ON. Data type is Bool.
0 | OFF: Standby function OFF
1 | ON: Standby function ON

Query response

mode<newline>

0 (OFF) or 1 (ON) is returned. Data type is Bool.

Example

:STANDBy:STAT ON

:STANDBy:STAT?

SYSTEM Subsystem

Describes SYSTEM subsystem command provided by the EasyEXPERT remote control interface.

:SYSTEM:ERROR[:NEXT]?

Reads and removes the top item in the error queue, and returns the top code and message.

Syntax :SYSTEM:ERROR[:NEXT]?

Query response *response*<newline>

response: code,"message"

code: Error code. Data type is NR1.

message: Error message. Data type is SRD.

Multiple responses are listed in the FIFO (first-in-first-out) order, separated by a comma.

If the queue is empty, the response is +0,"No error".

Example :SYST:ERR?

WORKspace Subsystem

Describes WORKspace subsystem commands used for opening/closing workspace, and so on.

:WORKspace:CATalog?

Returns catalog of your own workspace and the Public workspace.

Syntax :WORKspace:CATalog?

Query response "*workspace1*"[, "*workspace2*"[, ... "*workspace*"]]<newline>

Data type is SRD.

Example :WORK:CAT?

:WORKspace:CLOSe

Closes the workspace now opened. Use the *OPC? command to confirm the completion of close operation.

Syntax :WORKspace:CLOSe

Example :WORK:CLOS

:WORKspace:OPeN

Opens the specified workspace. Use the *OPC? command to confirm the completion of open operation.

Syntax :WORKspace:OPeN "*name*"

Parameter *name* Workspace name. Data type is SPD.

Example :WORK:OPeN "my workspace1"

:WORKspace[:SElected]:NAME?

Returns the name of the workspace now opened.

Syntax :WORKspace[:SElected]:NAME?

Query response "*name*"<newline>

Data type is SRD.

Example :WORK:NAME?

:WORKspace:STATe?

Returns the status of the workspace.

Syntax :WORKspace:STATe?

Query response *status*<newline>

OPEN or CLOS is returned. Data type is CRD.

OPEN: Workspace is now opened.

CLOS: Workspace is now closed. Or open/close operation is in progress.

Example :WORK:STAT?

Error Messages

- 0** No Error
- 101** EasyEXPERT Error; Message ID: *code* / *message*
Error occurs in EasyEXPERT remote operation. *code* and *message* are as follows.
- *code*: Error code sent by EasyEXPERT
 - *message*: Error message sent by EasyEXPERT
- See **“Keysight EasyEXPERT Operation Error”** on page 11-3.
- 201** Remote Control Error; *message*
Error occurs in EasyEXPERT remote control library. *message* is as follows.
- Application Test definition does not exist; name: *A*
 - Exporting as Text Format failed.
Could not convert the test result data to the text format.
 - Expression is not a resource; expression: *A*
 - Expression is not numeric; expression: *A*
 - Parameter is not numeric; Parameter: *A*
 - Preset Group does not exist; Preset Group: *A*
 - Parameter does not exist; parameter name: *A*
 - Test is being executed.
Measurement is now in progress.
 - Test Setup does not exist in My Favorite; Test setup name: *A*
Test setup *A* is not found in the preset group (My Favorite) now opened.
 - There is no test result.
 - SMU is not found; name: *A*
 - Smu Zero Cancel function is not supported.
Offset current cancel function is not supported.

Remote Control Interface Error Messages

- Working setup is empty.
Test setup has not been selected.
- Working test setup is not an Application Test.
This test setup is not application test setup.
- Workspace does not exist; workspace name: *A*
- Workspace is already open. Close before opening workspace.
- Workspace is not ready.
- There is no workspace.

This chapter explains how to run EasyEXPERT on an external PC.

- [System Requirements](#)
- [To Install EasyEXPERT in External PC](#)
- [Before Starting EasyEXPERT](#)
- [To Start EasyEXPERT on Your PC](#)
- [To Change Execution Mode and GPIB Settings](#)
- [Using 4155B/4156B/4155C/4156C](#)
- [Using E5260A/E5262A/E5263A/E5270B](#)
- [Using B2900](#)

NOTE**About privilege to use EasyEXPERT**

The revision 3.2 or later does not require the administrator privilege. However, if the software is updated from a previous revision to the revision 3.2 or later, it still requires the administrator privilege.

System Requirements

Table 7-1 shows the minimum requirements to run the EasyEXPERT software. They are effective as of March 2019. For the latest information, go to www.keysight.com/find/easyexpert.

Table 7-1 System Requirements

Operating system and service pack	Microsoft Windows Vista Business SP2 or later (32 bit)	Microsoft Windows 7 Professional SP1 or later (32 bit/64 bit)	Microsoft Windows 8.1 Professional or later (32 bit/64 bit)	Microsoft Windows 10 Pro or later (32bit/64bit)
Processor	Vista certified PC	Windows 7 certified PC	Windows 8.1 certified PC	Windows 10 certified PC
Language	English (US)			
Memory	2 GB			
Display	XGA 1024×768 (SXGA 1280×1024 recommended)			
Storage	1 GB free space on the C drive, 30 GB free space on a drive for test setup/result data storage is recommended.			
.NET Framework	Microsoft .NET Framework 3.5 SP1			
IO Libraries	Keysight IO Libraries Suite 16.2, 16.3, 17.1 update 1 or later (for the Online execution mode)		Keysight IO Libraries Suite 17.1 update 1 or later (for the Online execution mode)	

Recommended GPIB Interface

For the GPIB connection of the instrument, use an GPIB interface, Keysight 82350B/C (for PCI bus), Keysight 82351A/B (for PCIe bus), Keysight 82357A/B (USB/GPIB), or National Instrument GPIB-USB-HS. See [Table 7-2](#).

Table 7-2 Recommended GPIB Interface

		Interface	B1500A	E5270B E5260A E5262A E5263A	B2901A/B B2902A/B B2901BL B2911A/B B2912A/B B2910BL	4155B/C 4156B/C
Keysight	82350B/C	PCI	YES ^a	YES	YES	YES
	82351A/B	PCIe	YES ^a	YES	YES	YES
	82357A/B	USB	YES ^b	YES	YES ^{b, c}	YES
National Instruments	GPIB-USB-HS	USB	YES ^b	YES	YES ^{b, c}	

- a. A PCI or PCIe card is highly recommended because of stability and speed.
- b. USB GPIB interfaces might cause serial poll error intermittently due to the intrinsic communication scheme differences. It is reported that using an even GPIB address sometimes significantly decreases the chance of the error. The NI GPIB-USB-HS is recommended for stability, and the Keysight 82357A/B is recommended for speed.
- c. EasyEXPERT software prohibits to set the odd GPIB address to prevent the issue above. If using an odd GPIB address for Keysight 82357A/B, the address is detected and an error occurs when starting up. For NI GPIB-USB-HS, note that an odd address is not checked when starting up.

.NET Framework

As shown in [Table 7-1](#), the Microsoft .NET 3.5 Framework SP1 is required for the EasyEXPERT software.

Before installing the EasyEXPERT software, make sure that the Microsoft .NET Framework is installed and activated. On Windows 8.1 or later, it is not installed as default. Follow the procedure below if it is not installed.

- Installation through Internet:
 1. Click [Control Panel] > [Programs] > [Turn Windows features on or off].
 2. Check the “.Net 3.5 framework” box, and then click “OK”.
 3. Reboot the PC.
- Installation by using the Microsoft Windows DVD:
 1. Insert the media to the DVD drive.
 2. Go to the below folder:
E:\sources\sxs (in the case DVD drive is set to “E” drive)
 3. As the administrator, open the “Command Prompt” window.
 4. From the “Command Prompt” window, type in the following command and press the **Enter** key.

```
Dism.exe /online /enable-feature /featurename:NetFX3 /All  
/Source:E:\sources\sxs /LimitAccess
```

IO Library

As shown in [Table 7-1](#), the Keysight IO Libraries Suite is required for the EasyEXPERT software. You can download a proper version of the IO Libraries Suite from the Keysight website (<http://www.keysight.com>).

To Install EasyEXPERT in External PC

- Prepare the EasyEXPERT software installation package.
- Prepare a computer which satisfies the system requirements shown in [Table 7-1](#). For the accurate information for each revision, see README file included in the installation package.
- If you install the EasyEXPERT revision 5.5 or later, prepare the license file for EasyEXPERT.

If you do not have the license file, prepare the Software Entitlement Certificate sheet provided with the option SWS. And get the license file as described in this sheet.

- Install the EasyEXPERT software in your external PC by following the procedure described in the README file.

NOTE

To set the same module configuration as B1500

The module configuration of the B1500 can be set to the EasyEXPERT in the offline mode. Copy the following file on the B1500 internal solid state drive (SSD) to the <user configuration folder> on the PC which the EasyEXPERT runs.

For B1500A: <offline configuration folder>\UnitConfigB1500A.xml

For B1505A: <offline configuration folder>\UnitConfigB1505A.xml

Before Starting EasyEXPERT

Note the following when you use EasyEXPERT on your PC.

- When using the Offline mode, use the data import/export function to transfer your test setup data files and test result records.
- When using the Online mode, do not send a control command to the instrument (B1500A, B1505A or other supported model) by using a programming environment except for EasyEXPERT.
- Do not send a control command to the analyzer by using the GPIB IO statement in the application test definitions.
- To control the B1500 from the external PC, exit EasyEXPERT on the B1500. The Start EasyEXPERT window (button) must be displayed or be minimized to the Windows task bar on the B1500 screen.

To Start EasyEXPERT on Your PC

To launch EasyEXPERT on your PC, follow the procedure below.

1. Click Start > All Programs > Keysight EasyEXPERT > EasyEXPERT.
2. If the Execution Mode dialog box is not opened, click Option > Execution Mode on the Start EasyEXPERT window.
3. On the Execution Mode dialog box, select the execution mode, Online or Offline. If you select the Online mode, set the GPIB configuration. See *EasyEXPERT User's Guide Vol.1* for more detail on the Execution Mode dialog box.
4. Click the OK button on the Execution Mode dialog box.
5. Click the Start EasyEXPERT button to launch EasyEXPERT.

To Change Execution Mode and GPIB Settings

To change the EasyEXPERT execution mode or the GPIB configuration, follow the procedure below.

1. Launch Start EasyEXPERT.

If the Execution Mode dialog box is not opened, click Option > Execution Mode on the Start EasyEXPERT window.

If EasyEXPERT is running, exit it. And click Option > Execution Mode on the Start EasyEXPERT window.

2. Select the execution mode, Online or Offline.

If you select the Online mode, set the GPIB configuration. See *EasyEXPERT User's Guide Vol.1* for more detail on the Execution Mode dialog box.

3. Click the OK button to set the changes.

Click the Cancel button to cancel the setup changes.

Using 4155B/4156B/4155C/4156C

This section describes the notices for controlling the 4155/4156.

4155/4156 Firmware Revision

4155/4156 firmware revision supported by the EasyEXPERT

- HOSTC: 03.08 or later
- SMUC: 04.08 or later

4155/4156 Functions

4155/4156 functions unsupported by the EasyEXPERT

- Log sampling measurement and Thinned out sampling measurement
- Functions using R Box
- Differential voltage measurement using VMU (Voltage Monitor Unit)
- DC bias output using PGU (Pulse Generator Unit)
- Other functions unavailable for the B1500

EasyEXPERT

Classic tests available for 4155/4156

- I/V Sweep, I/V-t Sampling, and Switching Matrix Control for 4155C/4156C
- I/V Sweep and Switching Matrix Control for 4155B/4156B

EasyEXPERT functions unavailable for 4155/4156

- Tracer Test
- Functions using SMU Series Resistor
- Functions using ASU (Atto Sense Unit)
- Functions using SCUU (SMU CMU Unify Unit)
- Functions using CMU (Capacitance Measurement Unit)
- Functions using SPGU (Semiconductor Pulse Generator Unit)

PGU can be used instead of SPGU for the I/V Sweep and I/V-t Sampling classic tests. The Load Z function and the ALWG output are not supported. The Output Impedance dialog box is available to set the output impedance of the PGU.

- Functions using WGF MU (Waveform Generator/Fast Measurement Unit) and RSU (Remote-sense and Switch Unit)

Calibration	Differences on Calibration window <ul style="list-style-type: none">• Calibration window provides Module Self Calibration screen only.• Module Self Calibration screen provides Enable Auto Calibration only.
Configuration, Main Frame	Differences on Configuration window Main Frame screen <ul style="list-style-type: none">• Line Frequency just displays the setting of 4155/4156.• Firmware Rev. displays as follows. [HOSTC Rev.]:[SMUC Rev.]:[ADC Rev.]• Main Frame Diagnosis is not supplied.
Configuration, Module	Differences on Configuration window Module screen <ul style="list-style-type: none">• Self-test cannot be performed.• Status, SCUU, and Notes columns are not supplied.• Start Self Test and Recover Module buttons are not supplied.• Accessory Configuration is not supplied.
I/V Sweep	Differences on I/V Sweep Classic Test <ul style="list-style-type: none">• Time Stamp Name field is not supplied for 4155B/4156B.• Number of sweep steps must be 1 to 1001 for VAR1.• SMU Pulse Period and Width value must satisfy $\text{Period} \geq \text{Width} + 4 \text{ ms}$.
I/V-t Sampling	Differences on I/V-t Sampling Classic Test <ul style="list-style-type: none">• Log sampling is not supported.• Sampling interval must be 60 μs to 65.535 s.• Number of samples must be 1 to 10001.• Base hold time must be 0 sec.
ADC and Integration Time	Differences on A/D Converter & Integration Time Setup <ul style="list-style-type: none">• ADC always shows HR ADC.• High Resolution ADC is set as shown in Table 7-3. Integration Time is ignored for the sampling measurement of $\text{Interval} < 2 \text{ ms}$.

Using EasyEXPERT on External PC
Using 4155B/4156B/4155C/4156C

Advanced Setup Differences on Advanced Setup

- Series R always shows NONE.
- Wait Time Control is not supplied.

Table 7-3 Setting of High Resolution ADC

Mode	Factor	Setting of 4155/4156
AUTO	-	MEDIUM
MANUAL	$1 \leq N \leq 127$	SHORT, TIME=80 μ s \times N
PLC	1	MEDIUM
	$N \geq 2$	LONG, NPLC=N

NOTE

To reuse the test setup for B1500A

Perform the following procedure to reuse the test setup created for the B1500A.

1. Launch EasyEXPERT with the condition *Set Analyzer*=B1500A.
2. Export the test setups to be reused. And exit EasyEXPERT.
3. Launch EasyEXPERT with the condition *Set Analyzer*=4155B, 4156B, 4155C, or 4156C.
4. Import the test setups exported at the step 2.
5. Set the channel for the analyzer to use.

Also, the procedure made by replacing the step 1 with the step 3 can be used to reuse the test setup created for the 4155/4156.

Using E5260A/E5262A/E5263A/E5270B

This section describes the notices for controlling the E5260A/E5262A/E5263A/E5270B.

E5260A/E5262A/E5263A/E5270B Firmware Revision

Firmware revision supported by EasyEXPERT

- B.01.10 or later

EasyEXPERT

Classic tests available for E5260A/E5262A/E5263A/E5270B

- I/V Sweep, Multi Channel I/V Sweep, I/V List Sweep, and Switching Matrix

EasyEXPERT functions unavailable for E5260A/E5262A/E5263A/E5270B

- I/V-t Sampling
- Direct Control
- Tracer Test
- Functions using SCUU (SMU CMU Unify Unit)
- Functions using CMU (Capacitance Measurement Unit)
- Functions using SPGU (Semiconductor Pulse Generator Unit)
- Functions using WGFMU (Waveform Generator/Fast Measurement Unit) and RSU (Remote-sense and Switch Unit)

Calibration

Differences on Calibration window

- Calibration window provides Module Self Calibration screen only.
- Module Self Calibration screen provides Enable Auto Calibration only.

Configuration, Main Frame

Differences on Configuration window Main Frame screen

- Line Frequency just displays the setting of E5260A/E5262A/E5263A/E5270B.
- Main Frame Diagnosis is not supplied.

Configuration, Module

Differences on Configuration window Module screen

- Self-test cannot be performed.
- Status, SCUU, and Notes columns are not supplied.

Using EasyEXPERT on External PC
Using E5260A/E5262A/E5263A/E5270B

- Start Self Test and Recover Module buttons are not supplied.
- Accessory Configuration is not supplied.

I/V Sweep

Differences on I/V Sweep Classic Test

- Time Stamp Name field is not supplied for E5260A/E5262A/E5263A/E5270B.
- Number of sweep steps must be 1 to 1001 for VAR1.
- SMU Pulse Period and Width value must satisfy as:
 - $\text{Period} \geq \text{Width} + 2 \text{ ms.}$ (for $\text{width} \leq 100 \text{ ms}$)
 - $\text{Period} \geq \text{Width} + 10 \text{ ms.}$ (for $\text{width} > 100 \text{ ms}$)

NOTE

To reuse the test setup for B1500A

Perform the following procedure to reuse the test setup created for the B1500A.

1. Launch EasyEXPERT with the condition Set Analyzer=B1500A.
2. Export the test setups to be reused. And exit EasyEXPERT.
3. Launch EasyEXPERT with the condition Set Analyzer=E5260A, E5262A, E5263A, or E5270B.
4. Import the test setups exported at the step 2.
5. Set the channel for the analyzer to use.

Also, the procedure made by replacing the step 1 with the step 3 can be used to reuse the test setup created for the E5260A/E5262A/E5263A/E5270B.

Using B2900

This section describes the notices for controlling the B2900.

NOTE

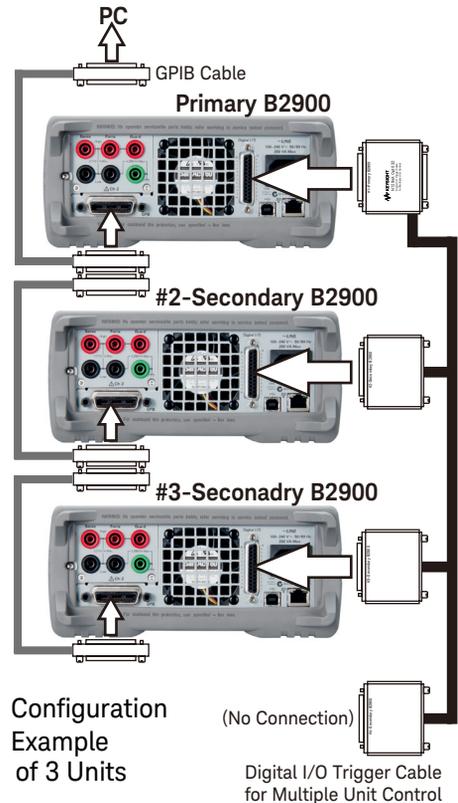
Using Multiple B2900 Units

To use the multiple B2900 units (maximum 4 units), each of the multiple B2900 units are connected together by using the N1294A opt.032 Digital I/O Trigger Cable for Multiple Unit Control. This cable has one connector for a primary unit and three connectors for secondary units. The connector for a primary unit is stacking connector also for general use such as interlock connection. Use only one cable for primary/secondary connections.

1. Connect the Primary connector of trigger cable to the Digital I/O terminal of Primary B2900.
2. Connect the Secondary connector of trigger cable to the Digital I/O terminal of Secondary B2900.

If the multiple secondary units are configured, connect all secondary units.

3. Connect all B2900 units to your PC using GPIB cables.
4. Launch EasyEXPERT.
5. Select Options > Execution Mode... on the Start EasyEXPERT window to open the Execution Mode dialog box, and set up VISA interface ID of GPIB interface installed in your computer and GPIB addresses on multiple B2900 units. See **“Recommended GPIB Interface”**.



Using EasyEXPERT on External PC
Using B2900

NOTE**Using B2901BL or B2910BL**

Some of B2900 functions and ranges are not available for B2901BL/B2910BL. For more information on the limitations, refer to the B2900B User's Guide.

If you set a parameter that B2901BL/B2910BL does not support, an error message will be displayed.

EasyEXPERT

The following EasyEXPERT functions are available for B2900

- I/V Sweep, Multi Channel I/V Sweep, I/V List Sweep, I/V-t Sampling, and Switching Matrix
- Tracer Test

EasyEXPERT functions unavailable for B2900

- Direct Control
- Functions using SCUU (SMU CMU Unify Unit)
- Functions using CMU (Capacitance Measurement Unit)
- Functions using SPGU (Semiconductor Pulse Generator Unit)
- Functions using WGFMU (Waveform Generator/Fast Measurement Unit) and RSU (Remote-sense and Switch Unit)

Calibration

Differences on Calibration window

- Calibration window provides Module Self Calibration screen only.
- Module Self Calibration screen does not provide Full Range Calibration and Enable Auto Calibration.

**Configuration,
Main Frame**

Differences on Configuration window Main Frame screen

- If the multiple B2900 configuration, the information of primary B2900 is displayed on Main Frame screen. The information of all B2900s are displayed at the bottom of the window.
- If you change the Line Frequency setting, the line frequency of all B2900s are changed.
- The diagnosis function for the trigger cable is provided on B2900 Diagnosis.

Configuration, Modules

Differences on Configuration window Module screen

- SCUU is not supported but the SCUU column exists.
- Recover Module button is not supplied.
- Accessory Configuration is not supplied.

I/V Sweep, Multi-Channel I/V Sweep

Differences on I/V Sweep and Multi-Channel Classic Test

- Differences on Channel Definition

Function	Description	
Unit	B2901A/B	SMU _n .B290X
	B2902A/B	
	B2901BL	
	B2911A/B	SMU _n .B291X
	B2912A/B	
	B2910BL	
Mode	V/I/VPULSE/IPULSE	
Function	VAR1/VAR2/CONST	

- Differences on Measurement

Function	Description	
Linear/Log	LINEAR/LOG10	
No. of Steps	VAR1	1 to 2500
	VAR2	1 to 1001
Power Compliance	Unsupported	
SMU Pulse: Base	Supports DC region	

Using EasyEXPERT on External PC
Using B2900

Function	Description	
SMU Pulse: Period	50 μ s to 100000 s	
SMU Pulse: Width	50 μ s to 99999.9 s	
Timing: Hold	0 to 100000 s	
Timing: Delay	0 to 100000 s If Pulse measurement, calculated as follows: Delay = Pulse end time – Integration Time (minimum value:0) If Integration Time: Mode is AUTO, Integration Time=2 ms	
Sweep status	The output switch is OFF when the sweep is aborted.	
A/D Converter Integration Setup	A/D Converter	HS ADC only
	Integration Time Setup	AUTO: 0.1 PLC or 1 PLC MANUAL: 1 to 40000 (1 Factor=50 μ s) PLC: 1 to 100
Advanced Setup: Channel Settings	Series R is unavailable	
	Low Terminal	Low terminal setting. GROUNDED/FLOATING
	High Cap.	High capacitance mode setting. ON/OFF
Advanced Setup: Wait Time Control	State	ON/OFF
	Factor	0 to 100
Advanced Setup: After Measurement Settings	Output value after measurement	START/STOP

I/V List Sweep

Differences on I/V List Classic Test.

Same as I/V Sweep Classic Test except the followings.

- Differences on Measurement

Function	Description	
List Length	VAR1	1 to 1001
	VAR2	1 to 1001

I/V-t Sampling

Differences on I/V-t Sampling Classic Test.

- Differences on Channel Definition

Function	Description	
Unit	B2901A/B	SMU _n .B290X
	B2902A/B	
	B2901BL	
	B2911A/B	SMU _n .B291X
	B2912A/B	
	B2910BL	
Mode	V/I	

Using EasyEXPERT on External PC
Using B2900

- Differences on Measurement

Function	Description	
Linear/Log	LINEAR only	
Interval	10 μ s to 100000 s If SMUn.B290X exists, the setting of 20 μ s or below is set to 20 μ s.	
No. of Samples	1 to 100000 (Total of all measurement channels)	
Hold Time	0 to 100000 s	
Base Hold Time	0 to 100000 s	
A/D Converter Integration Setup	A/D Converter	HS ADC only
	Integration Time Setup	AUTO: 0.1 PLC or 1 PLC MANUAL: 1 to 40000 (1 Factor=50 μ s) PLC: 1 to 100
Advanced Setup: Channel Settings	Series R is not available	
	Low Terminal	Low terminal setting. GROUNDED/FLOATING
	High Cap.	High capacitance mode setting. ON/OFF
Advanced Setup: Wait Time Control	State	ON/OFF
	Factor	0 to 100
Advanced Setup: After Measurement Settings	Output value after measurement	START only

Tracer Test

Differences on Tracer Test

Function		Description
VAR1	No. of Steps	1 to 2500
	Power Comp.	unsupported
	Pulse Delay	0 s to 99999.9 s
	Pulse Width	50 μ s to 100000 s
	Hold Time	0 s to 100000 s
VAR2	No. of Steps	1 to 2500
	Power Comp.	unsupported
	Hold Time	0 s to 100000 s
Meas. Delay	2 μ s to 4.99 s	
Meas. Time	8 μ s to 20 ms	
Step Time	500 μ s to 5 s	
Pulse Period	5 ms to 5 s	

NOTE

To reuse the test setup for B1500A

Perform the following procedure to reuse the test setup created for the B1500A.

1. Launch EasyEXPERT with the condition Set Analyzer=B1500A.
2. Export the test setups to be reused. And exit EasyEXPERT.
3. Launch EasyEXPERT with the condition Set Analyzer=B2901A, B2902A, B2911A, B2912A, B2901B, B2902B, B2901BL, B2911B, B2912B, or B2910BL.
4. Import the test setups exported at the step 2.
5. Set the channel for the analyzer to use.

Also, the procedure made by replacing the step 1 with the step 3 can be used to reuse the test setup created for B2900.

Using EasyEXPERT on External PC
Using B2900

8

Utilities

This chapter introduces the utility programs included in Keysight B1500 and EasyEXPERT.

- “System Requirement”
- “License Management Tool”
- “Setup File Converter”
- “MDM File Converter”
- “Utility Programs”

NOTE

The following conventions are used in this chapter.

- For Windows 7/8.1/10 64 bit version
 - <program folder>: <system drive>\Program Files (x86)
 - <offline configuration folder>: <system drive>\ProgramData\Agilent\EasyEXPERT\Service\OfflineConfiguration
 - <user configuration folder>: <system drive>\Users\<your account>\AppData\Roaming\Agilent\EasyEXPERT\Service\OfflineConfiguration
 - For Windows Vista, 7/8.1/10 32 bit version
 - <program folder>: <system drive>\Program Files
 - <offline configuration folder>: <system drive>\ProgramData\Agilent\EasyEXPERT\Service\OfflineConfiguration
 - <user configuration folder>: <system drive>\Users\<your account>\AppData\Roaming\Agilent\EasyEXPERT\Service\OfflineConfiguration
 - For Windows XP
 - <program folder>: <system drive>\Program Files
 - <offline configuration folder>: <system drive>\Documents and Settings\All Users\Application Data\Agilent\EasyEXPERT\Service\OfflineConfiguration
 - <user configuration folder>: <system drive>\Documents and Settings\All Users\Application Data\Agilent\EasyEXPERT\Service\OfflineConfiguration
- <system drive>: Drive the EasyEXPERT has been installed
- <your account>: Your Windows login account
-

System Requirement

Table 8-1 shows the minimum requirements to run the EasyEXPERT software and the programs furnished with the B1500. They are effective as of March 2019. For the latest information, go to www.keysight.com/find/easyexpert.

Table 8-1 System Requirements

Operating system and service pack	Microsoft Windows Vista Business SP2 or later (32 bit)	Microsoft Windows 7 Professional SP1 or later (32 bit/64 bit)	Microsoft Windows 8.1 Professional or later (32 bit/64 bit)	Microsoft Windows 10 Pro or later (32bit/64bit)
Processor	Vista certified PC	Windows 7 certified PC	Windows 8.1 certified PC	Windows 10 certified PC
Language	English (US)			
Memory	2 GB			
Display	XGA 1024×768 (SXGA 1280×1024 recommended)			
Storage	1 GB free space on the C drive, 30 GB free space on a drive for test setup/result data storage is recommended.			
.NET Framework	Microsoft .NET Framework 3.5 SP1			
IO Libraries	Keysight IO Libraries Suite 16.2, 16.3, 17.1 update 1 or later (for the Online execution mode)		Keysight IO Libraries Suite 17.1 update 1 or later (for the Online execution mode)	

License Management Tool

The licence management tool is the program used to install the license of the software listed below. This program is also used to confirm the licenses already installed and the host ID of the B1500 or the computer for EasyEXPERT.

- B1500A-SWS EasyEXPERT Extension
- B1500AU-SWS EasyEXPERT Extension
- B1505A-SWS EasyEXPERT Extension
- B1505AU-SWS EasyEXPERT Extension
- B1506A-SWS EasyEXPERT Extension
- B1507A-SWS EasyEXPERT Extension
- B2901AU EasyEXPERT Extension
- B2902AU EasyEXPERT Extension
- B2911AU EasyEXPERT Extension
- B2912AU EasyEXPERT Extension
- B2901BU EasyEXPERT Extension
- B2902BU EasyEXPERT Extension
- B2901BLU EasyEXPERT Extension
- B2911BU EasyEXPERT Extension
- B2912BU EasyEXPERT Extension
- B2910BLU EasyEXPERT Extension
- E5260A-SWS EasyEXPERT Extension
- E5260AU-SWS EasyEXPERT Extension
- E5270B-SWS EasyEXPERT Extension
- E5270BU-SWS EasyEXPERT Extension

To launch program Click Start > All Programs > (Keysight EasyEXPERT >) Licence Management Tool.

- To check licenses already installed** Click Installed Licenses tab on the Licence Management Tool. The installed licenses will be displayed.
- To check host ID** Click Information tab on the Licence Management Tool. The host ID of the B1500 or the computer will be displayed.
- To install license** The following procedure installs the license.
1. Click Install icon, or click File > Install License File to open a dialog box.
 2. Specify the license file (.lic file).
 3. Click Open.

License Management Tool GUI

- File menu**
- Install License File** Opens a dialog box used to specify the license file.
 - Exit** Closes the License Management Tool.
- Help menu**
- About** Opens the About dialog box.
- Install icon** Opens a dialog box used to specify the license file.
- Installed Licenses tab screen** Displays the license already installed.
- Information tab screen** Displays the host ID of the B1500 or the computer for EasyEXPERT.

Setup File Converter

The setup file converter is the program which converts the Keysight 4155A/4156A/4155B/4156B/4155C/4156C setup file (extension: DAT or MES) and creates the EasyEXPERT setup file (extension: XTS). This program can convert the setup information but cannot convert the test result data.

Execution environment

EasyEXPERT execution environment

To execute this program, the SetupFileConverter.exe, SetupFileConverterW.exe, and SetupFileConverterW.exe.config files must be stored in the following folder.

<program folder>\Agilent\B1500\EasyEXPERT\415xC\Conversion\

To launch program Click Start > All Programs > Agilent B1500A EasyEXPERT > 4155,4156 Setup File Converter.

To create XTS file The following procedure converts the 4155/4156 setup file (.DAT or .MES) and creates the .XTS file in the folder the setup file is stored.

1. Click Select icon, or click File > Select Files to open the Select 4155/4156 MES Files or DAT Files dialog box.
2. Specify the 4155/4156 setup file to convert. Multiple files can be selected.
3. Click Open on the Select 4155/4156 MES Files or DAT Files dialog box.
4. Click Convert icon, or click File > Convert Files.

Instead of the step 1 to 3, you can use the drag and drop operation from Explorer to the Selected Files area on the Setup File Converter.

To read XTS file Use the import function to read the created .XTS file on the EasyEXPERT.

Open the Import Test Setup window by clicking File > Import Test Setup... on the Classic Test screen. Specify the .XTS file to be imported, and click Open.

Conversion results For details about the conversion results, see [“SetupFileConverter.exe” on page 8-24](#).

Setup File Converter GUI

The setup file converter provides the following GUI.

File menu	Select Files	Opens the Select 4155/4156 MES Files or DAT Files dialog box used to specify the 4155/4156 setup files to convert.
	Convert Files	Performs conversion and creates XTS file. This program overwrites the file of the same name.
	Clear	Clears the Selected Files area and the Log area.
	Quit	Closes the setup file converter.
Help menu	About	Opens the About dialog box.
Icons	Select	Opens the Select 4155/4156 MES Files or DAT Files dialog box used for specifying the 4155/4156 setup files to convert.
	Convert	Performs conversion and creates XTS file. This program overwrites the file of the same name.
	Clear	Clears the Selected Files area and the Log area.
Create XTS for		Specifies the type of the XTS file to create.
	B1500A	XTS file for the B1500
	4155B/C	XTS file for the 4155A/B/C
	4155B/C with HPSMU	XTS file for the 4155A/B/C. The HPSMU in the MES/DAT file is converted to SMU5: HP.
	4156B/C	XTS file for the 4156A/B/C
	4156B/C with HPSMU	XTS file for the 4155A/B/C. The HPSMU in the MES/DAT file is converted to SMU5: HP.
Selected Files		Lists the 4155/4156 setup files to convert. Drag and drop operation is allowed.
Log		Displays the execution log.

MDM File Converter

The MDM file converter is the program which converts the EasyEXPERT test result data file (extension: xtr or ztr) and creates the Keysight IC-CAP model data manager file (extension: mdm).

Supported data The MDM file converter supports the test result data of the following Classic Tests.

- I/V Sweep
- Multi Channel I/V Sweep
- C-V Sweep

The Application Test result data is not supported.

Execution environment EasyEXPERT execution environment

To execute this program, the MdmFileConverter.exe and MdmFileConverterW.exe files must be stored in the following folder.

<program folder>\Agilent\B1500\EasyEXPERT\IC-CAP Support\MDM\

To launch program Click Start > All Programs > Agilent B1500A EasyEXPERT > IC-CAP MDM File Converter.

To create MDM file The following procedure converts the xtr/ztr file and creates the mdm file with the same name as the xtr/ztr file in the folder which the xtr/ztr file has been stored.

1. Click Browse... to open the Please select Test Result File dialog box.
2. Select the xtr/ztr file to convert. Multiple files can be selected.
3. Click Convert, or click Action > Convert.

Instead of the step 1 to 2, you can use the drag and drop operation from Explorer to the Input Files area on the MDM file converter.

NOTE

If a mdm file of the same name already exists, “(N)” is added to the file name. For example, if the abc.mdm file already exists when converting the abc.xtr file, the abc(1).mdm file is created.

MDM File Converter GUI

The MDM file converter provides the following GUI.

File menu	Exit	Closes the MDM file converter.
Action menu	Convert	Performs conversion of the files listed in Input Files and creates mdm files.
Help menu	About	Opens the About dialog box.
Input Files		Lists the xtr/ztr file.
	Browse...	Opens the Please select Test Result File dialog box used for selecting the xtr/ztr files to convert. The selected files are listed in Input Files.
	Remove	Removes the highlighted files from Input Files.
	Convert	Performs conversion of the files listed in Input Files and creates mdm files.
	Cancel	Cancels the file conversion.
Options		The following optional functions are available. <ul style="list-style-type: none">• Append Test Setup Title to Mdm File Name Check this box if you want to append the test setup title to the mdm file name. If the xtr/ztr file name is “abc” and the test setup title is “title”, the mdm file name will be “abc-title”.• Specified Output Folder Check this box if you want to specify the folder used for storing the mdm files which are the conversion results. This enables the entry field and the Browse... button. The folder can be specified by entering a folder name to this field directly or by selecting a folder on the dialog box opened by clicking the Browse... button.
Log		Displays the execution log.

Utility Programs

The following useful programs are stored in the following folder. Remember that they are just sample programs.

<program folder>\Agilent\B1500\EasyEXPERT\Utilities\

- “User Account Management Tool”
- “Offline Configuration Tool”
- “Software Configuration Tool”
- “Prober Control”
- “sleep.exe”
- “XSLT”

<program folder>\Agilent\B1500\EasyEXPERT\415xC\Conversion\

- “SetupFileConverter.exe”

<program folder>\Agilent\B1500\EasyEXPERT\IC-CAP Support\MDM\

- “MdmFileConverter.exe”

User Account Management Tool

User Account Management Tool sets the passwords to the user level of the EasyEXPERT and assigns the user level of the EasyEXPERT to the Windows accounts.

To launch program Click Start > All Programs > Keysight EasyEXPERT > Tools > User Account Management.

NOTE This program requires administrator privileges.

For details, see “User Level Setting” section in *EasyEXPERT User’s Guide Vol.1.*

Offline Configuration Tool

Offline Configuration Tool sets the configuration of B1500 or E5270B for the offline mode.

To launch program Click Start > All Programs > Keysight EasyEXPERT > Tools > Offline Configuration.

Offline Configuration Tool provides the following GUI.

File menu	New	Creates new offline configuration.
	Load	Loads the offline configuration file. You can select Common for all user or User for personal.
	Import	Import the offline configuration from the exported offline configuration file (Arbitrary file) or the instrument (from Equipment).
	Save	Saves the current configuration to the file. You can select As Common for all user or As User for personal use.
	Export	Exports the current configuration as the offline configuration file with the specified name.
	Delete	Deletes the configuration file.
	Exit	Closes the Offline Configuration Tool.
Modules	Slot	Slot number
	Module Type	Selects the module in the corresponding slot.
	Name	Module name.
Main Frame	Shows the information of the mainframe.	

Software Configuration Tool

Software Configuration Tool sets the auto start programs at Windows startup.

To launch program Click Start > All Programs > Keysight EasyEXPERT > Tools > Software Configuration.

NOTE This program requires administrator privileges.

Software Configuration Tool provides the following GUI.

File menu **Exit** Closes Software Configuration Tool.

Edit menu **Cancel all** Clears all programs in the Startup Programs.

**Reset to the
factory default** Resets to the setting at factory shipment.

Startup The programs listed the Startup Programs will automatically start at Windows startup.

1. Selects the program to auto start from the Programs.
2. Click the right-arrow to move the selected program to the Startup Programs.
3. To delete the program in the Startup Programs, select it and click Delete button.

Prober Control

The <program folder>\Agilent\B1500\EasyEXPERT\Utilities\ProberControl folder stores the execution files used to control the following probers.

- Cascade Microtech Summit 12000/S300 (Nucleus)
- Cascade Microtech (Suss MicroTec) PA200 or PA300
- Vector Semiconductor VX-2000 or VX-3000

You can use the execution files when you perform a repeat measurement by using EasyEXPERT and a prober listed above. The execution files control the prober chuck movement (down, move, and up) by defining them in the Repeat Measurement Setup window. See “Remote Measurement Setup” in Chapter 1, User’s Guide Vol. 1.

This folder also stores the source files and the document files. See the pdf files in the ProberControl\xxxx\doc folder for more details or if you create your own prober control script by referring to the source code; xxxx is cascade, suss, or vector.

And also, the prober information file “prober_info.ini” is stored in the <AllUsersProfile>\Agilent\EasyEXPERT\Utilities\ProberControl folder, where <AllUsersProfile> is C:\Documents and Settings\All Users on Windows XP and C:\Program Data on Windows Vista/7/8.1/10. For details, see “[Prober_info.ini](#)”.

See the following sections for how to use the prober control script.

Prober Control Script

Prober control script is sample program used for semi-automatic prober control. The EasyEXPERT can call the script by using the Repeat Measurement Setup window.

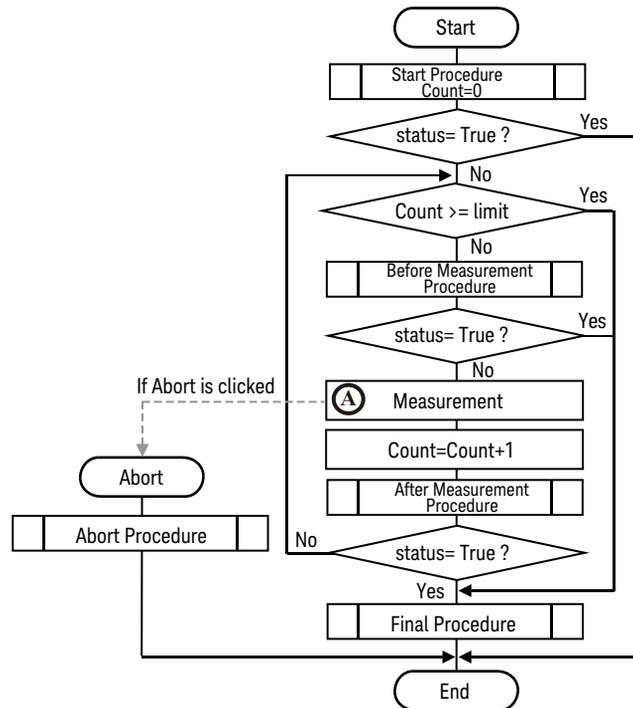
- See “[Repeat Measurements](#)” to call the script and perform repeat measurement.
- See “[Prober_info.ini](#)” for the prober information file.

The prober control script can be used for Start Procedure, After Measurement Procedure, and Final Procedure on the Repeat Measurement Setup dialog box. And use the Subsite move test setup in your quick test to control sub die move. The Subsite move setup uses the subsite procedure for moving wafer chuck to the next subsite. See “[Subsite_xxxx.exe](#)”, “[Subsite move Test Setup](#)”, and “[To Use Subsite move](#)”.

Repeat Measurements

Figure 8-1

Flow of Repeat Measurement Setup



The repeat measurement is performed as shown in this flowchart. The status is a response returned by each procedure. The Count is the accumulated number of test executions. They are the stop condition of the repeat measurement.

The repeat measurement stop function is enabled by the following check boxes.

- Counter reaching to
- Procedure return condition

If the first box is checked and the limit value is specified, the repeat measurement will be stopped if $\text{Count} \geq \text{limit}$. To perform the repeat measurement, set the limit value more than the number of devices under test or remove check from this box.

If the second box is checked, the repeat measurement will be stopped if $\text{status} = \text{True}$.

When the second box is checked, the device ID automatic setup function is available and is enabled/disabled by using the following check box. The function enters the device_id value to the Device ID of the test result record. The device_id is a response returned by each procedure.

- Automatically fill in Device ID

The Repeat Measurement Setup dialog box provides the following action buttons.

Run: Starts repeat measurement.

Abort: Stops repeat measurement immediately.

Cancel: Closes the Repeat Measurement Setup dialog box.

Start/Before Measurement/After Measurement/Abort/Final Procedure:

Enter the full path name of the procedure. For example, enter as follows.

C:\Program Files\Agilent\B1500\EasyEXPERT\Utilities\ProberControl\suss\Start_suss.exe

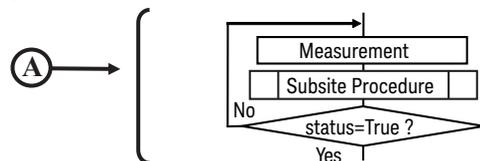
Arguments:

Enter the options of the procedure. See the following sections for the options. For example, enter as follows.

-a GPIB0::5::INSTR -l C:\temp\prb.log

If you use the subsite procedure, the flowchart must be changed below.

Replace the box A shown in [Figure 8-1](#) with the block A shown as follows.

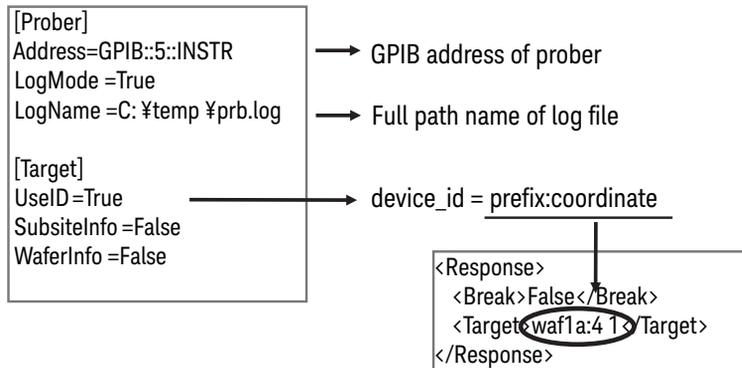


Prober_info.ini

The prober information file is necessary to execute the prober control script. Before starting tests, open this file, edit it as you want, and overwrite it. The name must be prober_info.ini.

Figure 8-2

Prober_info.ini



The prober_info.ini file stores the information shown below.

Address: GPIB address of prober

LogMode: Log file creation mode; True or False

LogName: Log file name (full path)

UseID: Device ID creation mode; True or False

SubsiteInfo: Set always False. This is just a place holder.

WaferInfo: Set always False. This is just a place holder.

If the procedures specify the `-a` option, the Address value is not used.

If the procedures specify the `-l` option, the LogName value is not used.

To create a log file, set LogMode=True.

To use the prefix:coordinate format for the device_id value, set UseID=True. If UseID=False, the device_id value will be coordinate, not prefix:coordinate. The prefix will be the value entered in the Device ID Entry dialog box that is opened by Start_xxxx.exe. This function is available when the Automatically fill in Device ID check box is checked.

Start_xxxx.exe

This script can be used for Start Procedure. It must be specified by the full path name.

Figure 8-3

Start_xxxx.exe

- Arguments: -a GPIB_address
 -l log_file_name
- Example:
-a GPIB0::5::INSTR -l C:\temp %prb.log

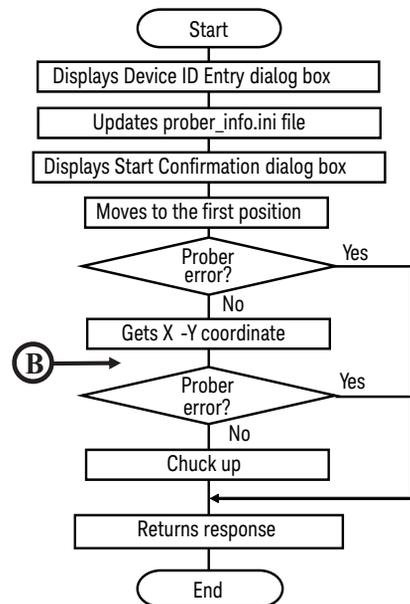
- Response: XML format data

```
<Response>
<Break>status</Break>
<Target>device_id</Target>
</Response>
```

status: True (error) or False
device_id: prefix:coordinate

Example:

```
<Response>
<Break>False</Break>
<Target>waf1a:3 1</Target>
</Response>
```



After the repeat measurement is started, this procedure displays the Device ID Entry dialog box and waits for your input. On the dialog box, enter a string used for the prefix of device_id. After that, you will see the Start Confirmation dialog box that is used to confirm your wafer setup status. Load wafer and perform wafer alignment, then click OK on the dialog box. The procedure moves wafer chuck to the first probing position, checks the prober status, gets the X-Y coordinate of the probing position, and sets the wafer chuck to the UP position. At last, the procedure returns the response.

The status is True or False. It is used for the EasyEXPERT repeat measurement stop function. When the Procedure return condition box is checked in the Repeat Measurement Setup dialog box, the repeat measurement will be stopped if status = True.

The device_id is a string for the Device ID of the test result record. When the Automatically fill in Device ID box is checked in the Repeat Measurement Setup dialog box, the device_id will be entered to the Device ID of the test result record.

If you use the subsite procedure, the flowchart must be changed below.

Insert the box B shown as follows to the position B shown in **Figure 8-3**.



NOTE

To ignore the Arguments, set the GPIB address and log file name in the `prober_info.ini`.

Iterator_xxxx.exe

This script can be used for After Measurement Procedure. It must be specified by the full path name.

Figure 8-4

Iterator_xxxx.exe

- Arguments: -a GPIB_address
 -l log_file_name
- Example:
-a GPIB0::5::INSTR -l C:\temp \prb.log

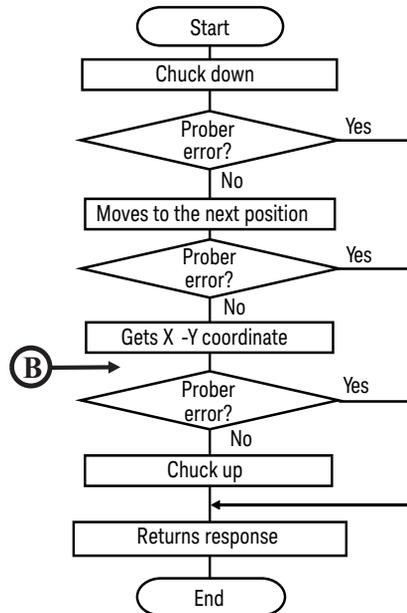
- Response: XML format data

```
<Response>
<Break>status</Break>
<Target>device_id</Target>
</Response>
```

status: True (error) or False
device_id: prefix:coordinate

Example:

```
<Response>
<Break>False</Break>
<Target>waf1a:4 1</Target>
</Response>
```



The procedure is called after the measurement is completed for a die. This procedure sets wafer chuck to the DOWN position, moves it to the next probing position, checks the prober status, gets the X-Y coordinate of the probing position, and sets the wafer chuck to the UP position. At last, the procedure returns the response.

The status is True or False. It is used for the EasyEXPERT repeat measurement stop function. When the Procedure return condition box is checked in the Repeat Measurement Setup dialog box, the repeat measurement will be stopped if status = True.

The device_id is a string for the Device ID of the test result record. When the Automatically fill in Device ID box is checked in the Repeat Measurement Setup dialog box, the device_id will be entered to the Device ID of the test result record.

If you use the subsite procedure, the flowchart must be changed below.

Insert the box B shown as follows to the position B shown in **Figure 8-3**.



NOTE

To ignore the Arguments, set the GPIB address and log file name in the prober_info.ini.

Final_ xxxx.exe

This script can be used for Final Procedure. It must be specified by the full path name.

Figure 8-5

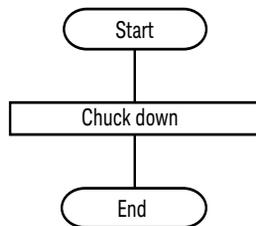
Final_ xxxx.exe

- Arguments: -a GPIB_address
 -l log_file_name

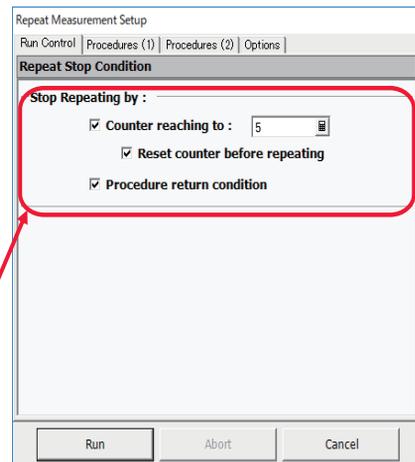
Example:

-a GPIB0::5::INSTR -l C:\temp %prb.log

- Response: none



Stop condition



The procedure is called after one of the stop condition is detected. This procedure sets wafer chuck to the DOWN position.

NOTE

To ignore the Arguments, set the GPIB address and log file name in the `prober_info.ini`.

Subsite_XXXX.exe

To realize sub die move operation, you need to define `Subsite_XXXX.exe` in your test definition and create your application test setup. However, you do not need to take care of this procedure by using the Subsite move test setup included in the application library. The Subsite move setup moves wafer chuck to the next subsite, reads device ID from the prober, and sets it to the Device ID of the test result record.

Figure 8-6

Subsite_XXXX.exe

- Arguments: -a GPIB_address
 -l log_file_name

Example:
-a GPIB0::5::INSTR -l C:\temp\prb.log

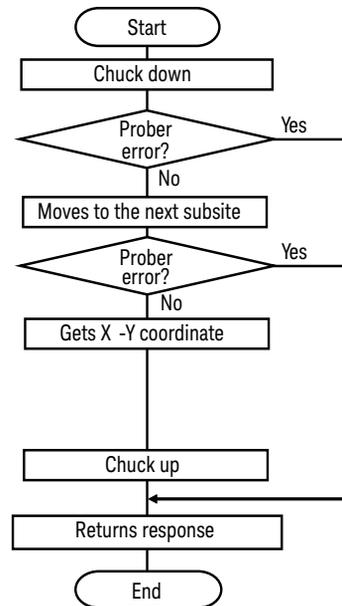
- Response: XML format data

```
<Response>  
<Break>status</Break>  
<Target>device_id</Target>  
</Response>
```

status: True (error) or False
device_id: prefix:coordinate

Example:

```
<Response>  
<Break>False</Break>  
<Target>waf1a:3 1</Target>  
</Response>
```



Open the Subsite move test setup and save it as a setup in your preset group (My Favorite Setup). Then you can use the setup for your quick test.

NOTE

To use the Subsite move setup, set the GPIB address and log file name in the `prober_info.ini`. And ignore the Arguments for `Subsite_XXXX.exe`.

NOTE

If you use a Suss prober, the number of Subsite move setups used in your quick test (die test) is important. It must be $N-1$; N is the number of subsites defined in the prober.

The status is True or False. It is used for the EasyEXPERT repeat measurement stop function. When the Procedure return condition box is checked in the Repeat Measurement Setup dialog box, the repeat measurement will be stopped if status = True.

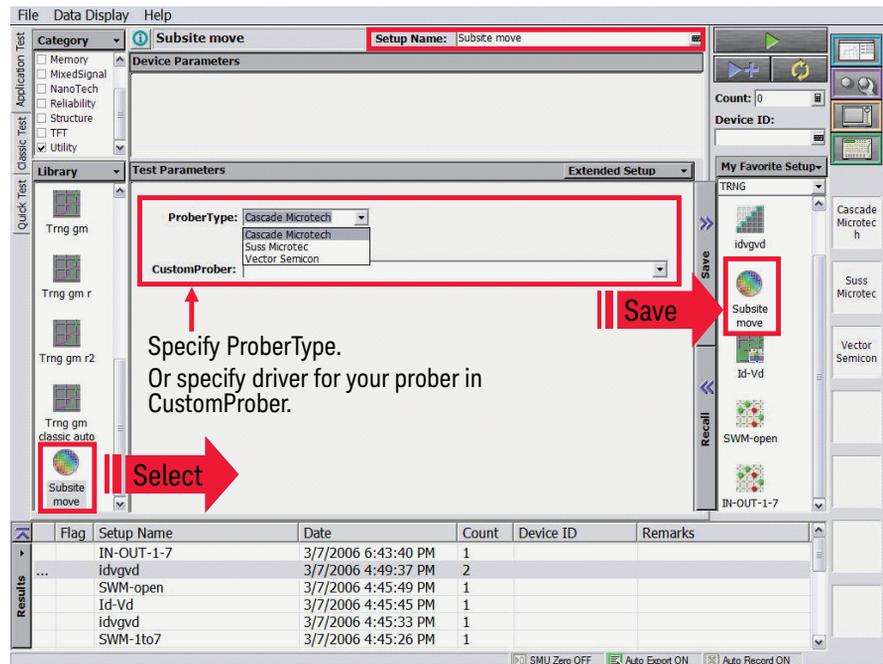
The device_id is a string for the Device ID of the test result record.

Subsite move Test Setup

Click Application Test tab and open the Subsite move test setup in the Utility category. On the Subsite move setup screen, specify ProberType (Cascade, Suss, or Vector) or driver for your prober in CustomerProber, and save it as a setup in your preset group (My Favorite Setup). Then you can use the setup for your quick test. See [“To Use Subsite move”](#).

Figure 8-7

Subsite move Test Setup



The Subsite move setup moves wafer chuck to the next subsite, reads device ID from the prober, and sets it to the Device ID of the test result record.

For more details of the test setup, open the Test Definition window.

Utilities
Utility Programs

In the Subsite move test definition, an execution file callProbeDvr.exe is used. This file is used to send Subsite_XXXX.exe to the prober specified by the prober_info.ini file and receive the response; status and device_id. The callProberDvr.exe has the following input/output parameters.

Input: Full path of Subsite_XXXX.exe
Output: status; True (error) or False (no error)
Output: device_id

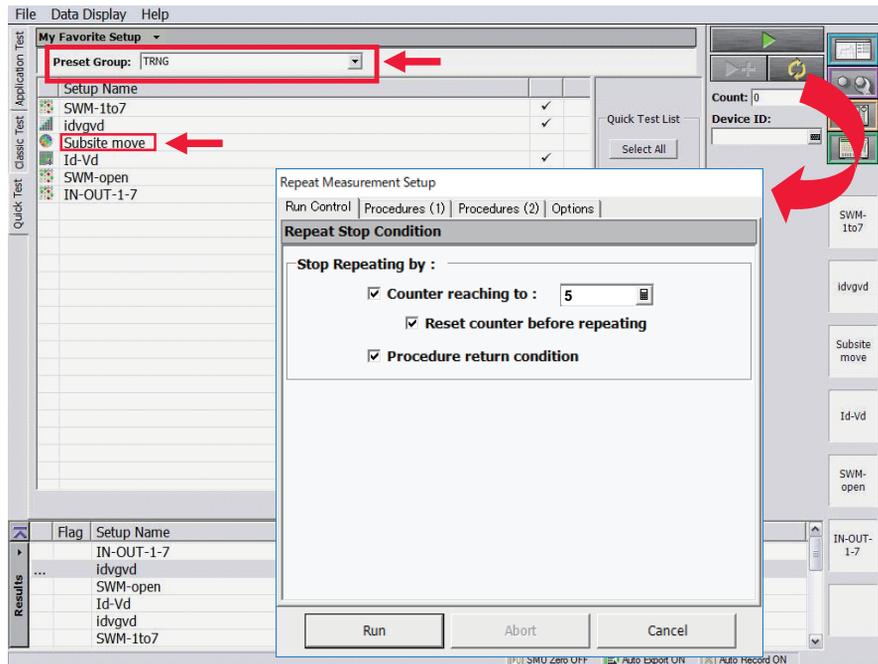
NOTE

The callProberDvr.exe refers to the prober_info.ini file for the GPIB address and log file name. Do not set the Arguments of Subsite_XXXX.exe.

To Use Subsite move

Figure 8-8

To Use Subsite move



To perform the test with the sub die move operation, do as follows.

1. Add the Subsite move test setup to your preset group (My Favorite setup).
2. Set your preset group and test setups in the Quick Test tab screen.
3. Open the Repeat Measurement Setup dialog box.
4. Specify the procedures and the repeat measurement condition.
5. Start repeat measurement.

The Subsite move setup must be entered after measurements for a sub die.

SetupFileConverter.exe

This program is the script version of the setup file converter. This program converts the 4155A/4156A/4155B/4156B/4155C/4156C setup file (.DAT or .MES) and creates the EasyEXPERT setup file (.XTS). This program can convert the setup information but cannot convert the test result data.

Execution environment

EasyEXPERT execution environment

Syntax

```
SetupFileConverter.exe [option] [file]
```

Parameter

option : Execution options. See [Table 8-2](#). Multiple options can be set. Both /4155 and /4156 cannot be set for one execution.

file : 4155/4156 setup file name

You can specify multiple files by using a space as the separator. Also wildcard can be used.

If no parameter is specified, the Usage message is displayed.

Execution examples

```
C:\415xConvert>SetupFileConverter.exe MOS1.MES  
C:\415xConvert>SetupFileConverter.exe MOS*.DAT MOS*.MES  
C:\415xConvert>SetupFileConverter.exe /4156 /HP *.MES
```

Table 8-2

Option Parameter

Option	Description
(no option)	Performs normal operation.
/4155	Creates the XTS file for the 4155, not for the B1500.
/4156	Creates the XTS file for the 4156, not for the B1500.
/HP	Converts HPSMU in the MES/DAT file to SMU5: HP. For creating the XTS file for the 4155/4156.
/S	Leaves <i>Command Prompt</i> open after execution.

XTS file creation example 1

The .XTS file can be created by using *Command Prompt* as shown below.

1. Create your working folder (for example, C:\415xConvert\).
2. Copy the 4155/4156 setup files to convert and the SetupFileConverter.exe file, and paste them to the working folder.
3. Open *Command Prompt*.
4. On *Command Prompt*, execute SetupFileConverter.exe as shown below. This creates the .XTS file in the working folder and displays the message as follows.

```
C:\415xConvert>SetupFileConverter.exe IDVG.MES
SetupFileConverter.exe : Version A.02.10
Start Conversion : IDVG.MES
      ExportFile      : IDVG.xts
      SetupVersion    : HP4155_C03.06
Conversion successfully completed.
```

XTS file creation example 2

The .XTS file can be created by using a shortcut on the Desktop. The shortcut should be created by the following conditions.

- Name: SetupFileConverter
- Target file:
"<program folder>\Agilent\B1500\EasyEXPERT\415xC\Conversion\SetupFileConverter.exe" /S

If you want to make the .XTS file for the 4155/4156, insert /4155 or /4156 before /S.

If you want to add /HP option, insert /HP before /S.

1. Create your working folder (for example, C:\415xConvert\).
2. Copy the 4155/4156 setup files to convert, and paste them to the working folder.
3. Drag the files and drop them on the SetupFileConverter icon. This creates the .XTS files in the working folder.

To read XTS file

Use the import function to read the created .XTS file on the EasyEXPERT.

Open the Import Test Setup window by clicking File > Import Test Setup... on the Classic Test screen. Specify the .XTS file to be imported, and click Open.

- About conversion results** The setup file conversion is not complete. The following are the expected differences. When you use the .XTS file, you will see differences in the operation, performance, measurement result data, and so on.
- Channel number may be changed. For example, the HPSMU channel number is 5 for the 4155/4156 but 1 for the B1500.
 - Setup value is changed to the value available for the B1500 and EasyEXPERT.
 - Voltage Source and Monitor Unit (two channels of VSU and two channels of VMU) is converted to four channels of MPSMU.
 - Pulse Generator Unit (PGU) setup is deleted.
 - Unused module information is deleted.
 - Functions only for the 4155/4156 are deleted.
 - For converting the setup data which satisfies the following two conditions, SMU5 is converted to HPSMU. Else, SMU5 is converted to MPSMU.
 1. SMU6 information is not included in the setup data.
 2. SMU5 information contains the value available only for the HPSMU.

If an inconvertible setup parameter is found during the setup file conversion, a message will be displayed. If an inconvertible setup file is specified, the file conversion is not performed for the file and a message will be displayed.

- About conversion results with option /4155 or /4156** If the /4155 or /4156 option is specified, there are the following differences between the conversion results.
- Channel number is not changed.
 - Setup value will be changed to the value available for the 4155/4156 and EasyEXPERT.
 - VSU/VMU is converted to VSU/VMU respectively.

MdmFileConverter.exe

This program is the script version of the MDM file converter. This program converts the EasyEXPERT test result data file (extension: xtr or ztr) and creates the Keysight IC-CAP model data manager file (extension: mdm).

Execution environment

EasyEXPERT execution environment

Syntax

MdmFileConverter.exe [*option*] [*file*]

Parameter

option : Execution options. See [Table 8-3](#). Multiple options can be set.

file : xtr/ztr file name

You can specify multiple files by using a space as the separator. Also wildcard can be used.

If no parameter is specified, the MDM file converter is launched.

Execution examples

```
C:\MdmFileConvert>MdmFileConverter.exe MOS.xtr
```

```
C:\MdmFileConvert>MdmFileConverter.exe *.xtr *.ztr
```

```
C:\MdmFileConvert>MdmFileConverter.exe /o MOS1 MOS.xtr
```

```
C:\MdmFileConvert>MdmFileConverter.exe /d folder1 *.xtr *.ztr
```

Table 8-3

Option Parameter

Option	Description
(no option)	Performs normal operation.
<i>/o outfile</i>	Specifies the mdm file name. Only one xtr/ztr file can be specified.
<i>/d outfold</i>	Specifies the folder used for storing the mdm files.
<i>/l log</i>	Specifies the file for recording the conversion log.
<i>/s</i>	Does not record the conversion log.
<i>/t</i>	Appends the test setup title to the mdm file name. If the xtr/ztr file name is “abc” and the test setup title is “title”, the mdm file name will be “abc-title”.

**mdm file creation
example 1**

The mdm file can be created by using *Command Prompt* as shown below.

1. Create your working folder (for example, C:\MdmConversion\).
2. Copy the xtr/ztr files to convert and the MdmFileConverter.exe file, and paste them to the working folder.
3. Open *Command Prompt*.
4. On *Command Prompt*, execute MdmFileConverter.exe as shown below. This creates the mdm file in the working folder and displays the message as follows.

```
C:\MdmConversion>MdmFileConverter.exe Idvd.xtr
Starting at 2013/03/27 18:11:15
Reading 'Idvd.xtr' ...
Converting 'Idvd' ...
Writing 'Idvd.mdm' ...
Completed successfully.
```

**mdm file creation
example 2**

The mdm file can be created by using a shortcut on the Desktop. The shortcut should be created by the following conditions.

- Name: MdmFileConverter
- Target file:
"<program folder>\Agilent\B1500\EasyEXPERT\IC-CAP Support
\MDM\MdmFileConverter.exe" /t

Add or delete the option as you want. See [Table 8-3](#) for the available options.

1. Create your working folder (for example, C:\MdmConversion\).
2. Copy the xtr/ztr files to convert, and paste them to the working folder.
3. Drag the files and drop them on the MdmFileConverter icon. This creates the mdm files in the working folder.

mdm file name and folder

- Without the /d option, the mdm file is created in the folder which the xtr/ztr file has been stored.
- With the /d option, the mdm file is created in the specified folder.
- Without the /o option, the mdm file name is same as the xtr/ztr file name.
Example: MdmFileConverter.exe abc.xtr creates the abc.mdm file.
- With the /o option, the mdm file is created with the specified name.
Example: MdmFileConverter.exe /o xyz abc.xtr creates the xyz.mdm file.
- If the xtr/ztr file includes multiple test data, “(N)” is added to the file name.
Example: If the xtr/ztr file includes three test data, MdmFileConverter.exe abc.xtr creates the abc.mdm, abc(1).mdm, and abc(2).mdm files.
- With the /t option, the title of the test setup is added to the file name.
Example: If the title is “title”, MdmFileConverter.exe /t abc.xtr creates the abc-title.mdm file.
- If a mdm file of the same name already exists, “(N)” is added to the file name.
Example: If the abc.mdm file already exists, MdmFileConverter.exe abc.xtr creates the abc(1).mdm file.

sleep.exe

This execution file is used to put a wait time in the test execution flow of an application test.

Execution environment

EasyEXPERT application test execution environment

File Name

<program folder>\Agilent\B1500\EasyEXPERT\Utilities\sleep.exe

Parameters

The following parameters are available for this file. To use sleep.exe, the parameters must be defined in the Local Variables Definition statement of the Test Contents tab in the Test Definition window.

WAIT : List input parameter. Vector variable (1 × 1) to store the data passed to sleep.exe. Enter a wait time in ms.

PassFail : Value output parameter. Numeric variable to store the execution result. 0 is always returned.

Return Value : Value output parameter. Numeric variable to store the data returned by executing sleep.exe. 1 is returned after execution.

Setup examples

To execute sleep.exe, the following setup should be done in the Command Execution element, Miscellaneous component, Test Contents tab in the Test Definition window.

Windows Command Execution							
Command Filename:	C:\Program Files\Agilent\B1500\EasyEXPERT\Utilities\sleep.exe						
Argument:							
Write Type:		String	x	List			
Read Type:		String	x	Value		List	None
Write List							
Values:	WAIT						
Format:							
Read Value							
Result:	PassFail			Value:	ReturnValue		

XSLT

The XSLT (XSL-Transformation, eXtensible Stylesheet Language Transformation) filter files are used to export test records. The fifteen filter files listed below are stored in the <program folder>\Agilent\B1500\EasyEXPERT\Utilities\XSLT folder. See [Table 8-4](#).

Filter files that contain *csv* in the file name export test record in the format that uses a comma (,) as data separator.

Filter files that contain *tab-sv* in the file name export test record in the format that uses a tab as data separator.

Filter files that contain *xmlss* in the file name export test record in the XML Spread Sheet format.

To export test record

Test record can be exported by the following procedure.

1. Open the Export in My Format dialog box by clicking Results > Transport Data > Export in My Format....
2. Enter the XSLT filter file name, and click the Export As... button.
3. On the Export As dialog box, specify the file name and file type for the export data, and click Save.

To read export result

The exported data file can be opened and read with a spreadsheet software. The procedure for opening the export data with a spreadsheet software is as follows.

- For data separated by a comma
Specify the data separated by a comma for the original data format.
- For data separated by a tab
Specify the data separated by a tab for the original data format.
- For data in the XML Spread Sheet format
Specify the XML file for the file type.

After reading the file, all data in the file will be entered into independent cells on the spreadsheet software.

Table 8-4 XSLT Filter Files

Group	File name	Description
1	<ul style="list-style-type: none"> • meas-csv.xml • meas-tab-sv.xml • meas-xmlss.xml 	<p>Filter files for exporting the measurement data only</p> <p>Classic test record export example is shown in Table 8-5.</p>
2	<ul style="list-style-type: none"> • meas-index-csv.xml • meas-index-tab-sv.xml • meas-index-xmlss.xml 	<p>Filter files for exporting the measurement data with the index</p> <p>Classic test record export example is shown in Table 8-6.</p>
3	<ul style="list-style-type: none"> • meas-meta-csv.xml • meas-meta-tab-sv.xml • meas-meta-xmlss.xml 	<p>Filter Files for exporting the measurement data with the meta data</p> <p>The meta data contains the test name, the setup name, the record time of the test results, the device ID, the counter number, the flag of the test results, and the remarks on the test results.</p> <p>Classic test record export example is shown in Table 8-7.</p>
4	<ul style="list-style-type: none"> • meas-index-meta-csv.xml • meas-index-meta-tab-sv.xml • meas-index-meta-xmlss.xml 	<p>Filter files for exporting the measurement data with the index and the meta data</p> <p>The meta data contains the test name, the setup name, the record time of the test results, the device ID, the counter number, the flag of the test results, and the remarks on the test results.</p> <p>Classic test record export example is shown in Table 8-8.</p>
5	<ul style="list-style-type: none"> • csv.xml (used by the Export As CSV... function) • tab-sv.xml • xmlss.xml (used by the Export As XML Spread Sheet... function) 	<p>Filter files for exporting all data including the test setup</p> <p>Application test record export example is shown in Table 8-9. Data in the first cell is the label for the data components in that row. The following cells are the data corresponding to the label. Table 8-12 and Table 8-13 list the components available for the exported data file.</p>

Table 8-5 Example of the data exported by using the XSLT Filter File Group 1

Vd	Vg	Index	Time	Id	ABS_ID	Slope
0	1	1	0.00264	-0.00012	0.00012	0.004346
0.06	1	2	0.01265	0.000398	0.000398	0.004346
0.12	1	3	0.02265	0.000902	0.000902	0.004346
:	:	:	:	:	:	:

Table 8-6 Example of the data exported by using the XSLT Filter File Group 2

No.	Vd	Vg	Index	Time	Id	ABS_ID	Slope
1	0	1	1	0.00264	-0.00012	0.00012	0.004346
2	0.06	1	2	0.01265	0.000398	0.000398	0.004346
3	0.12	1	3	0.02265	0.000902	0.000902	0.004346
:	:	:	:	:	:	:	:

Table 8-7 Example of the data exported by using the XSLT Filter File Group 3

I/V Sweep	Trng Id-Vd					
Record Time	04/04/2007 08:36:42					
Device ID						
Count	2					
Flag						
Remarks						
Vd	Vg	Index	Time	Id	ABS_ID	Slope
0	1	1	0.00264	-0.00012	0.00012	0.004346
0.06	1	2	0.01265	0.000398	0.000398	0.004346
0.12	1	3	0.02265	0.000902	0.000902	0.004346
:	:	:	:	:	:	:

Table 8-8 Example of the data exported by using the XSLT Filter File Group 4

I/V Sweep	Trng Id-Vd						
Record Time	04/04/2007 08:36:42						
Device ID							
Count	2						
Flag							
Remarks							
No.	Vd	Vg	Index	Time	Id	ABS_ID	Slope
1	0	1	1	0.00264	-0.00012	0.00012	0.004346
2	0.06	1	2	0.01265	0.000398	0.000398	0.004346
3	0.12	1	3	0.02265	0.000902	0.000902	0.004346
:	:	:	:	:	:	:	:

Filter File Modification Example

This section explains the modification example of a filter file. In this example, a filter file of group 5 is used.

The group 5 filter files will export the data that contains the test setup information. To obtain the data without the setup information, modify the filter file as shown below, also see [Figure 8-9](#), and export data by using the filter file after modification.

The data will not contain the *TestParameter*, *DutParameter*, *MetaData*, and *AnalysisSetup* of the Application test result record, and the *TestParameter*, *MetaData*, and *AnalysisSetup* of the Classic test result record.

1. Modify the following *template* elements for *sta:TestParameterList* to *sta:TerminalList* as shown below.

```
<xsl:template match="sta:TestParameterList">
</xsl:template>

<xsl:template match="sta:DutParameterList">
</xsl:template>

<xsl:template match="sta:AnalysisParameterList">
</xsl:template>

<xsl:template match="sta:MetaData/sta:ParameterList">
</xsl:template>

<xsl:template match="sta:TerminalList">
  <xsl:apply-templates />
</xsl:template>
```

2. Comment out the whole of the following *template* element.

```
<!--
<xsl:template match="sta:Parameter">
  : : : : : : :
</xsl:template>
-->
```

Exported data examples of Classic test result record are shown in [Table 8-9](#) and [Table 8-10](#).

[Table 8-11](#) explains the reference name used in the filter file and shows the relation to the parameter name used in the data file exported by using the filter file.

Table 8-9 Example of the data exported by using the filter file before modification

SetupTitle	Trng Id-Vd				
PrimitiveTest	I/V Sweep				
TestParameter	Channel.Unit	SMU1:HP	SMU2:HP	SMU3:HR	SMU4:HR
TestParameter	Channel.IName	Id	Ig	Is	Sub
TestParameter	Channel.VName	Vd	Vg	Vs	Vsub
:	:	:	:	:	:
MetaData	TestRecord.Entr	true			
:	:	:	:	:	:
AnalysisSetup	Analysis.Setup.	true			
:	:	:	:	:	:
Dimension1	51	51	51	51	51
Dimension2	3	3	3	3	3
DataName	Vd	Vg	Index	Time	Id
DataValue	0	1	1	0.00251	0
DataValue	0.06	1	2	0.01251	3.35E-05
:	:	:	:	:	:

Table 8-10 Example of the data exported by using the filter file after modification

SetupTitle	Trng Id-Vd				
PrimitiveTest	I/V Sweep				
Dimension1	51	51	51	51	51
Dimension2	3	3	3	3	3
DataName	Vd	Vg	Index	Time	Id
DataValue	0	1	1	0.00251	0
DataValue	0.06	1	2	0.01251	3.35E-05
:	:	:	:	:	:

Table 8-11 Filter File Reference Name

Reference name	Description
sta:TestData	Indicates a test result data saved in an EasyEXPERT test result record
sta:MeasurementData	Indicates a measurement result data saved in a test result data
sta:DataVectorSet	Indicates a set of vector data saved in a measurement result data
sta:TestSetup	Indicates a test setup data saved in a test result data
sta:Title	Indicates test setup name, <i>SetupTitle</i> in export data
sta:PrimitiveTest	Indicates a classic test data set, <i>PrimitiveTest</i> in export data
sta:ApplicationTest	Indicates an application test data set, <i>ApplicationTest</i> in export data
sta:TestParameterList	Indicates a set of Test Parameters definitions, <i>TestParameter</i> in export data
sta:DutParameterList	Indicates a set of Device Parameters definitions, <i>DutParameter</i> in export data
sta:AnalysisParameterList	Indicates a set of display and analysis data, <i>AnalysisSetup</i> in export data
sta:MetaData/sta:ParameterList	Indicates a set of system data, <i>MetaData</i> in export data
sta:TerminalList	Indicates a set of terminal information
sta:Parameter	Indicates a parameter
sta:Number	Indicates an integer data
sta:Double	Indicates a real data
sta:String	Indicates a string data
sta:Boolean	Indicates a boolean data
sta:DateTime	Indicates a date time data
sta:Binary	Indicates a binary data
sta:Channel	Indicates a channel information
sta:Terminal	Indicates a terminal information
sta:Port	Indicates a port information

Table 8-12 Export Data Components for Classic Test Result

Label	Description	Example (csv output)
SetupTitle	Title of this test setup	Trng_Id_Vd
PrimitiveTest	Setup name of this classic test	I/V Sweep
TestParameter	Parameter name and setup value of Channel Setup, Measurement Setup, Function Setup, Auto Analysis Setup, and Display Setup. Data file contains a lot of rows for TestParameter. One setup item per row.	Channel.Unit, SMU1:HP, SMU2:HP, SMU3:HR, SMU4:HR
MetaData	Data for system use. Test record entry point, record time, test target, iteration index, preservation, flag, remarks, and link key.	TestRecord.EntryPoint, true
AnalysisSetup	Parameter name and setup value of the data display and analysis setup. Data file contains a lot of rows for AnalysisParameter. One setup item per row.	Analysis.Setup.Vector.Graph.Enabled, true
Dimension1	Size of data variable. For dimension 1. Order sensitive. 51 for all data variables in Example.	51, 51, 51, 51, 51
Dimension2	Size of data variable. For dimension 2. Order sensitive. 1 for all data variables in Example.	3, 3, 3, 3, 3
DataName	Measurement parameter names or data variable names. Order sensitive. For example, Vgate=-0.5 in Example.	Vd, Vg, Index, Time, Id
DataValue	Measurement result data. Order sensitive. For example, Vgate=-0.5 in Example. Data file contains a lot of rows for DataValue. One data set per row.	0, 1, 1, 0.00251, 0

Table 8-13 Export Data Components for Application Test Result

Label	Description	Example (csv output)
SetupTitle	Title of this test setup	Trng_Id_Vd
ApplicationTest	Setup name of this application test	Trng_Id_Vd, Public
TestParameter	Two rows. The upside is for the test parameter names. The downside is for the test parameter values. Order sensitive. For example, Vd=0.1 in Example.	Name, VdStart, VdStop, VdStep, VgStart, VgStop, VgStep, Vs
		Value, 0, 3, 0.06, 1, 2, 0.5, 0
DutParameter	Two rows. The upside is for the device parameter names. The downside is for the device parameter values. Order sensitive. For example, Temp=25 in Example.	Name, Polarity, Lg, Wg, Temp, IdMax
		Value, 1, 1.00E-07, 1.00E-05, 25, 0.005
MetaData	Data for system use. Test record entry point, record time, test target, iteration index, preservation, flag, remarks, and link key.	TestRecord.EntryPoint, true
AnalysisSetup	Parameter name and setup value of the data display and analysis setup. Data file contains a lot of rows for AnalysisParameter. One setup item per row.	Analysis.Setup.Vector.Graph.Enabled, true
Dimension1	Size of data variable. For dimension 1. Order sensitive. 51 for all data variables in Example.	51, 51, 51, 51, 51
Dimension2	Size of data variable. For dimension 2. Order sensitive. 1 for all data variables in Example.	3, 3, 3, 3, 3
DataName	Measurement parameter names or data variable names. Order sensitive. For example, Vgate=-0.5 in Example.	Vd, Vg, Index, Time, Id
DataValue	Measurement result data. Order sensitive. For example, Vgate=-0.5 in Example. Data file contains a lot of rows for DataValue. One data set per row.	0, 1, 1, 0.00251, 0

9

Application Library

Application Library

This chapter lists the application tests provided by EasyEXPERT. This chapter also describes the maximum measurement value and accuracy for the result data measured by using the QSCV[2] application test.

- “Application Test Definitions”
- “QSCV Maximum Measurement Value and Accuracy”

Application Test Definitions

Keysight EasyEXPERT software contains the application library which supports the several characteristic measurements listed in [Table 9-1](#). They are classified into the following categories.

- BJT
- CMOS
- Discrete
- GenericTest
- MCSMU_IV
- Memory
- MixedSignal
- NanoTech
- Organic
- PwrDevice
- Reliability
- Sample
- Solar Cell
- SPGU_PLSDIV
- Structure
- TFT
- Utility
- WGFMU
- WGFMU Utility
- WGFMU_IV
- GaN Diode
- GaN FET
- IGBT

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Application Test Definitions

- Interconnection
- MISCAP
- PMIC
- PowerBJT
- PowerDiode
- PowerMOSFET
- SiC
- GateCharge
- GateChargeUtilities
- N1272A
- N1274A
- Thermal
- MultiHVSMU
- Advanced NVM
- Utility (NVM)
- Thyristor

NOTE

All test definitions are just sample. If the samples damage your devices, Keysight Technologies is NOT LIABLE for the damage.

NOTE

If you delete a test definition

Application library should be recovered. Import the test definition by using the Import Test Definition... function of the Library button. The original test definitions are stored in the following folders.

<program folder>\Agilent\B1500\EasyEXPERT\Application Tests

<program folder>\Agilent\B1500\EasyEXPERT\Contribution\Application Tests

Table 9-1 Application Test Definitions

Category	Test definition name	Supported instrument	Required equipment and quantity
BJT	BC Diode Fwd	B1500A, E5260A, E5262A, E5263A, E5270B	SMU 2
	BC Diode Fwd [2HL]	B2901A/B, B2902A/B, B2901BL, B2911A/B, B2912A/B, B2910BL	SMU×2. See Figure 2.
	BC diode Rev	B1500A, E5260A, E5262A, E5263A, E5270B	SMU 2
	BC diode Rev [2HL]	B2901A/B, B2902A/B, B2901BL, B2911A/B, B2912A/B, B2910BL	SMU×2. See Figure 2.
	BVcbo	B1500A, E5260A, E5262A, E5263A, E5270B	SMU 2
	BVcbo [2HL]	B2901A/B, B2902A/B, B2901BL, B2911A/B, B2912A/B, B2910BL	SMU×2. See Figure 2.
	BVcei	B1500A, E5260A, E5262A, E5263A, E5270B	SMU 3
	BVceo		SMU 2
	BVceo [2HL]	B2901A/B, B2902A/B, B2901BL, B2911A/B, B2912A/B, B2910BL	SMU×2. See Figure 2.
	BVebo	B1500A, E5260A, E5262A, E5263A, E5270B	SMU 2
	BVebo [2HL]	B2901A/B, B2902A/B, B2901BL, B2911A/B, B2912A/B, B2910BL	SMU×2. See Figure 2.
	CS Diode Fwd	B1500A, E5260A, E5262A, E5263A, E5270B	SMU 2
	CS Diode Fwd [2HL]	B2901A/B, B2902A/B, B2901BL, B2911A/B, B2912A/B, B2910BL	SMU×2. See Figure 2.
	CS Diode Rev	B1500A, E5260A, E5262A, E5263A, E5270B	SMU 2
	CS Diode Rev [2HL]	B2901A/B, B2902A/B, B2901BL, B2911A/B, B2912A/B, B2910BL	SMU×2. See Figure 2.
	Cte-Freq Log	B1500A	MFCMU 1
	Cte-Vc		MFCMU 1
	Cte-Ve		MFCMU 1
	Cts		MFCMU 1
	EB Diode Fwd	B1500A, E5260A, E5262A, E5263A, E5270B	SMU 2
	EB Diode Rev		SMU 2
	EB Diode Fwd [2HL]	B2901A/B, B2902A/B, B2901BL, B2911A/B, B2912A/B, B2910BL	SMU×2. See Figure 2.
	EB Diode Rev [2HL]		SMU×2. See Figure 2.
	G-Plot ConstVce Pulse	B1500A, E5260A, E5270B	SMU 4

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Category	Test definition name	Supported instrument	Required equipment and quantity
BJT	G-Plot ConstVce Pulse[3]	B1500A, E5260A, E5262A, E5263A, E5270B	SMU 3
	G-Plot ConstVce Pulse [2HL]	B2901A/B, B2902A/B, B2901BL, B2911A/B, B2912A/B, B2910BL	SMU×2. See Figure 2.
	G-Plot ConstVce	B1500A, E5260A, E5270B	SMU 4
	G-Plot ConstVce[3]	B1500A, E5260A, E5262A, E5263A, E5270B	SMU 3
	G-Plot ConstVce [2HL]	B2901A/B, B2902A/B, B2901BL, B2911A/B, B2912A/B, B2910BL	SMU×2. See Figure 2.
	G-Plot Vbc=0V Pulse	B1500A, E5260A, E5270B	SMU 4
	G-Plot Vbc=0V Pulse[3]	B1500A, E5260A, E5262A, E5263A, E5270B	SMU 3
	G-Plot Vbc=0V Pulse [2HL]	B2901A/B, B2902A/B, B2901BL, B2911A/B, B2912A/B, B2910BL	SMU×2. See Figure 2.
	G-Plot Vbc=0V	B1500A, E5260A, E5270B	SMU 4
	G-Plot Vbc=0V[3]	B1500A, E5260A, E5262A, E5263A, E5270B	SMU 3
	G-Plot Vbc=0V [2HL]	B2901A/B, B2902A/B, B2901BL, B2911A/B, B2912A/B, B2910BL	SMU×2. See Figure 2.
	hfe-Vbe ConstVce	B1500A, E5260A, E5270B	SMU 4
	hfe-Vbe Vbc=0V		SMU 4
	Ic-Vc Ib		SMU 4
	Ic-Vc Ib[3]	B1500A, E5260A, E5262A, E5263A, E5270B	SMU 3
	Ic-Vc Ib [2HL]	B2901A/B, B2902A/B, B2901BL, B2911A/B, B2912A/B, B2910BL	SMU×2. See Figure 2.
	Ic-Vc Pulse Ib	B1500A, E5260A, E5270B	SMU 4
	Ic-Vc Pulse Ib[3]	B1500A, E5260A, E5262A, E5263A, E5270B	SMU 3
	Ic-Vc Pulse Ib [2HL]	B2901A/B, B2902A/B, B2901BL, B2911A/B, B2912A/B, B2910BL	SMU×2. See Figure 2.
	Ic-Vc Pulse Vb	B1500A, E5260A, E5270B	SMU 4
	Ic-Vc Pulse Vb[3]	B1500A, E5260A, E5262A, E5263A, E5270B	SMU 3
	Ic-Vc Pulse Vb [2HL]	B2901A/B, B2902A/B, B2901BL, B2911A/B, B2912A/B, B2910BL	SMU×2. See Figure 2.
	Ic-Vc Vb	B1500A, E5260A, E5270B	SMU 4
	Ic-Vc Vb[3]	B1500A, E5260A, E5262A, E5263A, E5270B	SMU 3

Category	Test definition name	Supported instrument	Required equipment and quantity	
BJT	Ic-Vc Vb [2HL]	B2901A/B, B2902A/B, B2901BL, B2911A/B, B2912A/B, B2910BL	SMU×2. See Figure 2.	
	Rb	B1500A, E5260A, E5270B	SMU 4	
	Rb [2HL]	B2901A/B, B2902A/B, B2901BL, B2911A/B, B2912A/B, B2910BL	SMU×2. See Figure 2.	
	Re+Rc	B1500A, E5260A, E5270B	SMU 4	
	Re		SMU 4	
	Simple Gummel Plot	B1500A, E5260A, E5262A, E5263A, E5270B	SMU 3	
	Simple Gummel Plot [2HL]	B2901A/B, B2902A/B, B2901BL, B2911A/B, B2912A/B, B2910BL	SMU×2. See Figure 2.	
	Vbe-Le	B1500A, E5260A, E5270B	SMU 4, B2200A/B2201A 1	
	Vbe-We		SMU 4, B2200A/B2201A 1	
CMOS	BVdss	B1500A, E5260A, E5270B	SMU 4	
	BVdss [2HL]	B2901A/B, B2902A/B, B2901BL, B2911A/B, B2912A/B, B2910BL	SMU×2. See Figure 2.	
	BVgso	B1500A, E5260A, E5262A, E5263A, E5270B	SMU 3	
	BVgso [2HL]	B2901A/B, B2902A/B, B2901BL, B2911A/B, B2912A/B, B2910BL	SMU×2. See Figure 2.	
	Cgb-AC Level	B1500A	MFCMU 1, SMU 1	
	Cgb-Freq Log		MFCMU 1, SMU 1	
	Cgb-Vg HighVoltage		MFCMU 1, SMU 3, SCUU 1, GSWU 1	
	Cgb-Vg		MFCMU 1, SMU 1	
	Cgc-Freq Log		MFCMU 1, SMU 1	
	Cgc-Vg		MFCMU 1, SMU 1	
	Cgg-Freq Linear		MFCMU 1	
	Cgg-Freq Log		MFCMU 1	
	Cgg-Vg 2Freq		MFCMU 1	
	Cgg-Vg		MFCMU 1	
	IdRdsGds		B1500A, E5260A, E5270B	SMU 4
	Id-Vd pulse			SMU 4
	IdRdsGds [2HL]	B2901A/B, B2902A/B, B2901BL, B2911A/B, B2912A/B, B2910BL	SMU×2. See Figure 2.	
	Id-Vd pulse [2HL]		SMU×2. See Figure 2.	
	Id-Vd pulse[3]	B1500A, E5260A, E5262A, E5263A, E5270B	SMU 3	
	Id-Vd	B1500A, E5260A, E5270B	SMU 4	

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Category	Test definition name	Supported instrument	Required equipment and quantity
CMOS	Id-Vd[3]	B1500A, E5260A, E5262A, E5263A, E5270B	SMU 3
	Id-Vd [2HL]	B2901A/B, B2902A/B, B2901BL, B2911A/B, B2912A/B, B2910BL	SMU×2. See Figure 2.
	Id-Vg pulse	B1500A, E5260A, E5270B	SMU 4
	Id-Vg Vpulse[3]	B1500A, E5260A, E5262A, E5263A, E5270B	SMU 3
	Id-Vg	B1500A, E5260A, E5270B	SMU 4
	Id-Vg[3]	B1500A, E5260A, E5262A, E5263A, E5270B	SMU 3
	IonIoffSlope	B1500A, E5260A, E5270B	SMU 4
	IonIoffSlope [2HL]	B2901A/B, B2902A/B, B2901BL, B2911A/B, B2912A/B, B2910BL	SMU×2. See Figure 2.
	Isub-Vg	B1500A, E5260A, E5270B	SMU 4
	QSCV[4]	B1500A, B1505A	SMU 5
	Simple Cgb	B1500A	MFCMU 1
	Simple Vth	B1500A, E5260A, E5270B	SMU 4
	Simple Vth [2HL]	B2901A/B, B2902A/B, B2901BL, B2911A/B, B2912A/B, B2910BL	SMU×2. See Figure 2.
	Vth Const Id	B1500A, E5260A, E5270B	SMU 4
	Vth Const Id [2HL]	B2901A/B, B2902A/B, B2901BL, B2911A/B, B2912A/B, B2910BL	SMU×2. See Figure 2.
	Vth gmMax	B1500A, E5260A, E5270B	SMU 4
	Vth gmMax [2HL]	B2901A/B, B2902A/B, B2901BL, B2911A/B, B2912A/B, B2910BL	SMU×2. See Figure 2.
	Vth gmMax and Id	B1500A, E5260A, E5270B	SMU 4
	VthAndCgg-Vg ASU	B1500A	MFCMU 1, SMU 1, ASU+SMU 2
	VthAndCgg-Vg SCUU		MFCMU 1, SMU 3, SCUU 1, GSWU 1
Vth-Lg	B1500A, E5260A, E5270B	SMU 4, B2200A/B2201A 1	
Vth-Wg		SMU 4, B2200A/B2201A 1	
Discrete	BJT GummelPlot	B1500A, E5260A, E5262A, E5263A, E5270B	SMU 3
	BJT Ic-Vc Ib		SMU 3
	BJT Ic-Vc Ib [2HL]	B2901A/B, B2902A/B, B2901BL, B2911A/B, B2912A/B, B2910BL	SMU×2. See Figure 2.
	Diode IV Fwd	B1500A, E5260A, E5262A, E5263A, E5270B	SMU 2
	Diode IV Fwd [1HL]	B2901A/B, B2902A/B, B2901BL, B2911A/B, B2912A/B, B2910BL	SMU×1. See Figure 1.

Category	Test definition name	Supported instrument	Required equipment and quantity
Discrete	Diode IV Rev	B1500A, E5260A, E5262A, E5263A, E5270B	SMU 2
	Diode IV Rev [1HL]	B2901A/B, B2902A/B, B2901BL, B2911A/B, B2912A/B, B2910BL	SMU×1. See Figure 1.
	FET Id-Vd	B1500A, E5260A, E5262A, E5263A, E5270B	SMU 3
	FET Id-Vd [2HL]	B2901A/B, B2902A/B, B2901BL, B2911A/B, B2912A/B, B2910BL	SMU×2. See Figure 2.
	FET Id-Vg	B1500A, E5260A, E5262A, E5263A, E5270B	SMU 3
	FET Id-Vg [2HL]	B2901A/B, B2902A/B, B2901BL, B2911A/B, B2912A/B, B2910BL	SMU×2. See Figure 2.
GenericTest	Generic C-f	B1500A, B1505A, B1506A	MFCMU 1
	Generic C-t		MFCMU 1
Memory	Flash Ccf-V	B1500A	MFCMU 1
	Flash Cgg-Vcg		MFCMU 1
	Flash Cfb-V		MFCMU 1
	NandFlash2 Endurance 3devices		SMU 3, B2200A/B2201A 1, 81110A (2 outputs) 1
	NandFlash2 Endurance		ASU+SMU 3, 81110A (2 outputs) 1
	NandFlash2 IV-Erase-IV		SMU 1, ASU+SMU 2, 81110A (2 outputs) 1
	NandFlash2 IV-Write-IV		SMU 2, ASU+SMU 1, 81110A (2 outputs) 1
	NandFlash2 Retention(ErasedCell)		SMU 1, ASU+SMU 2, 81110A (2 outputs) 1
	NandFlash2 Retention(WrittenCell)		SMU 2, ASU+SMU 1, 81110A (2 outputs) 1
	NandFlash2 Vth(ErasingTimeDependence)		SMU 1, ASU+SMU 2, 81110A (2 outputs) 1
	NandFlash2 Vth(WritingTimeDependence)		SMU 2, ASU+SMU 1, 81110A (2 outputs) 1
	NandFlash2 WordDisturb(ErasedCell)		ASU+SMU 3, 81110A (2 outputs) 1
	NandFlash2 WordDisturb(WrittenCell)		SMU 2, ASU+SMU 1, 81110A (2 outputs) 1
	NandFlash3 Endurance		[SPGU 1, ASU+SMU 3] or [SPGU 1, SMU 3, 16440A/16445A 2]
	NandFlash3 IV-Erase-IV		[SPGU 1, SMU 1, ASU+SMU 2] or [SPGU 1, SMU 3, 16440A/16445A 1]

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Category	Test definition name	Supported instrument	Required equipment and quantity
Memory	NandFlash3 IV-Write-IV	B1500A	[SPGU 1, SMU 2, ASU+SMU 1] or [SPGU 1, SMU 3, 16440A/16445A 1]
	NandFlash3 Retention(ErasedCell)		[SPGU 1, SMU 1, ASU+SMU 2] or [SPGU 1, SMU 3, 16440A/16445A 1]
	NandFlash3 Retention(WrittenCell)		[SPGU 1, SMU 2, ASU+SMU 1] or [SPGU 1, SMU 3, 16440A/16445A 1]
	NandFlash3 Vth(ErasingTimeDependence)		[SPGU 1, SMU 1, ASU+SMU 2] or [SPGU 1, SMU 3, 16440A/16445A 1]
	NandFlash3 Vth(WritingTimeDependence)		[SPGU 1, SMU 2, ASU+SMU 1] or [SPGU 1, SMU 3, 16440A/16445A 1]
	NandFlash3 WordDisturb(ErasedCell)		[SPGU 1, ASU+SMU 3] or [SPGU 1, SMU 3, 16440A/16445A 2]
	NandFlash3 WordDisturb(WrittenCell)		[SPGU 1, SMU 2, ASU+SMU 1] or [SPGU 1, SMU 3, 16440A/16445A 1]
	NorFlash Endurance		[SPGU 2, SMU 1, ASU+SMU 3] or [SPGU 2, SMU 4, 16440A/16445A 2]
	NorFlash IV-Erase-IV		[SPGU 1, SMU 2, ASU+SMU 2] or [SPGU 1, SMU 4, 16440A/16445A 1]
	NorFlash IV-Write-IV		[SPGU 1, SMU 2, ASU+SMU 2] or [SPGU 1, SMU 4, 16440A/16445A 1]
	NorFlash Retention(ErasedCell)		[SPGU 1, SMU 2, ASU+SMU 2] or [SPGU 1, SMU 4, 16440A/16445A 1]
	NorFlash Retention(WrittenCell)		[SPGU 1, SMU 2, ASU+SMU 2] or [SPGU 1, SMU 4, 16440A/16445A 1]
	NorFlash Vth(ErasingTimeDependence)		[SPGU 1, SMU 2, ASU+SMU 2] or [SPGU 1, SMU 4, 16440A/16445A 1]
	NorFlash Vth(WritingTimeDependence)		[SPGU 1, SMU 2, ASU+SMU 2] or [SPGU 1, SMU 4, 16440A/16445A 1]
	NorFlash WordDisturb(ErasedCell)		[SPGU 1, SMU 2, ASU+SMU 2] or [SPGU 1, SMU 4, 16440A/16445A 1]
	NorFlash WordDisturb(WrittenCell)		[SPGU 1, SMU 2, ASU+SMU 2] or [SPGU 1, SMU 4, 16440A/16445A 1]
	NorFlash DataDisturb(ErasedCell)		[SPGU 2, SMU 1, ASU+SMU 3] or [SPGU 2, SMU 4, 16440A/16445A 2]
NorFlash DataDisturb(WrittenCell)	[SPGU 1, SMU 2, ASU+SMU 2] or [SPGU 1, SMU 4, 16440A/16445A 1]		
MixedSignal	BJT Varactor CV Mismatch	B1500A	MFCMU 1
	Diff-R Mismatch	B1500A, E5260A, E5270B	SMU 8
	Diode IV Fwd Mismatch	B1500A, E5260A, E5262A, E5263A, E5270B	SMU 3
	Diode IV Rev Mismatch		SMU 3

Category	Test definition name	Supported instrument	Required equipment and quantity
MixedSignal	G-Plot ConstVce Mismatch	B1500A, E5260A, E5270B	SMU 6
	G-Plot ConstVce Mismatch[3]		SMU 5
	G-Plot Vbc=0V Mismatch		SMU 6
	G-Plot Vbc=0V Mismatch[3]	B1500A, E5260A, E5270B	SMU 5
	Ic-Vc Ib Mismatch		SMU 6
	Ic-Vc Ib Mismatch[3]		SMU 5
	Ic-Vc Vb Mismatch		SMU 6
	Ic-Vc Vb Mismatch[3]		SMU 5
	Id-Vd Mismatch		SMU 5
	Id-Vd Mismatch[3]		SMU 4
	Id-Vg Mismatch		SMU 5
	Id-Vg Mismatch[3]		SMU 4
	MIM CV Mismatch		B1500A
	MOS Varactor CV Mismatch	MFCMU 1	
	Poly-R Mismatch	B1500A, E5260A, E5270B	SMU 7
NanoTech	CNT Differential R[AC]	B1500A	MFCMU 1
	CNT Gate Leak	B1500A, E5260A, E5262A, E5263A, E5270B	SMU 2
	CNT Gate Leak [1HL]	B2901A/B, B2902A/B, B2901BL, B2911A/B, B2912A/B, B2910BL	SMU×1. See Figure 1.
	CNT Id-Time	B1500A, E5260A, E5270B	SMU 4
	CNT Id-Time [2HL]	B2901A/B, B2902A/B, B2901BL, B2911A/B, B2912A/B, B2910BL	SMU×2. See Figure 2.
	CNT Id_Vd	B1500A, E5260A, E5270B	SMU 4
	CNT Id_Vd [2HL]	B2901A/B, B2902A/B, B2901BL, B2911A/B, B2912A/B, B2910BL	SMU×2. See Figure 2.
	CNT Id_Vg	B1500A, E5260A, E5270B	SMU 4
	CNT Id_Vg [2HL]	B2901A/B, B2902A/B, B2901BL, B2911A/B, B2912A/B, B2910BL	SMU×2. See Figure 2.
	CNT Id-Vg-Time	B1500A, E5260A, E5270B	SMU 4
	CNT Id-Vg-Time [2HL]	B2901A/B, B2902A/B, B2901BL, B2911A/B, B2912A/B, B2910BL	SMU×2. See Figure 2.
	CNT IV Sweep	B1500A, E5260A, E5262A, E5263A, E5270B	SMU 2
	CNT IV Sweep [1HL]	B2901A/B, B2902A/B, B2901BL, B2911A/B, B2912A/B, B2910BL	SMU×1. See Figure 1.

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Category	Test definition name	Supported instrument	Required equipment and quantity
NanoTech	CNT R-I Kelvin 2SMU	B1500A, E5260A, E5262A, E5263A, E5270B	SMU 2
	CNT R-V Kelvin 2SMU		SMU 2
	CNT Vth gmMax	B1500A, E5260A, E5270B	SMU 4
	CNT Vth gmMax [2HL]	B2901A/B, B2902A/B, B2901BL, B2911A/B, B2912A/B, B2910BL	SMU×2. See Figure 2.
PwrDevice	BVdss[3] PwrDevice	B1500A, E5260A, E5262A, E5263A, E5270B	SMU 3
	BVgso[3] PwrDevice		SMU 2
	Id-Vd pulse[3] PwrDevice		SMU 3
	Id-Vd[3] PwrDevice		SMU 3
	Id-Vg pulse[3] PwrDevice		SMU 3
	Id-Vg[3] PwrDevice		SMU 3
	Vth Const Id[3] PwrDevice		SMU 3
	Vth gmMax[3] PwrDevice		SMU 3
Reliability	BJT EB RevStress 3devices	B1500A, E5260A, E5270B	SMU 6, B2200A/B2201A 1
	BJT EB RevStress 3devices[3]		SMU 5, B2200A/B2201A 1
	BJT EB RevStress		SMU 4
	BJT EB RevStress2		SMU 4
	BJT EB RevStress[3]	B1500A, E5260A, E5262A, E5263A, E5270B	SMU 3
	BJT EB RevStress2[3]		SMU 3
	BTI 3devices	B1500A, E5260A, E5270B	SMU 5, B2200A/B2201A 1
	BTI 3devices[3]		SMU 5, B2200A/B2201A 1
	BTI		SMU 4
	BTI2		SMU 4
	BTI[3]	B1500A, E5260A, E5262A, E5263A, E5270B	SMU 3
	BTI2[3]		SMU 3
	Charge Pumping	B1500A	SMU 2, 81110A (2 outputs) 1
	Charge Pumping2		SMU 2, SPGU 1
	EM Istress	B1500A, E5260A, E5270B	SMU 4
	EM Istress2		SMU 4
	EM Istress[2]	B1500A, E5260A, E5262A, E5263A, E5270B	SMU 2
	EM Istress2[2]		SMU 2
	EM Istress[6]	B1500A, E5260A, E5270B	SMU 6
	EM Istress2[6]		SMU 6
EM Vstress	SMU 4		
EM Vstress2	SMU 4		

Category	Test definition name	Supported instrument	Required equipment and quantity
Reliability	EM Vstress[2]	B1500A, E5260A, E5262A, E5263A, E5270B	SMU 2
	EM Vstress2[2]		SMU 2
	EM Vstress[6]	B1500A, E5260A, E5270B	SMU 6
	EM Vstress2[6]		SMU 6
	HCI 3devices		SMU 8
	HCI		SMU 4
	HCI2		SMU 4
	J-Ramp		B1500A, E5260A, E5262A, E5263A, E5270B
	TDDB Istress 3devices	B1500A, E5260A, E5270B	SMU 4
	TDDB Istress2 3devices		SMU 4
	TDDB Istress	B1500A, E5260A, E5262A, E5263A, E5270B	SMU 2
	TDDB Istress2		SMU 2
	TDDB Vstress 3devices	B1500A, E5260A, E5270B	SMU 4
	TDDB Vstress2 3devices		SMU 4
	TDDB Vstress	B1500A, E5260A, E5262A, E5263A, E5270B	SMU 2
	TDDB Vstress2		SMU 2
	Timing On-the-fly NBTI	B1500A, E5260A, E5270B	SMU 4
	Timing On-the-fly NBTI -Mch	B1500A	SMU 4 or SMU 7
	TZDB	B1500A, E5260A, E5262A, E5263A, E5270B	SMU 2
	V-Ramp		SMU 2
Structure	BVgb ThinOx	B1500A, E5260A, E5262A, E5263A, E5270B	SMU 2
	BVgb ThinOx [1HL]	B2901A/B, B2902A/B, B2901BL, B2911A/B, B2912A/B, B2910BL	SMU×1. See Figure 1.
	BVgb	B1500A, E5260A, E5262A, E5263A, E5270B	SMU 2
	BVgb [1HL]	B2901A/B, B2902A/B, B2901BL, B2911A/B, B2912A/B, B2910BL	SMU×1. See Figure 1.
	Cgb-Freq[2] Log	B1500A	MFCMU 1
	Cgb-Vg 2Freq		MFCMU 1
	Cgb-Vg[2]		MFCMU 1
	Cj-Freq Log		MFCMU 1
	Cj-V		MFCMU 1
	Diode BVAndCj-V ASU		MFCMU 1, ASU+SMU 2
	Diode BVAndCj-V SCUU		MFCMU 1, SMU 2, SCUU 1, GSWU 1

Application Library
Application Test Definitions

Category	Test definition name	Supported instrument	Required equipment and quantity
Structure	Ig-Vg Iforce	B1500A, E5260A, E5262A, E5263A, E5270B	SMU 2
	Ig-Vg Iforce [1HL]	B2901A/B, B2902A/B, B2901BL, B2911A/B, B2912A/B, B2910BL	SMU×1. See Figure 1.
	Ig-Vg Vforce	B1500A, E5260A, E5262A, E5263A, E5270B	SMU 2
	Ig-Vg Vforce [1HL]	B2901A/B, B2902A/B, B2901BL, B2911A/B, B2912A/B, B2910BL	SMU×1. See Figure 1.
	Interconnect CouplingCap	B1500A	MFCMU 1
	Interconnect OverlapCap		MFCMU 1
	Junction BV	B1500A, E5260A, E5262A, E5263A, E5270B	SMU 2
	Junction BV [1HL]	B2901A/B, B2902A/B, B2901BL, B2911A/B, B2912A/B, B2910BL	SMU×1. See Figure 1.
	Junction DcParam	B1500A, E5260A, E5262A, E5263A, E5270B	SMU 2
	Junction DcParam [1HL]	B2901A/B, B2902A/B, B2901BL, B2911A/B, B2912A/B, B2910BL	SMU×1. See Figure 1.
	Junction IV Fwd	B1500A, E5260A, E5262A, E5263A, E5270B	SMU 2
	Junction IV Fwd [1HL]	B2901A/B, B2902A/B, B2901BL, B2911A/B, B2912A/B, B2910BL	SMU×1. See Figure 1.
	Junction IV Rev	B1500A, E5260A, E5262A, E5263A, E5270B	SMU 2
	Junction IV Rev [1HL]	B2901A/B, B2902A/B, B2901BL, B2911A/B, B2912A/B, B2910BL	SMU×1. See Figure 1.
	QSCV[2]	B1500A, B1505A	SMU 3
	QSCV C Offset Meas		SMU 2
	Rdiff-I kelvin	B1500A, E5260A, E5270B	SMU 5
	Rdiff-I	B1500A, E5260A, E5262A, E5263A, E5270B	SMU 3
	Rdiff-I [2HL]	B2901A/B, B2902A/B, B2901BL, B2911A/B, B2912A/B, B2910BL	SMU×2. See Figure 2.
	Rdiff-V	B1500A, E5260A, E5262A, E5263A, E5270B	SMU 3
	Rdiff-V [2HL]	B2901A/B, B2902A/B, B2901BL, B2911A/B, B2912A/B, B2910BL	SMU×2. See Figure 2.
	Rdiff-V kelvin	B1500A, E5260A, E5270B	SMU 5
	R-I DVM	B1500A, E5260A, E5262A, E5263A, E5270B	SMU 2, 3458A 1

Category	Test definition name	Supported instrument	Required equipment and quantity
Structure	R-I kelvin	B1500A, E5260A, E5270B	SMU 4
	R-I kelvin [2HL]	B2901A/B, B2902A/B, B2901BL, B2911A/B, B2912A/B, B2910BL	SMU×2. See Figure 2.
	R-I	B1500A, E5260A, E5262A, E5263A, E5270B	SMU 2
	R-I [1HL]	B2901A/B, B2902A/B, B2901BL, B2911A/B, B2912A/B, B2910BL	SMU×1. See Figure 1.
	R-V DVM	B1500A, E5260A, E5262A, E5263A, E5270B	SMU 2, 3458A 1
	R-V kelvin	B1500A, E5260A, E5270B	SMU 4
	R-V kelvin [2HL]	B2901A/B, B2902A/B, B2901BL, B2911A/B, B2912A/B, B2910BL	SMU×2. See Figure 2.
	R-V	B1500A, E5260A, E5262A, E5263A, E5270B	SMU 2
	R-V [1HL]	B2901A/B, B2902A/B, B2901BL, B2911A/B, B2912A/B, B2910BL	SMU
	VanDerPauw Square	B1500A, E5260A, E5270B	SMU 4
	VanDerPauw Square [2HL]	B2901A/B, B2902A/B, B2901BL, B2911A/B, B2912A/B, B2910BL	SMU×2. See Figure 2.
	Van Der Pau NonUniform	B1500A	SMU 4
	Utility (Auxiliary) ^a	Van Der Pau NonUniform Child Calc Rs	
TFT	TFT Id-Vd	B1500A, E5260A, E5262A, E5263A, E5270B	SMU 3
	TFT Id-Vg		SMU 3
Utility	CV Curve Parameter Calculator		
	CVSweep4284_a		4284A 1 or E4980A 1
	ForcePG1		81110A (2 outputs) 1
	ForcePG2		81110A (2 outputs) 1
	ForcePG2P		81110A (2 outputs) 1
	ForcePG12		81110A (2 outputs) 1
	ForcePG		81110A (2 outputs) 1
	ForcePGC		81110A (2 outputs) 1
	Measure Diff-V		3458A 1
	QSCV C Offset Meas		B1500A, B1505A
	ResetPG		81110A (2 outputs) 1
	Subsite move		Wafer prober 1
	TSet_T2420		Thermonics T-2420

Application Library
Application Test Definitions

Category	Test definition name	Supported instrument	Required equipment and quantity
Power MOSFET	Vds-Vgs	B1505A, B1506A	HCSMU 1, SMU 1
	Id-Vgs for Expanders		N1265A 1, MC/HCSMU 2, SMU 1
	TDDB Constant V		SMU 1
	Ciss (N1272A)		MPSMU 1, HVSMU 1, MFCMU 1
	Coss (N1272A)		MPSMU 1, HVSMU 1, MFCMU 1
	Crss (N1272A)		MPSMU 1, HVSMU 1, MFCMU 1
	Cgs (N1272A)		MPSMU 1, HVSMU 1, MFCMU 1
	Cds (N1272A)		MPSMU 1, HVSMU 1, MFCMU 1
	Cgd (N1272A)		MPSMU 1, HVSMU 1, MFCMU 1
	Rg(N1272A) for PowerMOSFET		MPSMU 1, HVSMU 1, MFCMU 1
	Ciss-Vgs (N1272A)		MPSMU 1, HVSMU 1, MFCMU 1
	IDSS (N1272A)		MPSMU 1, HVSMU 1
	IGSS (N1272A)		MPSMU 1, HVSMU 1
MCSMU_IV	Id-Vds MCSMU	B1500A	[[MCSMU 1 and MP/HP/HRSMU 1] or MCSMU 2] and [MP/HP/HRSMU 2 or [MP/HP/HRSMU 1 and GNDU]]
	Id-Vgs MCSMU		
	Id-Vgs MCSMU 2-stage		
Organic	2-terminal dual Vsweep	B1500A	[SMU 1 and GNDU] or SMU 2
	2-terminal dual Vsweep [1HL]	B2901A/B, B2902A/B, B2901BL, B2911A/B, B2912A/B, B2910BL	SMU×1. See Figure 1.
Sample	Vth gmMax and Id	B1500A, B5260A, E5270B	SMU 4
	Vth gmMax and Id [2HL]	B2901A/B, B2902A/B, B2901BL, B2911A/B, B2912A/B, B2910BL	SMU×2. See Figure 2.
Solar Cell	Solar Cell IV	B1500A	[SMU 1 and GNDU] or SMU 2
	Solar Cell IV [1HL]	B2901A/B, B2902A/B, B2901BL, B2911A/B, B2912A/B, B2910BL	SMU×1. See Figure 1.
	Solar Cell IV Fwd	B1500A	[SMU 1 and GNDU] or SMU 2
	Solar Cell IV Fwd [1HL]	B2901A/B, B2902A/B, B2901BL, B2911A/B, B2912A/B, B2910BL	SMU×1. See Figure 1.
	Solar Cell IV Rev	B1500A	[SMU 1 and GNDU] or SMU 2
	Solar Cell IV Rev [1HL]	B2901A/B, B2902A/B, B2901BL, B2911A/B, B2912A/B, B2910BL	SMU×1. See Figure 1.

Category	Test definition name	Supported instrument	Required equipment and quantity
Solar Cell	Solar Cell Cp-V	B1500A	MFCMU 1
	Solar Cell Nc-W		MFCMU 1
	Solar Cell Cp-Freq Log		MFCMU 1
	Solar Cell Nyquist Plot		MFCMU 1
	Solar Cell Cp-AC Level		MFCMU 1
	Solar Cell DLCP		MFCMU 1
SPGU_ PLSDIV	SPGU PLSDIV	B1500A	SPGU 1
	SPGU PLSDIV Id-Vd		SPGU 1
	SPGU PLSDIV Id-Vg		SPGU 1
WGFMU (needs test definitions of WGFMU Utility)	Fast BTI(ACstress Id-Sampling)	B1500A	WGFMU 1, RSU 2
	Fast BTI(DCstress Id-Sampling)		WGFMU 1, RSU 2
	Fast BTI(ACstress Id-Vg)		WGFMU 1, RSU 2
	Fast BTI(DCstress Id-Vg)		WGFMU 1, RSU 2
	TRANSIV DC IdVd		SMU 2, WGFMU 1, RSU 2
	TRANSIV DC IdVg		SMU 2, WGFMU 1, RSU 2
	WGFMU Pattern Editor		WGFMU 1, RSU 2
WGFMU Utility ^a	Fast BTI Id-Sampling child	B1500A	WGFMU 1, RSU 2
	Fast BTI Id-Sampling child2		WGFMU 1, RSU 2
	Fast BTI Id-Vg child		WGFMU 1, RSU 2
	Fast BTI Id-Vg child2		WGFMU 1, RSU 2
	Fast BTI Pattern Editor Child DataDisplay		WGFMU 1, RSU 2
WGFMU_IV	WGFMU DCIV	B1500A	WGFMU 1, RSU 2
	WGFMU PLSDIV		WGFMU 1, RSU 2
	WGFMU Id-Vd (DC)		WGFMU 1, RSU 2
	WGFMU Id-Vg (DC)		WGFMU 1, RSU 2
	WGFMU Id-Vd pulse		WGFMU 1, RSU 2
	WGFMU Id-Vg pulse		WGFMU 1, RSU 2
GaN Diode	Diode Current Collapse IV-t Sampling	B1505A	N1267A 1, HVSMU 1, HCSMU 1, MCSMU 1
	Diode Current Collapse Signal Monitor		N1267A 1, HVSMU 1, HCSMU 1, MCSMU 1

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Application Test Definitions

Category	Test definition name	Supported instrument	Required equipment and quantity
GaN FET	FET Current Collapse IV-t Sampling (I Force)	B1505A	N1267A 1, HVSMU 1, HCSMU 1, MCSMU 2, SMU 1
	FET Current Collapse IV-t Sampling		N1267A 1, HVSMU 1, HCSMU 1, MCSMU 2, SMU 1
	FET Current Collapse Signal Monitor (I Force)		N1267A 1, HVSMU 1, HCSMU 1, MCSMU 2, SMU 1
	FET Current Collapse Signal Monitor		N1267A 1, HVSMU 1, HCSMU 1, MCSMU 2, SMU 1
	Id-Vds Current Collapse		N1267A 1, HVSMU 1, HCSMU 1, MCSMU 2, SMU 1
	Id-Vds Current Collapse (Pulse)		N1267A 1, HVSMU 1, HCSMU 1, MCSMU 2, SMU 1
IGBT	Cce	B1505A, B1506A	MFCMU 1, HVSMU 1, Bias-T 1
	Cgc		MFCMU 1, HVSMU 1, Bias-T 1
	Cge		MFCMU 1, Bias-T 1 or N1259A with 020
	Cge-Vge		MFCMU 1
	Ic(off)-Vce		SMU 2
	Ic-Vce		[HCSMU 1 and SMU 1] or SMU 2
	Ic-Vge		[HCSMU 1 and SMU 1] or SMU 2
	Vce(sat)		[HCSMU 1 and SMU 1] or SMU 2
	Vth Vge(off)		[HCSMU 1 and SMU 1] or SMU 2
	Vce-Vge		HCSMU 1, SMU 1
	Ic-Vge for Expanders		N1265A 1, MC/HCSMU 2, SMU 1
	Cies (N1272A)		MPSMU 1, HVSMU 1, MFCMU 1
	Coes (N1272A)		MPSMU 1, HVSMU 1, MFCMU 1
	Cres (N1272A)		MPSMU 1, HVSMU 1, MFCMU 1
	Cge (N1272A)		MPSMU 1, HVSMU 1, MFCMU 1
	Cce (N1272A)		MPSMU 1, HVSMU 1, MFCMU 1
	Cgc (N1272A)		MPSMU 1, HVSMU 1, MFCMU 1
	Cies-Vge (N1272A)		MPSMU 1, HVSMU 1, MFCMU 1
	Rg (N1272A) for IGBT		MPSMU 1, HVSMU 1, MFCMU 1
	ICES (N1272A)		MPSMU 1, HVSMU 1
	IGES (N1272A)		MPSMU 1, HVSMU 1
Interconnection	Residual R	B1505A, B1506A	HCSMU 1 or SMU 1

Category	Test definition name	Supported instrument	Required equipment and quantity
MISCAP	BV	B1505A, B1506A	SMU 1
	C(MISCAP)		MFCMU 1
	Ileak-V		SMU 1
PowerBJT	Ic-Vcbo	B1505A, B1506A	SMU 1
	Ic-Vce(PowerBJT)		[HCSMU 1 and SMU 1] or SMU/HCSMU 2
	Ic-Vceo		SMU 1
	Ic-Vces		SMU 2
	Ie-Vebo		SMU 1
	Vce(sat)-Ic		[HCSMU 1 and SMU 1] or SMU/HCSMU 2
	G-Plot for Expanders		N1265A 1, MC/HCSMU 2, SMU 1
	Ic-Ib for Expanders		N1265A 1, MC/HCSMU 2, SMU 1
PowerDiode	Cj-Vr	B1505A, B1506A	MFCMU 1, HVSMU 1, Bias-T 1
	If-Vf		HCSMU 1 or SMU 1
	Ir-Vr		SMU 1
	Vf		HCSMU 1 or SMU 1
	CT (N1272A)		MPSMU 1, HVSMU 1, MFCMU 1
	IR (N1272A)		MPSMU 1, HVSMU 1
GateCharge Utilities ^a	Qg(High Id Switching)	B1505A, B1506A	UHCU/HCSMU 1, MCSMU 2
	Qg(High Vds Switching)		MCSMU 1, HVSMU 1
	Qg(High Ic Switching)		UHCU/HCSMU 1, MCSMU 2
	Qg(High Vce Switching)		MCSMU 2, HVSMU 1
N1272A	N1272ACheckBreakdown ^a	B1505A, B1506A	N1272A, MPSMU 1, HVSMU 1
	IV Path (N1272A)		N1272A
N1274A	IV Path (N1274A)	B1505A	N1274A

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Application Test Definitions

Category	Test definition name	Supported instrument	Required equipment and quantity
Thermal	N1265A WaitTemperature	B1505A, B1506A	ThermoStream
	ThermoStream ControlTemperature		ThermoStream
	ThermoStream DefineParameters		ThermoStream
	ThermoStream FlowOff		ThermoStream
	ThermoStream Initialize		ThermoStream
	ThermoStream ReadTemperature		ThermoStream
	ThermoStream WaitReady		ThermoStream
	ThermoStream WaitTemperature		ThermoStream
	ThermalPlate Initialize		Thermal Plate
	ThermalPlate DefineParabeters		Thermal Plate
Thermal	ThermalPlate ControlTemperature	B1505A, B1506A	Thermal Plate
	ThermalPlate WaitTemperature		Thermal Plate
	ThermalPlate ReadTemperature		Thermal Plate
MultiHVSMU	Switch HVSMU Output Mode	B1505A	HVSMU
Advanced NVM (needs test definitions of Utility (NVM))	FERAM Hysteresis	B1500A	WGFMU 1, RSU 2
	FERAM PUND		WGFMU 1, RSU 2
	FERAM Endurance		WGFMU 1, RSU 2
	ReRAM IV-Butterfly		SMU 2 (3 for current limit control option), WGFMU 1, RSU 2, GNDU
	ReRAM FORM		WGFMU 1, RSU 2, SMU 1 (Optional)
	ReRAM Set ResetV-Loop		WGFMU 1, RSU 2, SMU 1 (Optional)
	ReRAM Reset SetV-Loop		WGFMU 1, RSU 2, SMU 1 (Optional)
	ReRAM Reset-Set		WGFMU 1, RSU 2, SMU 1 (Optional)
	ReRAM Endurance		WGFMU 1, RSU 2, SMU 1 (Optional)
	PCRAM Reset-Set		WGFMU 1, RSU 2, SPGU 1
	PCRAM ResetV-Loop		WGFMU 1, RSU 2, SPGU 1
	PCRAM SetV-Loop		WGFMU 1, RSU 2, SPGU 1
	PCRAM Endurance		WGFMU 1, RSU 2, SPGU 1

Category	Test definition name	Supported instrument	Required equipment and quantity
Utility (NVM) ^a	FERAM Psw Qsw Graph	B1500A	WGFMU 1, RSU 2
	FERAM PUND Stress		WGFMU 1, RSU 2
	FERAM PUND Sub		WGFMU 1, RSU 2
	ReRAM RESET Graph		WGFMU 1, RSU 2, SMU 1 (Optional)
	ReRAM_Endurance_Sub		WGFMU 1, RSU 2, SMU 1 (Optional)
	ReRAM_Reset_Set_Endurance_Sub		WGFMU 1, RSU 2, SMU 1 (Optional)
	ReRAM_Reset_Set_Sub		WGFMU 1, RSU 2, SMU 1 (Optional)
	PCRAM_Reset-Set_Sub		WGFMU 1, RSU 2, SPGU 1
	PCRAM Reset-Set endurance sub (=SetV loop)		WGFMU 1, RSU 2, SPGU 1
	PCRAM_Reset-Set_Loop-Sub		WGFMU 1, RSU 2, SPGU 1
	PCRAM_Rm_Sub		WGFMU 1, RSU 2, SPGU 1
	WGFMU Pattern Editor NoRead		WGFMU 1, RSU 2, SMU 1 (Optional)
	Thyristor		Ia-Vak (PULSE)
Ia-Vak		SMU 2	
Thyristor	IGT,VGT_Ia-Ig	B1505A, B1506A	SMU 2
	IH_Ia-Vak		SMU 2
	IH_Va-Iak		SMU 2
	IL_Va-Iak		SMU 2
	Off_Ia-Vak (PULSE)		HVMCU, HP/HR/MPSMU
	Off_Ia-Vak		HVSMU, HP/HR/MPSMU
	R_Ia-Vak (PULSE)		HVMCU, HP/HR/MPSMU
	R_Ia-Vak		HVSMU, HP/HR/MPSMU
	VGD,IGD_Ia-Vgk (PULSE)		HVSMU/HVMCU, HP/HR/MPSMU
	VGD,IGD_Ia-Vgk		HVSMU, HP/HR/MPSMU
	TM_Ia-Vak		HCSMU, HP/HR/MPSMU

Application Library
Application Test Definitions

Category	Test definition name	Supported instrument	Required equipment and quantity
See Note 1	Cds	B1505A, B1506A	MFCMU 1, HVSMU 1, Bias-T 1
	Cgd		MFCMU 1, HVSMU 1, Bias-T 1
	Cgs		MFCMU 1, Bias-T 1 or N1259A with 020
	Cgs-Vgs		MFCMU 1
	Id(off)-Vds		SMU 2
	Id-Vds		[HCSMU 1 and SMU 1] or SMU 2
	Id-Vgs		[HCSMU 1 and SMU 1] or SMU 2
	Rds-Id		[HCSMU 1 and SMU 1] or SMU 2
	Vth Vgs(off)		[HCSMU 1 and SMU 1] or SMU/HCSMU 2
See Note 2	TDDB Constant V	B1505A, B1506A	SMU 1
See Note 3 (needs test definitions of GateCharge Utilities)	Qg(High Ic + High Vce + JESD24-2)	B1505A, B1506A	UHCU/HCSMU 1, MCSMU 2, HVSMU 1
	Qg(R Load High Ic + High Vce + JESD24-2)		UHCU/HCSMU 1, MCSMU 2, HVSMU 1
	Qg(High Ic + High Vce)		UHCU/HCSMU 1, MCSMU 2, HVSMU 1
	Qg(R Load High Ic + High Vce)		UHCU/HCSMU 1, MCSMU 2, HVSMU 1
	Qg(High Ic + JESD24-2)		UHCU/HCSMU 1, MCSMU 2
	Qg(R Load High Ic + JESD24-2)		UHCU/HCSMU 1, MCSMU 2
	Qg(High Ic)		UHCU/HCSMU 1, MCSMU 2
	Qg(R Load High Ic)		UHCU/HCSMU 1, MCSMU 2
	Qg(High Vce + JESD24-2)		MCSMU 2, HVSMU 1
	Qg(High Vce)		MCSMU 2, HVSMU 1
	Qg(JESD24-2 High Ic + JESD24-2 High Vce)		

Category	Test definition name	Supported instrument	Required equipment and quantity
See Note 4 (needs test definitions of GateCharge Utilities)	Qg(High Id + High Vds + JESD24-2)	B1505A, B1506A	UHCU/HCSMU 1, MCSMU 2, HVSMU 1
	Qg(R Load High Id + High Vds + JESD24-2)		UHCU/HCSMU 1, MCSMU 2, HVSMU 1
	Qg(High Id + High Vds)		UHCU/HCSMU 1, MCSMU 2, HVSMU 1
	Qg(R Load High Id + High Vds)		UHCU/HCSMU 1, MCSMU 2, HVSMU 1
	Qg(High Id + JESD24-2)		UHCU/HCSMU 1, MCSMU 2
	Qg(R Load High Id + JESD24-2)		UHCU/HCSMU 1, MCSMU 2
	Qg(High Id)		UHCU/HCSMU 1, MCSMU 2
	Qg(R Load High Id)		UHCU/HCSMU 1, MCSMU 2
	Qg(High Vds + JESD24-2)		MCSMU 1, HVSMU 1
	Qg(High Vds)		MCSMU 1, HVSMU 1
	Qg(JESD24-2 High Id + JESD24-2 High Vds)		

a. This test definition cannot be executed individually. It is called from other test definitions.

Note 1 These test definitions belong to the categories PMIC, PowerMOSFET, and SiC.

Note 2 This test definition belongs to the categories IGBT, MISCAP, PMIC, PowerMOSFET, and SiC.

Note 3 These test definitions belong to the categories IGBT and GateCharge.

Note 4 These test definitions belong to the categories PowerMOSFET and GateCharge.

Figure 1

DUT connections for using B2900 test definitions [1HL]

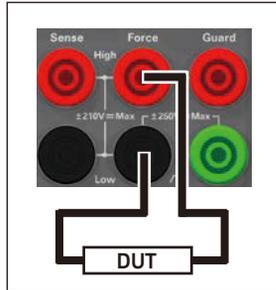
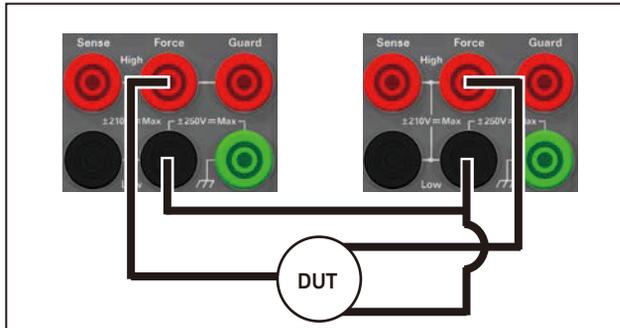


Figure 2

DUT connections for using B2900 test definitions [2HL]



QSCV Maximum Measurement Value and Accuracy

This section describes the maximum measurement value and accuracy for the result data measured by using the QSCV[2] application test. These values do not guarantee the measurement performance. They are just the supplemental information.

- “Maximum Measurement Value”
- “Measurement Accuracy”

NOTE

To obtain stable measurement results, use two source monitor units (SMU). Assign the current meter and the voltage sweep source to the individual SMU.

Maximum Measurement Value

NOTE

The maximum measurement value is not the specifications but the supplemental data.

Even if the capacitance is within this range, measurement may not be completed due to influences on the measurement path such as extension cables, etc. The maximum measurement value will be smaller depending on the leakage current.

The maximum measurement value depends on the settings of the current measurement range, the QSCV measurement voltage, and the integration time. See [Figure 9-1](#) to [Figure 9-5](#). Each figure shows the characteristics of the capacitance value vs. the QSCV measurement voltage by the integration time setting. Each line in the graph specifies the maximum measurement value for each integration time setting.

The graph data is applied to the measurement when the QSCV integration time is set to the same value as the LEAK integration time.

Figure 9-1 Maximum Measurement Value Using 10 pA and 100 pA Range: HRSMU, ASU+SMU

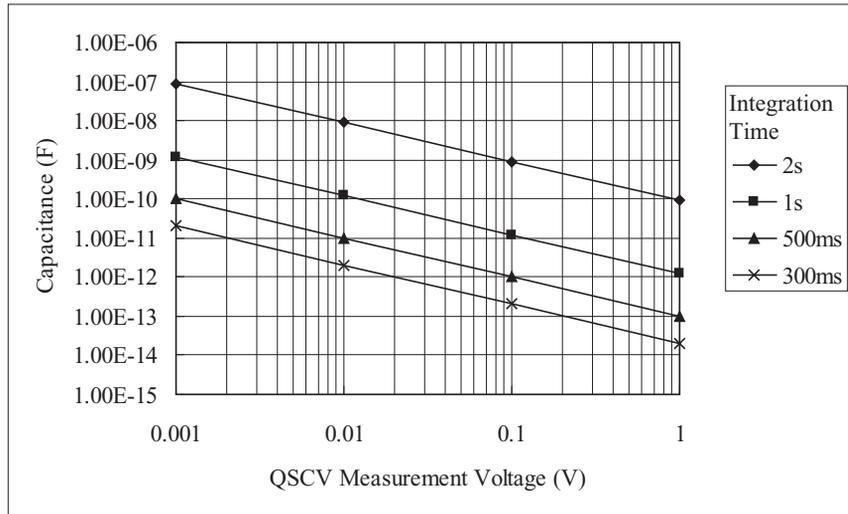


Figure 9-2 Maximum Measurement Value Using 1 nA Range: HPSMU, MPSMU, HRSMU, ASU+SMU

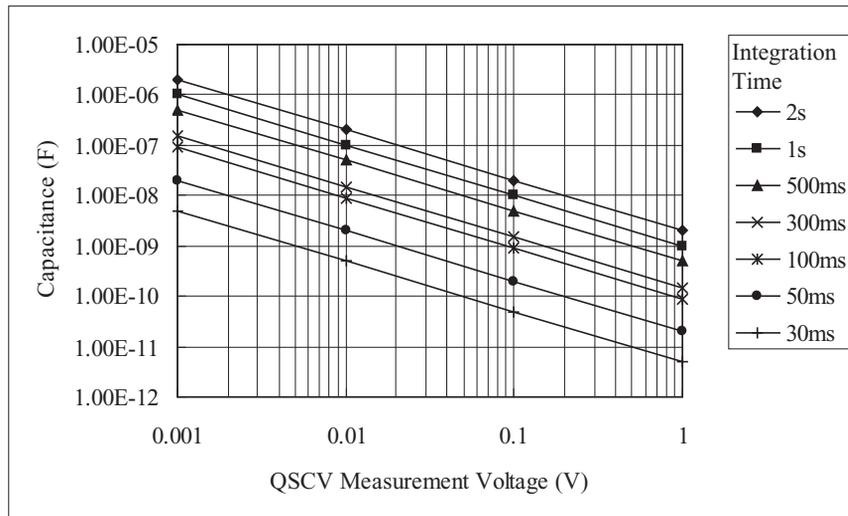


Figure 9-3

Maximum Measurement Value Using 10 nA Range: HPSMU, MPSMU, HRSMU, ASU+SMU

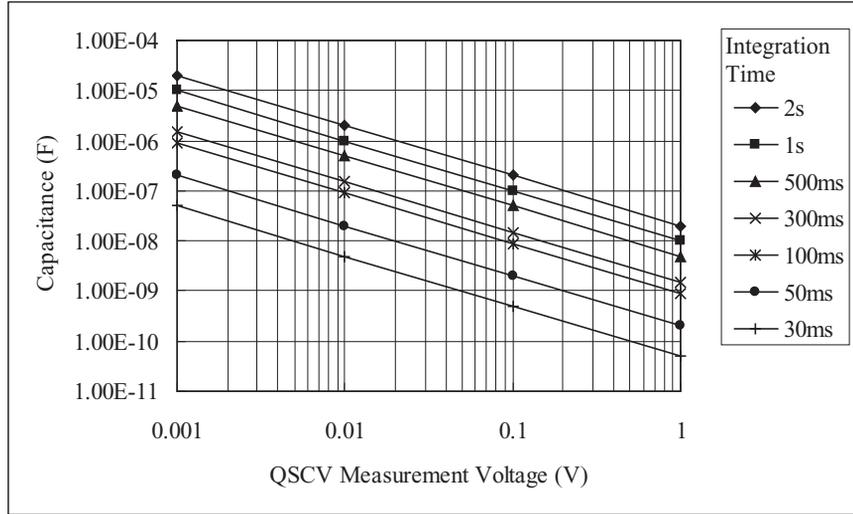


Figure 9-4

Maximum Measurement Value Using 100 nA Range: HPSMU, MPSMU, HRSMU, ASU+SMU

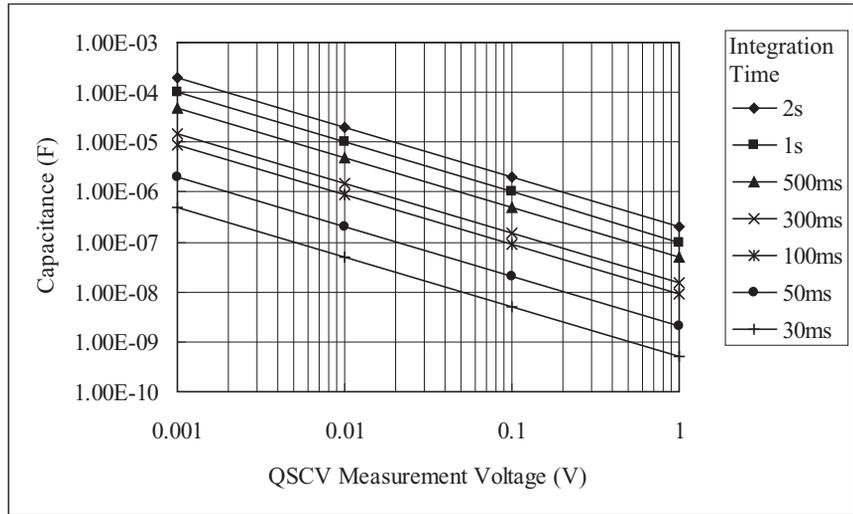
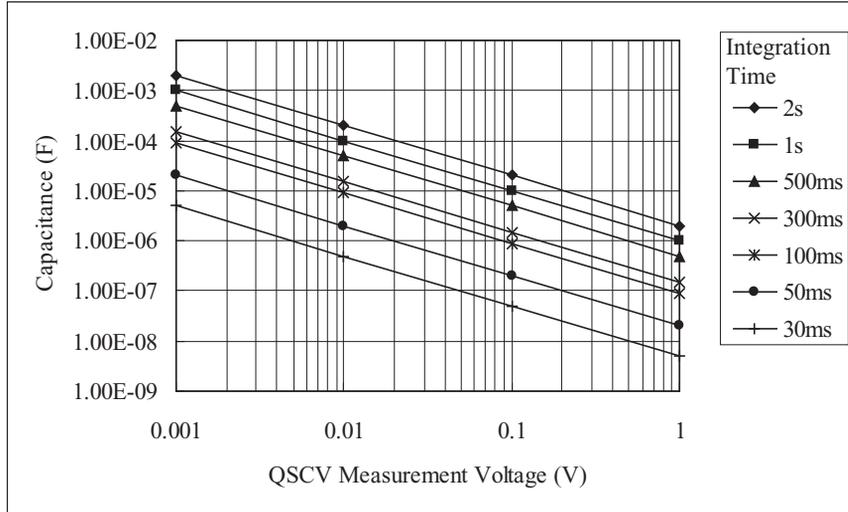


Figure 9-5

Maximum Measurement Value Using 1 μ A Range: HPSMU, MPSMU, HRSMU, ASU+SMU



Measurement Accuracy

NOTE

The measurement accuracy is not the specifications but the supplemental data.

Applicable conditions for supplemental data: Leak current compensation function ON, Offset cancel function ON, QSO mode OFF

The measurement accuracy can be calculated by the following formula:

Measurement accuracy = A (%) + B (F)

A : Reading accuracy. % accuracy of the measured value.

B : Offset accuracy.

$$A = A_p + \frac{B_p + C_p \times T_{integ} + D_p \times \frac{T_{integ}}{T_{leak}}}{V_{step}}$$

$$B = \frac{A_o}{R_{dut}} + \frac{B_o + B_{oc} \times C_g + (C_o + C_{oc} \times C_g) \times T_{integ} + (D_o + D_{oc} \times C_g) \times \frac{T_{integ}}{T_{leak}}}{V_{step}}$$

where,

T_{integ} : Integration time for the capacitance measurement, in seconds

T_{leak} : Integration time for the leakage current measurement, in seconds

V_{step} : QSCV measurement voltage, in V

R_{dut} : Equivalent parallel resistance of DUT, in Ω

C_g : Guard capacitance of the measurement path, in F

A_x , B_x , C_x , and D_x values are the constant. For the values, see [Table 9-2](#) to [Table 9-4](#).

Calculation examples of the measurement accuracy are shown in [Figure 9-6](#) through [Figure 9-30](#). Conditions of the calculation are shown in [Table 9-5](#).

NOTE

Settings for the QSCV Measurement Mode

The measurement mode should be selected based on the measurement conditions. Normal mode is effective for large leakage currents. The 4155C/4156C compatible mode is effective if the leakage current is low, or the QSCV measurement voltage is low.

Table 9-2 Constant Value for Calculating the Measurement Accuracy: HRSMU, ASU+SMU

Measurement Range	Constant	Voltage Output Range						QSCV Operating Mode
		0.5 V	2 V	5 V	20 V	40 V	100 V	
10 pA	Ap	0.47	0.47	0.47	0.47	0.48	0.48	
	Bp	0.014	0.029	0.051	0.15	0.30	0.72	Normal
		0.009	0.011	0.015	0.03	0.06	0.13	4155C/4156C compatible
	Cp	0.013						
	Dp	0.001						
	Ao	0.04						Normal
		0.07						4155C/4156C compatible
	Bo	1.3E-16						
	Boc	1.1E-05						
	Co	5.4E-15						
	Coc	2.4E-05						
	Do	1.3E-16						
	Doc	1.1E-05						
100 pA	Ap	0.31	0.31	0.31	0.31	0.32	0.32	
	Bp	0.014	0.029	0.051	0.153	0.298	0.720	Normal
		0.009	0.011	0.015	0.033	0.056	0.131	4155C/4156C compatible
	Cp	0.009						
	Dp	0.002						
	Ao	0.03						Normal
		0.071						4155C/4156C compatible
	Bo	4.7E-16						
	Boc	3.5E-05						
	Co	1.3E-14						
	Coc	9.8E-05						
	Do	4.7E-16						
	Doc	3.5E-05						

Table 9-3 Constant Value for Calculating the Measurement Accuracy: MPSMU, HRSMU, ASU+SMU

Measurement Range	Constant	Voltage Output Range						QSCV Operating Mode
		0.5 V	2 V	20 V	40 V	100 V	200 V	
1 nA	Ap	0.11	0.11	0.11	0.11	0.12	0.12	
	Bp	0.014	0.029	0.051	0.153	0.298	0.720	Normal
		0.009	0.011	0.015	0.033	0.056	0.131	4155C/4156C compatible
	Cp	0.026						
	Dp	0.014						
	Ao	0.03						Normal
		0.04						4155C/4156C compatible
	Bo	1.7E-15						
	Boc	1.3E-04						
	Co	5.9E-14						
	Coc	4.5E-04						
	Do	1.7E-15						
	Doc	1.3E-04						
	10 nA	Ap	0.11	0.11	0.11	0.11	0.12	0.12
Bp		0.014	0.029	0.051	0.153	0.298	0.720	Normal
		0.009	0.011	0.015	0.033	0.056	0.131	4155C/4156C compatible
Cp		0.031						
Dp		0.015						
Ao		0.03						Normal
		0.04						4155C/4156C compatible
Bo		1.7E-15						
Boc		7.3E-05						
Co		3.9E-14						
Coc		1.9E-04						
Do		1.7E-15						
Doc		7.3E-05						

Application Library
 QSCV Maximum Measurement Value and Accuracy

Measurement Range	Constant	Voltage Output Range						QSCV Operating Mode
		0.5 V	2 V	20 V	40 V	100 V	200 V	
100 nA	Ap	0.06	0.06	0.06	0.06	0.07	0.07	
	Bp	0.014	0.029	0.051	0.153	0.298	0.720	Normal
		0.009	0.011	0.015	0.033	0.056	0.131	4155C/4156C compatible
	Cp	0.209						
	Dp	0.023						
	Ao	0.03						Normal
		0.04						4155C/4156C compatible
	Bo	2.4E-15						
	Boc	2.0E-04						
	Co	8.7E-12						
	Coc	4.6.0E-04						
	Do	2.4E-15						
	Doc	2.0E-04						
	1 μ A	Ap	0.06	0.06	0.06	0.06	0.07	0.07
Bp		0.014	0.029	0.051	0.153	0.298	0.720	Normal
		0.009	0.011	0.015	0.033	0.056	0.131	4155C/4156C compatible
Cp		0.125						
Dp		0.021						
Ao		0.03						Normal
		0.04						4155C/4156C compatible
Bo		1.1E-14						
Boc		4.0E-05						
Co		3.1E-12						
Coc		3.5.0E-04						
Do		1.1E-14						
Doc		4.0E-05						

Table 9-4 Constant Value for Calculating the Measurement Accuracy: HPSMU

Measurement Range	Constant	Voltage Output Range					QSCV Operating Mode
		2 V	20 V	40 V	100 V	200 V	
1 nA	Ap	0.11	0.11	0.12	0.12	0.14	
	Bp	0.033	0.149	0.293	0.717	1.459	Normal
		0.0100	0.03	0.05	0.12	0.2347	4155C/4156C compatible
	Cp	0.026					
	Dp	0.014					
	Ao	0.03					Normal
		0.04					4155C/4156C compatible
	Bo	1.7E-15					
	Boc	1.3.0E-04					
	Co	5.9E-14					
	Coc	4.5.0E-04					
	Do	1.7E-15					
	Doc	1.3.0E-04					
10 nA	Ap	0.11	0.11	0.12	0.12	0.14	
	Bp	0.033	0.149	0.293	0.717	1.459	Normal
		0.0100	0.03	0.05	0.12	0.2347	4155C/4156C compatible
	Cp	0.031					
	Dp	0.015					
	Ao	0.03					Normal
		0.04					4155C/4156C compatible
	Bo	1.7E-15					
	Boc	7.3E-05					
	Co	3.9E-14					
	Coc	1.9.0E-04					
	Do	1.7E-15					
	Doc	7.3E-05					

Application Library
 QSCV Maximum Measurement Value and Accuracy

Measurement Range	Constant	Voltage Output Range					QSCV Operating Mode
		2 V	20 V	40 V	100 V	200 V	
100 nA	Ap	0.06	0.06	0.07	0.07	0.09	
	Bp	0.033	0.149	0.293	0.717	1.459	Normal
		0.0100	0.03	0.05	0.12	0.2347	4155C/4156C compatible
	Cp	0.209					
	Dp	0.023					
	Ao	0.01					Normal
		0.04					4155C/4156C compatible
	Bo	2.4E-15					
	Boc	2.0E-04					
	Co	8.7E-12					
	Coc	4.6.0E-04					
	Do	2.4E-15					
	Doc	2.0E-04					
1 μ A	Ap	0.06	0.06	0.07	0.07	0.09	
	Bp	0.033	0.149	0.293	0.717	1.459	Normal
		0.0100	0.03	0.05	0.12	0.2347	4155C/4156C compatible
	Cp	0.125					
	Dp	0.021					
	Ao	0.01					Normal
		0.04					4155C/4156C compatible
	Bo	1.1E-14					
	Boc	4.0E-05					
	Co	3.1E-12					
	Coc	3.5.0E-04					
	Do	1.1E-14					
	Doc	4.0E-05					

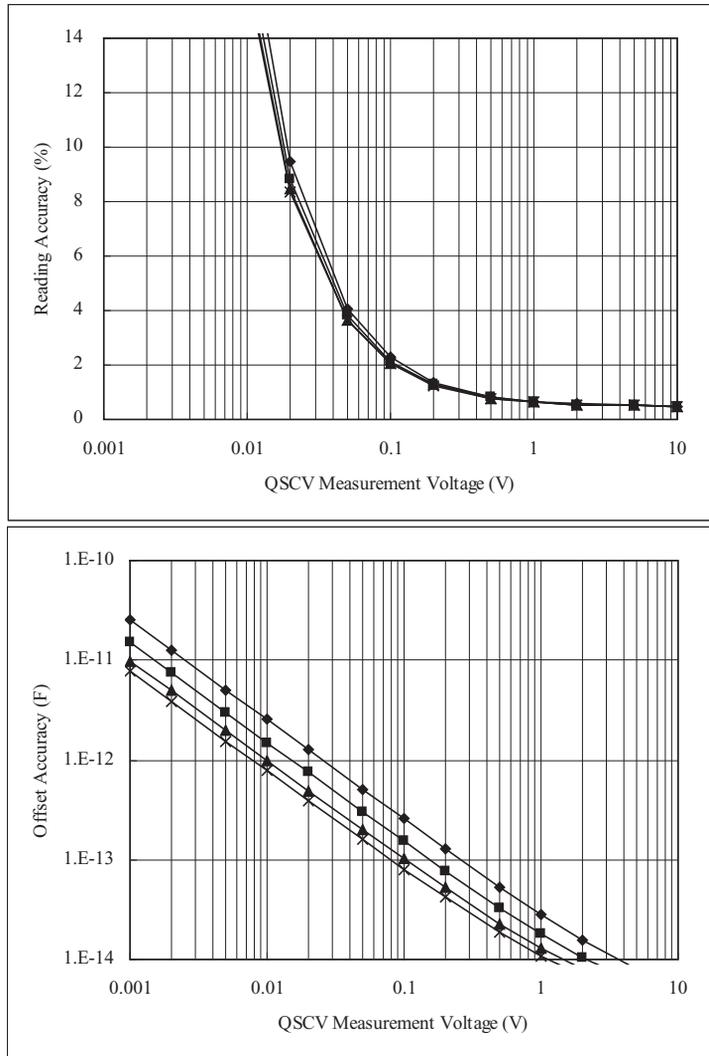
Table 9-5 Conditions for Calculating Measurement Accuracy

Conditions					Measurement accuracy calculation result
Measurement range	QSCV operating mode	Output range	Equivalent parallel resistance of DUT	Guard capacitance of measurement path	
10 pA	Normal	20 V	10 TΩ	200 pF	Figure 9-6
100 pA	Normal	20 V	10 TΩ	200 pF	Figure 9-7
	Normal	20 V	10 TΩ	1 nF	Figure 9-8
	Normal	20 V	100 GΩ	200 pF	Figure 9-9
1 nA	Normal	20 V	10 TΩ	200 pF	Figure 9-10
	Normal	20 V	10 TΩ	1 nF	Figure 9-11
	Normal	20 V	10 GΩ	200 pF	Figure 9-12
	Normal	20 V	1 GΩ	200 pF	Figure 9-13
10 nA	Normal	20 V	10 TΩ	200 pF	Figure 9-14
	Normal	20 V	10 GΩ	200 pF	Figure 9-15
	Normal	20 V	1 GΩ	200 pF	Figure 9-16
100 nA	Normal	20 V	10 TΩ	200 pF	Figure 9-17
	Normal	20 V	1 GΩ	200 pF	Figure 9-18
	Normal	20 V	100 MΩ	200 pF	Figure 9-19
	Normal	20 V	10 MΩ	200 pF	Figure 9-20
1 μA	Normal	20 V	10 TΩ	200 pF	Figure 9-21
	Normal	20 V	1 GΩ	200 pF	Figure 9-22
	Normal	20 V	100 MΩ	200 pF	Figure 9-23
	Normal	20 V	10 MΩ	200 pF	Figure 9-24
10 pA	4155C/4156C compatible	20 V	10 TΩ	200 pF	Figure 9-25
100 pA		20 V	10 TΩ	200 pF	Figure 9-26
1 nA		20 V	10 TΩ	200 pF	Figure 9-27
10 nA		20 V	10 TΩ	200 pF	Figure 9-28
100 nA		20 V	10 TΩ	200 pF	Figure 9-29
1 μA		20 V	10 TΩ	200 pF	Figure 9-30

Calculation example data shown in [Figure 9-6](#) through [Figure 9-30](#) is applied to the measurement data when the QSCV integration time *T_{integ}* is equal to the LEAK integration time *T_{leak}*.

Figure 9-6

Calculation Example of Measurement Accuracy: HRSMU, ASU+SMU



Conditions:

QSCV Operating Mode: Normal

Measurement Range: 10 pA

Output Range: 20 V

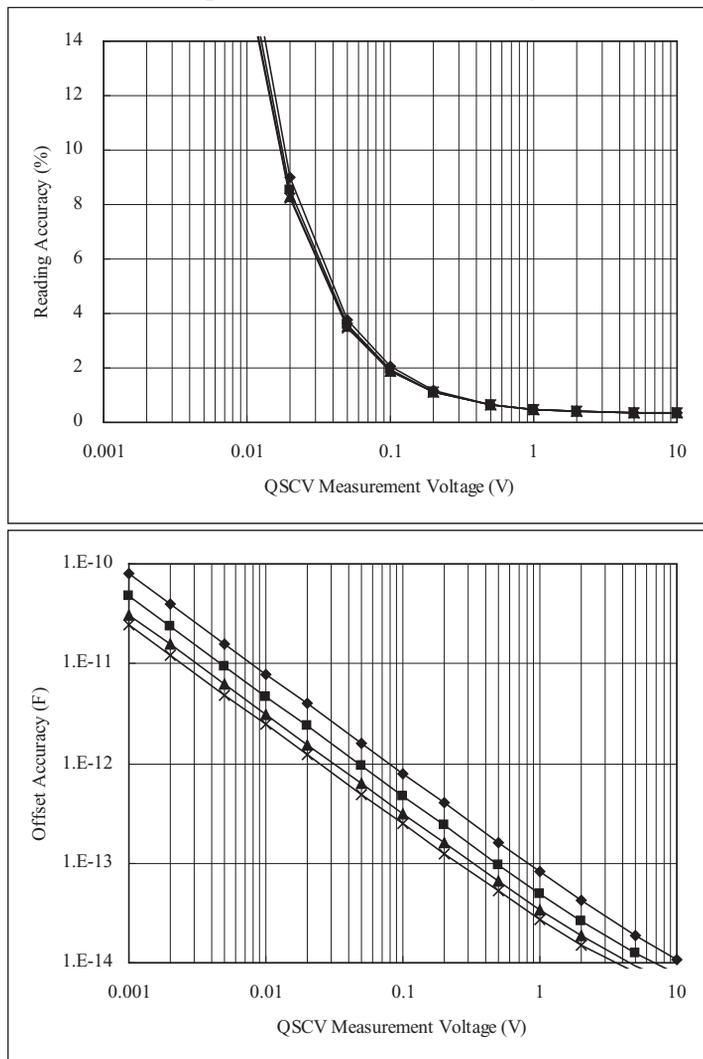
Integration Time: 2, 1, 0.5, 0.3 s corresponding to the lines from top to bottom

Equivalent Parallel Resistance of DUT: 10 T Ω

Guard Capacitance of Measurement Path: 200 pF

Figure 9-7

Calculation Example of Measurement Accuracy: HRSMU, ASU+SMU



Conditions:

QSCV Operating Mode: Normal

Measurement Range: 100 pA

Output Range: 20 V

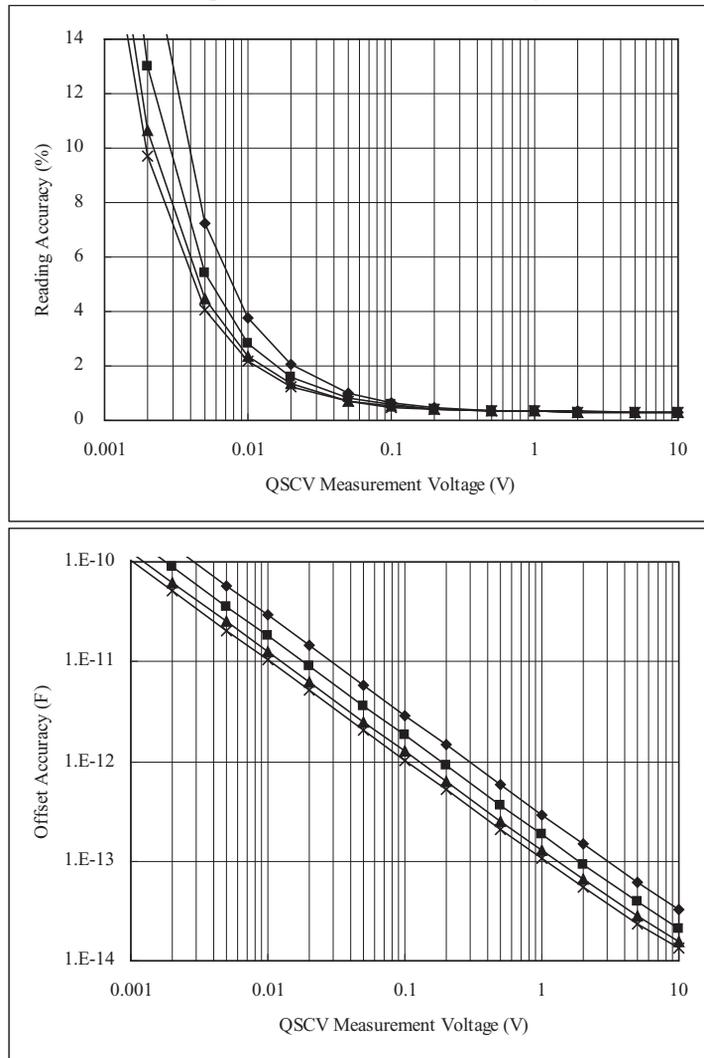
Integration Time: 2, 1, 0.5, 0.3 s corresponding to the lines from top to bottom

Equivalent Parallel Resistance of DUT: 10 TΩ

Guard Capacitance of Measurement Path: 200 pF

Figure 9-8

Calculation Example of Measurement Accuracy: HRSMU, ASU+SMU



Conditions:

QSCV Operating Mode: Normal

Measurement Range: 100 pA

Output Range: 20 V

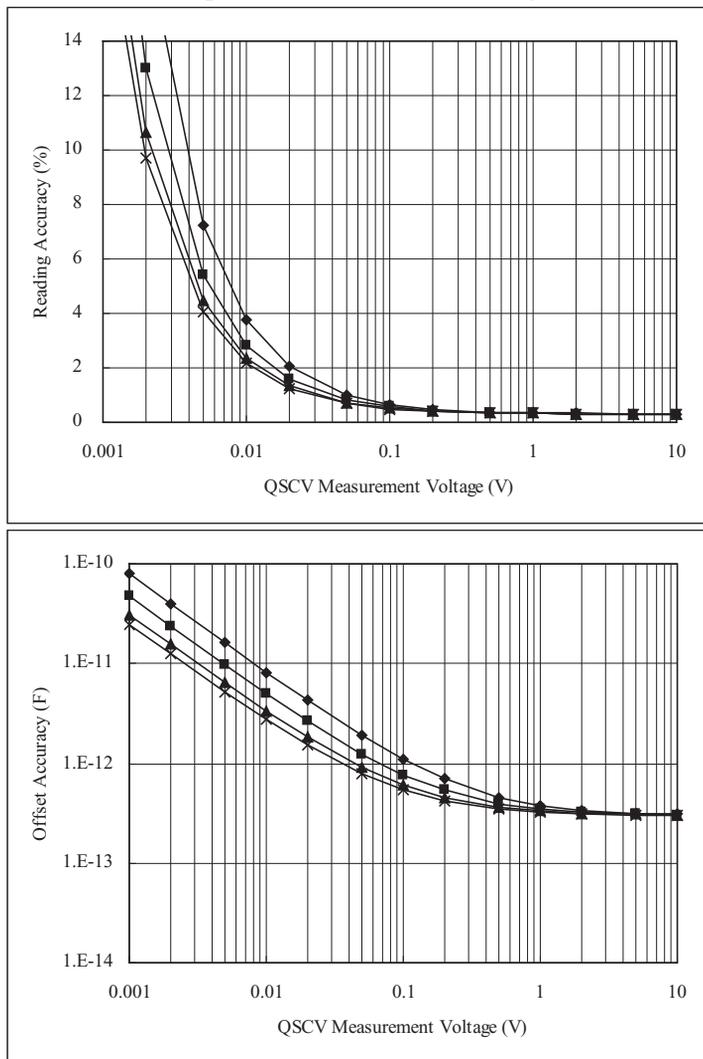
Integration Time: 2, 1, 0.5, 0.3 s corresponding to the lines from top to bottom

Equivalent Parallel Resistance of DUT: 10 TΩ

Guard Capacitance of Measurement Path: 1 nF

Figure 9-9

Calculation Example of Measurement Accuracy: HRSMU, ASU+SMU



Conditions:

QSCV Operating Mode: Normal

Measurement Range: 100 pA

Output Range: 20 V

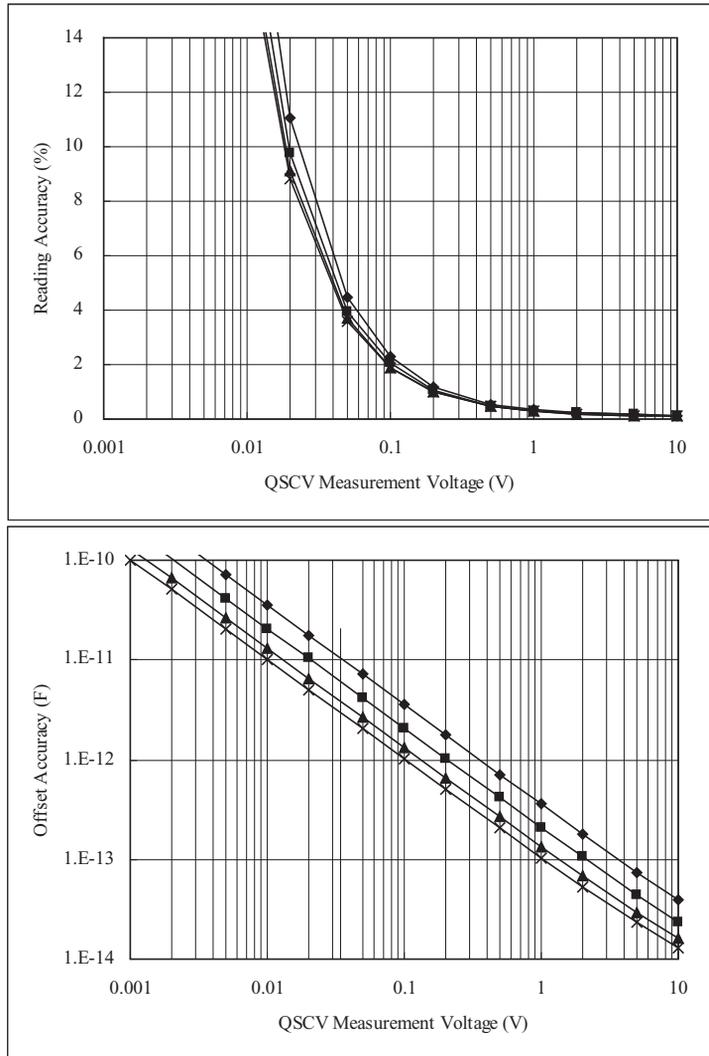
Integration Time: 2, 1, 0.5, 0.3 s corresponding to the lines from top to bottom

Equivalent Parallel Resistance of DUT: 100 GΩ

Guard Capacitance of Measurement Path: 200 pF

Figure 9-10

Calculation Example of Measurement Accuracy: MP/HRSMU, ASU+SMU



Conditions:

QSCV Operating Mode: Normal

Measurement Range: 1 nA

Output Range: 20 V

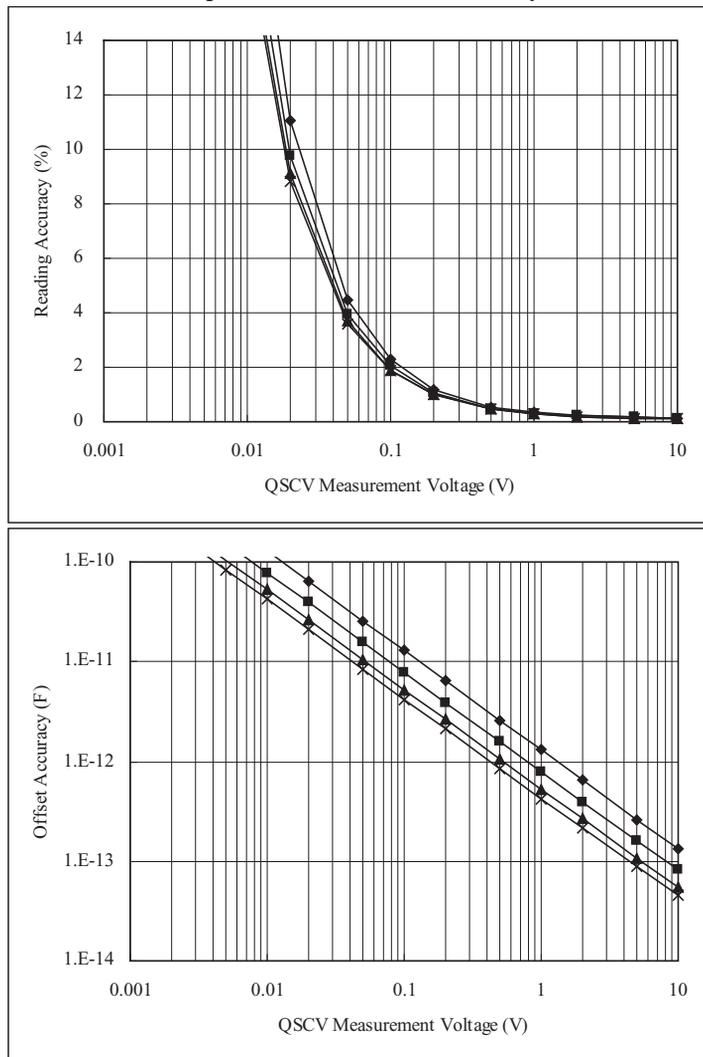
Integration Time: 2, 1, 0.5, 0.3 s corresponding to the lines from top to bottom

Equivalent Parallel Resistance of DUT: 10 TΩ

Guard Capacitance of Measurement Path: 200 pF

Figure 9-11

Calculation Example of Measurement Accuracy: MP/HRSMU, ASU+SMU



Conditions:

QSCV Operating Mode: Normal

Measurement Range: 1 nA

Output Range: 20 V

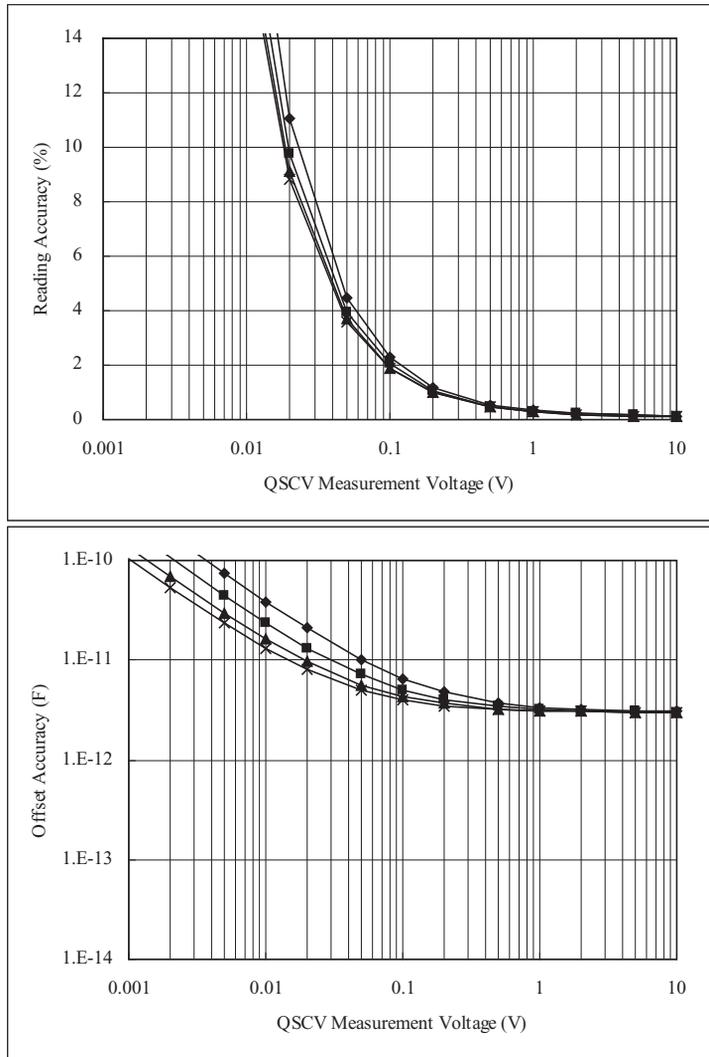
Integration Time: 2, 1, 0.5, 0.3 s corresponding to the lines from top to bottom

Equivalent Parallel Resistance of DUT: 10 T Ω

Guard Capacitance of Measurement Path: 1 nF

Figure 9-12

Calculation Example of Measurement Accuracy: MP/HRSMU, ASU+SMU



Conditions:

QSCV Operating Mode: Normal

Measurement Range: 1 nA

Output Range: 20 V

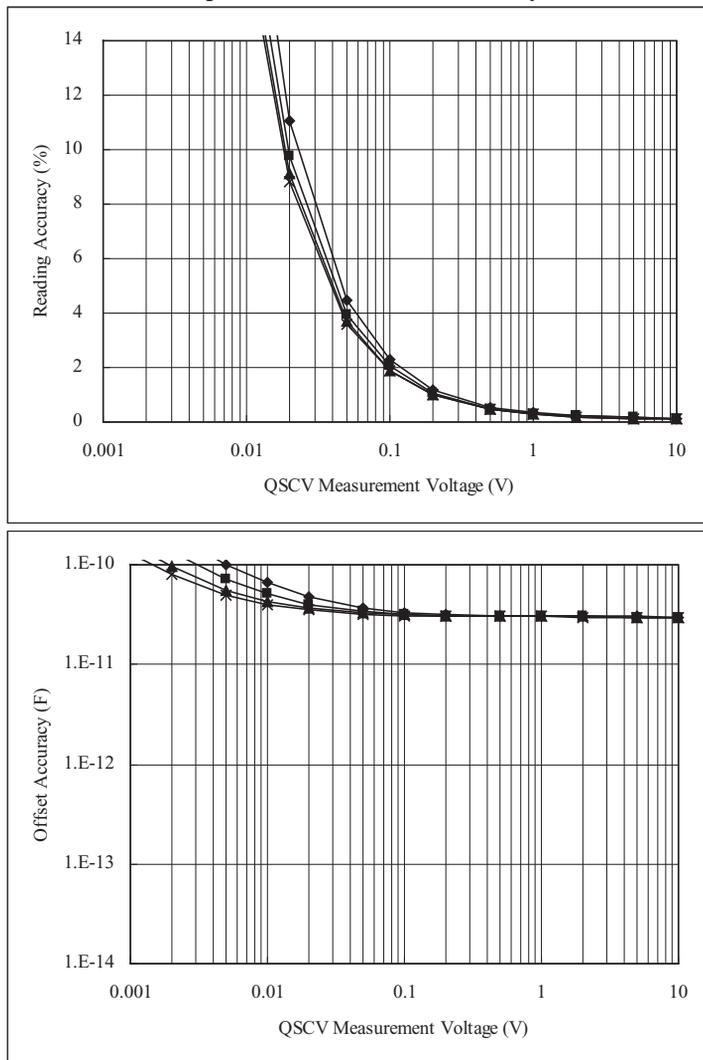
Integration Time: 2, 1, 0.5, 0.3 s corresponding to the lines from top to bottom

Equivalent Parallel Resistance of DUT: 10 G Ω

Guard Capacitance of Measurement Path: 200 pF

Figure 9-13

Calculation Example of Measurement Accuracy: MP/HRSMU, ASU+SMU



Conditions:

QSCV Operating Mode: Normal

Measurement Range: 1 nA

Output Range: 20 V

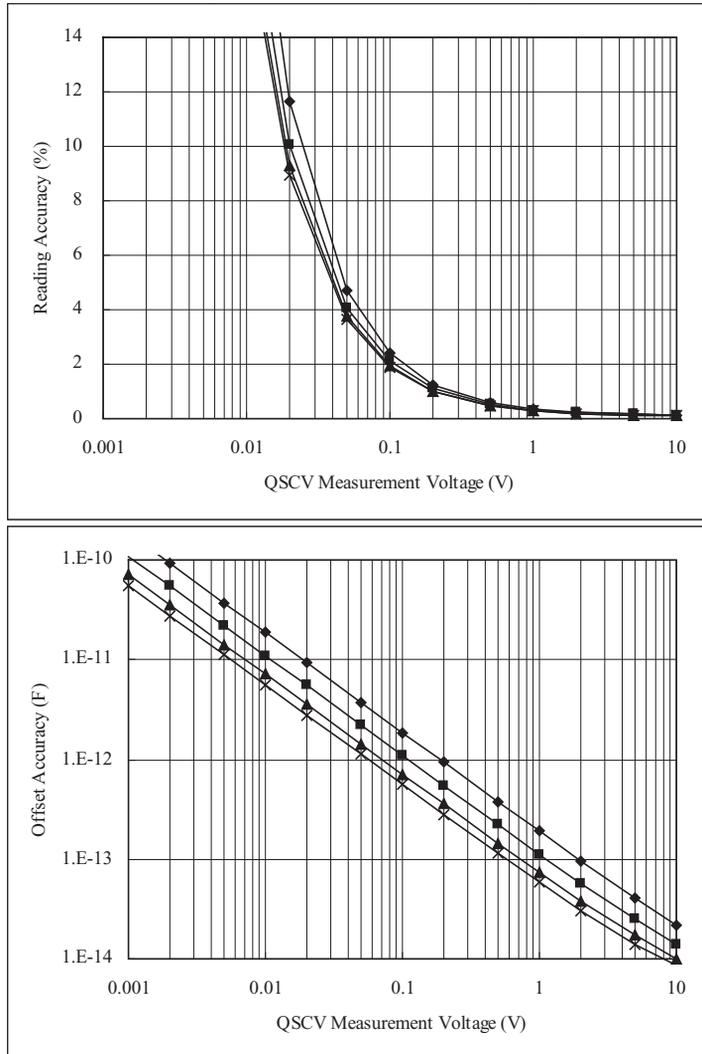
Integration Time: 2, 1, 0.5, 0.3 s corresponding to the lines from top to bottom

Equivalent Parallel Resistance of DUT: 1 GΩ

Guard Capacitance of Measurement Path: 200 pF

Figure 9-14

Calculation Example of Measurement Accuracy: MP/HRSMU, ASU+SMU



Conditions:

QSCV Operating Mode: Normal

Measurement Range: 10 nA

Output Range: 20 V

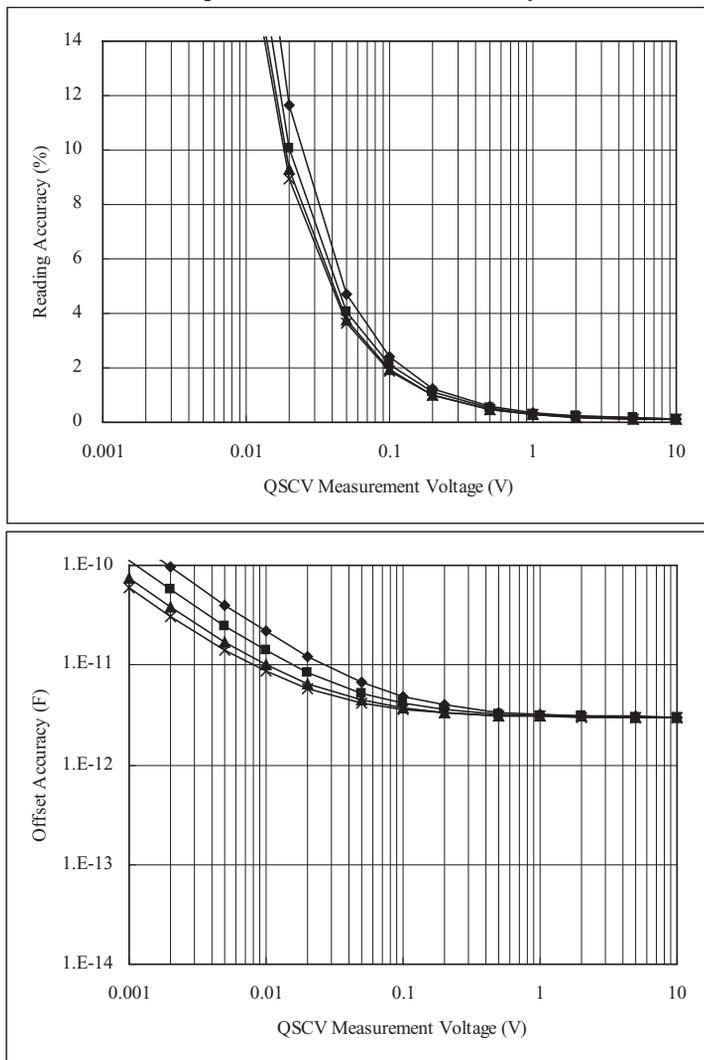
Integration Time: 2, 1, 0.5, 0.3 s corresponding to the lines from top to bottom

Equivalent Parallel Resistance of DUT: 10 TΩ

Guard Capacitance of Measurement Path: 200 pF

Figure 9-15

Calculation Example of Measurement Accuracy: MP/HRSMU, ASU+SMU



Conditions:

QSCV Operating Mode: Normal

Measurement Range: 10 nA

Output Range: 20 V

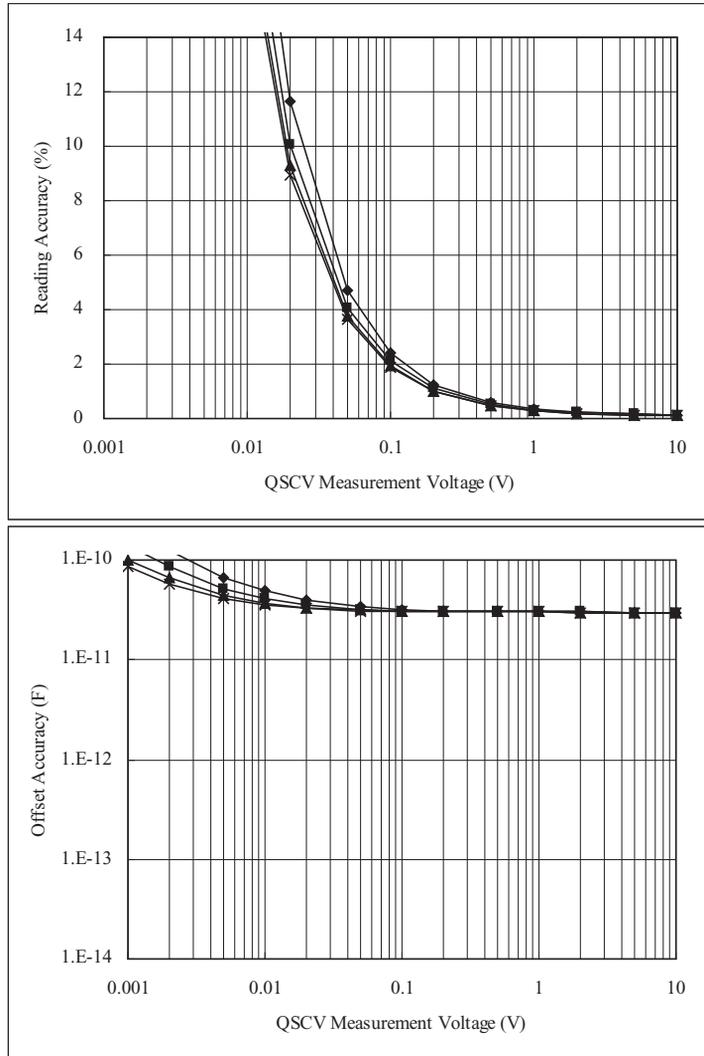
Integration Time: 2, 1, 0.5, 0.3 s corresponding to the lines from top to bottom

Equivalent Parallel Resistance of DUT: 10 GΩ

Guard Capacitance of Measurement Path: 200 pF

Figure 9-16

Calculation Example of Measurement Accuracy: MP/HRSMU, ASU+SMU



Conditions:

QSCV Operating Mode: Normal

Measurement Range: 10 nA

Output Range: 20 V

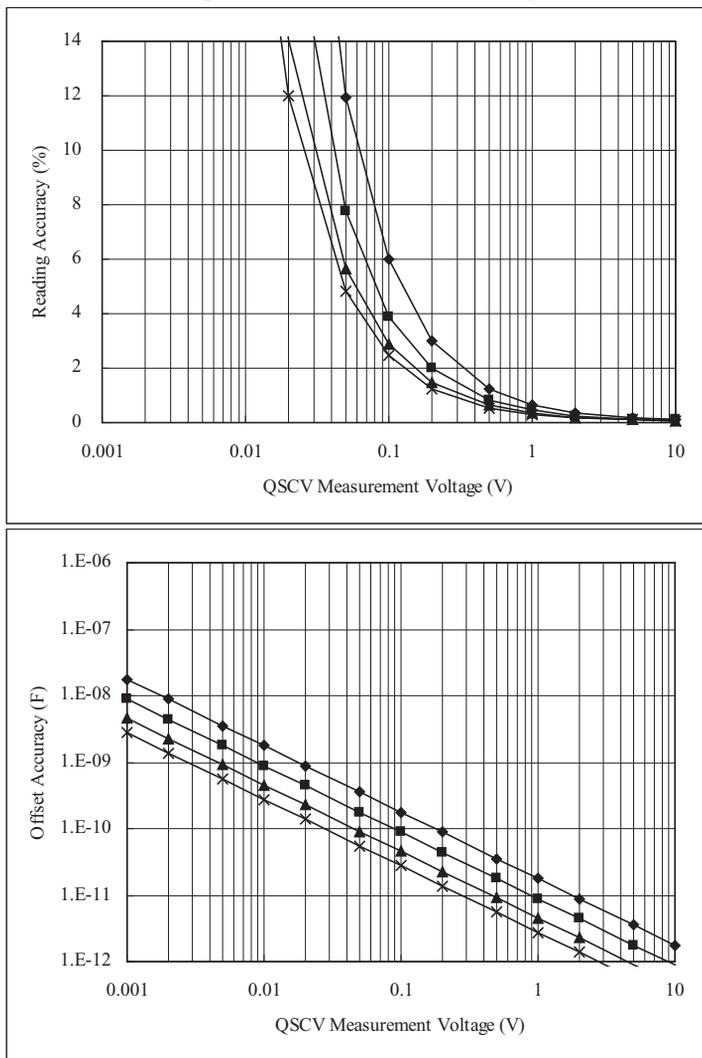
Integration Time: 2, 1, 0.5, 0.3 s corresponding to the lines from top to bottom

Equivalent Parallel Resistance of DUT: 1 G Ω

Guard Capacitance of Measurement Path: 200 pF

Figure 9-17

Calculation Example of Measurement Accuracy: MP/HRSMU, ASU+SMU



Conditions:

QSCV Operating Mode: Normal

Measurement Range: 100 nA

Output Range: 20 V

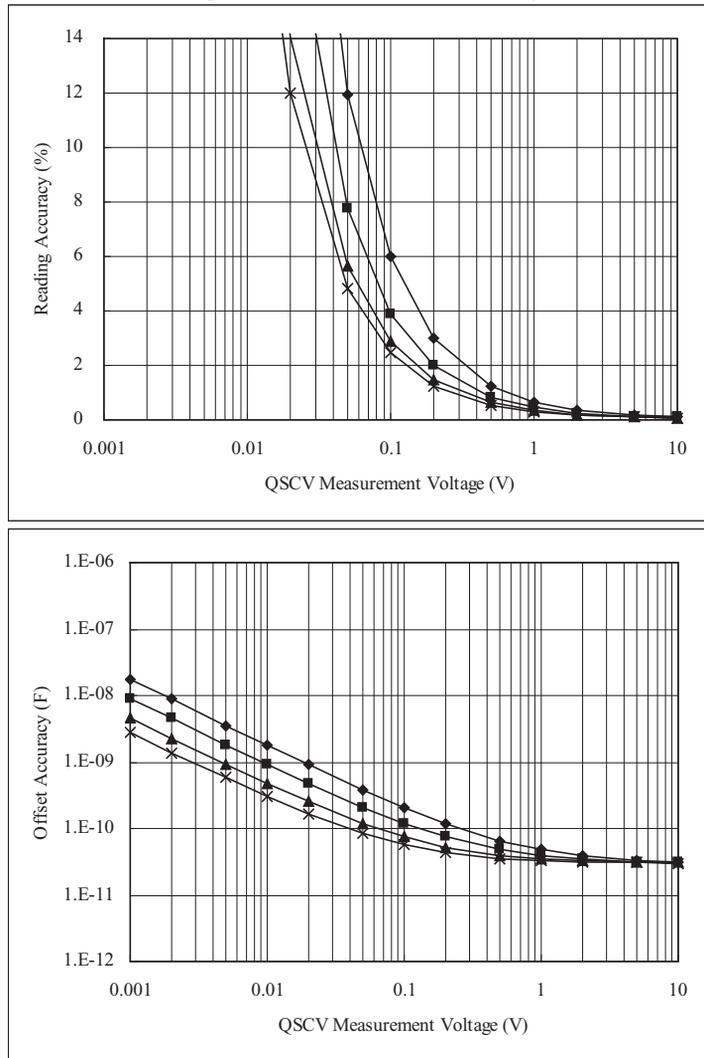
Integration Time: 2, 1, 0.5, 0.3 s corresponding to the lines from top to bottom

Equivalent Parallel Resistance of DUT: 10 TΩ

Guard Capacitance of Measurement Path: 200 pF

Figure 9-18

Calculation Example of Measurement Accuracy: MP/HRSMU, ASU+SMU



Conditions:

QSCV Operating Mode: Normal

Measurement Range: 100 nA

Output Range: 20 V

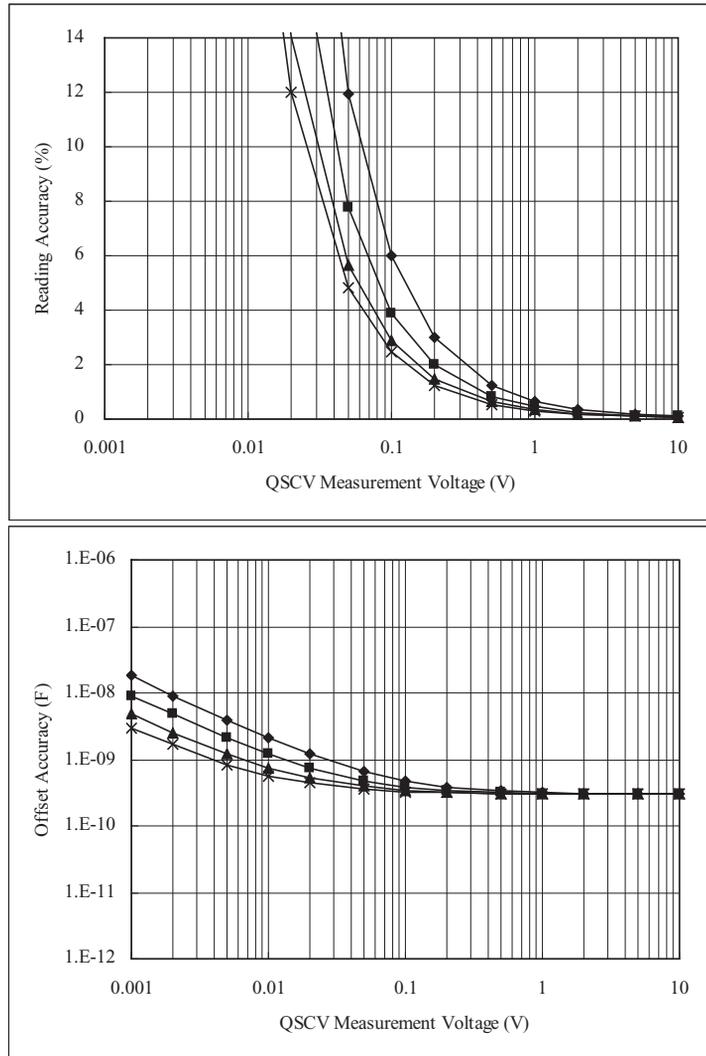
Integration Time: 2, 1, 0.5, 0.3 s corresponding to the lines from top to bottom

Equivalent Parallel Resistance of DUT: 1 G Ω

Guard Capacitance of Measurement Path: 200 pF

Figure 9-19

Calculation Example of Measurement Accuracy: MP/HRSMU, ASU+SMU



Conditions:

QSCV Operating Mode: Normal

Measurement Range: 100 nA

Output Range: 20 V

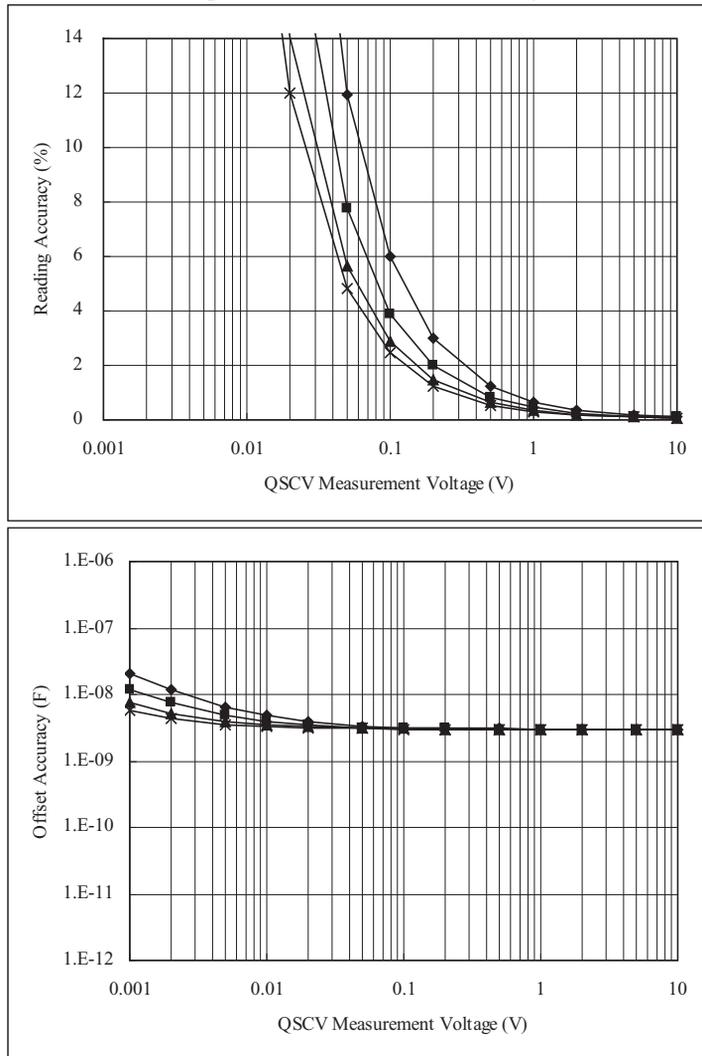
Integration Time: 2, 1, 0.5, 0.3 s corresponding to the lines from top to bottom

Equivalent Parallel Resistance of DUT: 100 MΩ

Guard Capacitance of Measurement Path: 200 pF

Figure 9-20

Calculation Example of Measurement Accuracy: MP/HRSMU, ASU+SMU



Conditions:

QSCV Operating Mode: Normal

Measurement Range: 100 nA

Output Range: 20 V

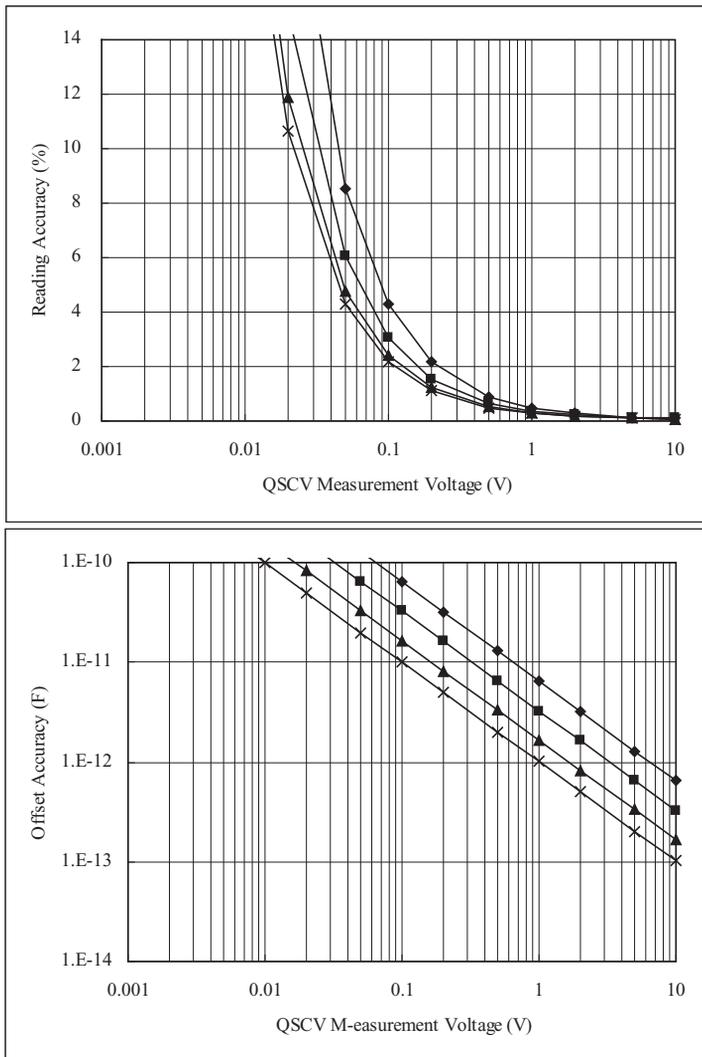
Integration Time: 2, 1, 0.5, 0.3 s corresponding to the lines from top to bottom

Equivalent Parallel Resistance of DUT: 10 M Ω

Guard Capacitance of Measurement Path: 200 pF

Figure 9-21

Calculation Example of Measurement Accuracy: MP/HRSMU, ASU+SMU



Conditions:

QSCV Operating Mode: Normal

Measurement Range: 1 μ A

Output Range: 20 V

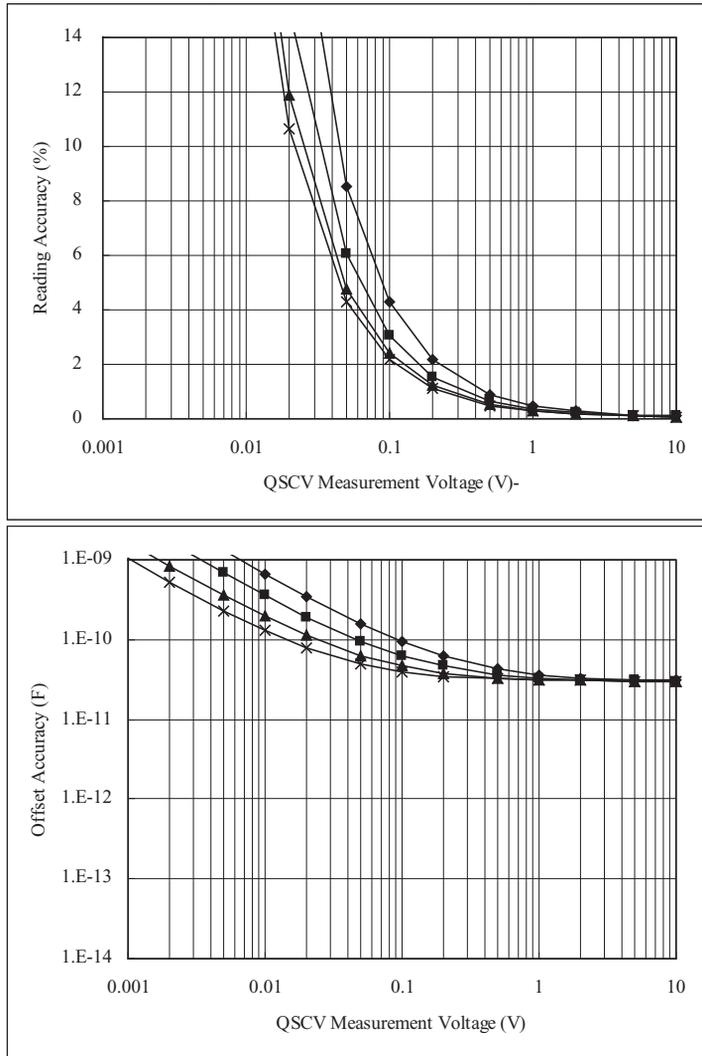
Integration Time: 2, 1, 0.5, 0.3 s corresponding to the lines from top to bottom

Equivalent Parallel Resistance of DUT: 10 T Ω

Guard Capacitance of Measurement Path: 200 pF

Figure 9-22

Calculation Example of Measurement Accuracy: MP/HRSMU, ASU+SMU



Conditions:

QSCV Operating Mode: Normal

Measurement Range: 1 μ A

Output Range: 20 V

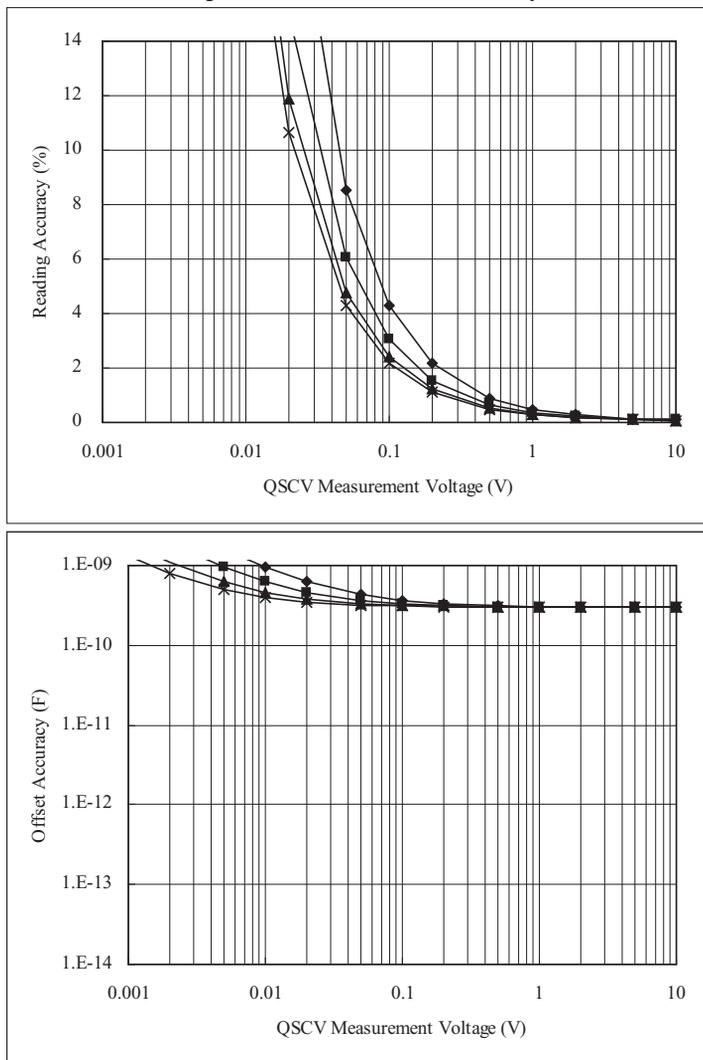
Integration Time: 2, 1, 0.5, 0.3 s corresponding to the lines from top to bottom

Equivalent Parallel Resistance of DUT: 1 G Ω

Guard Capacitance of Measurement Path: 200 pF

Figure 9-23

Calculation Example of Measurement Accuracy: MP/HRSMU, ASU+SMU



Conditions:

QSCV Operating Mode: Normal

Measurement Range: 1 μ A

Output Range: 20 V

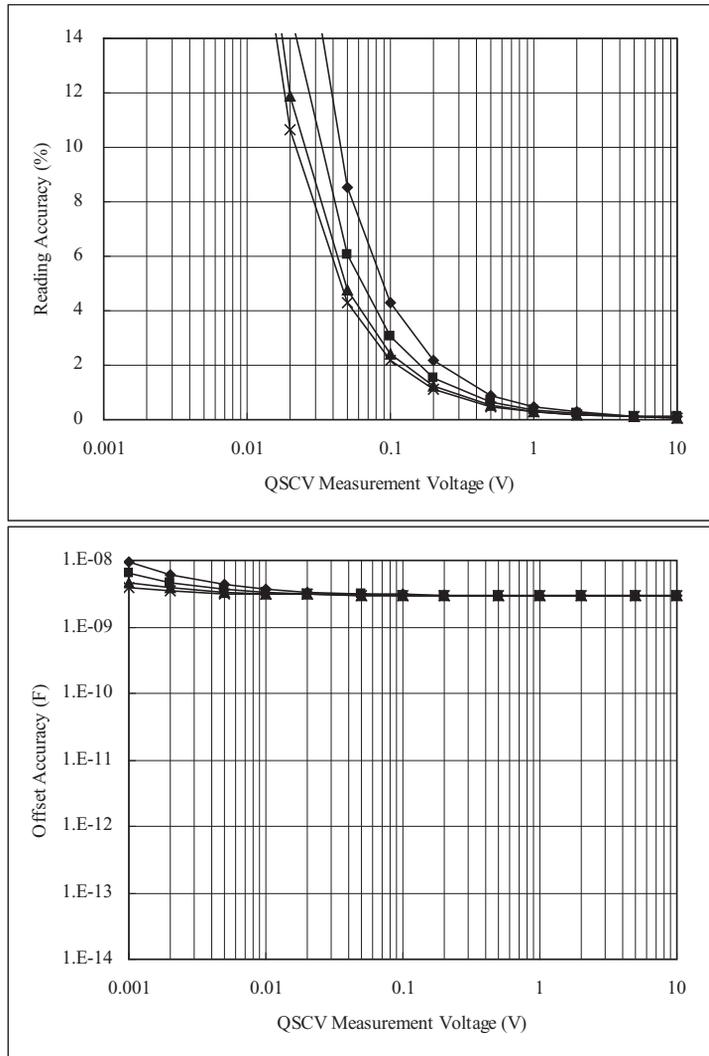
Integration Time: 2, 1, 0.5, 0.3 s corresponding to the lines from top to bottom

Equivalent Parallel Resistance of DUT: 100 M Ω

Guard Capacitance of Measurement Path: 200 pF

Figure 9-24

Calculation Example of Measurement Accuracy: MP/HRSMU, ASU+SMU



Conditions:

QSCV Operating Mode: Normal

Measurement Range: 1 μ A

Output Range: 20 V

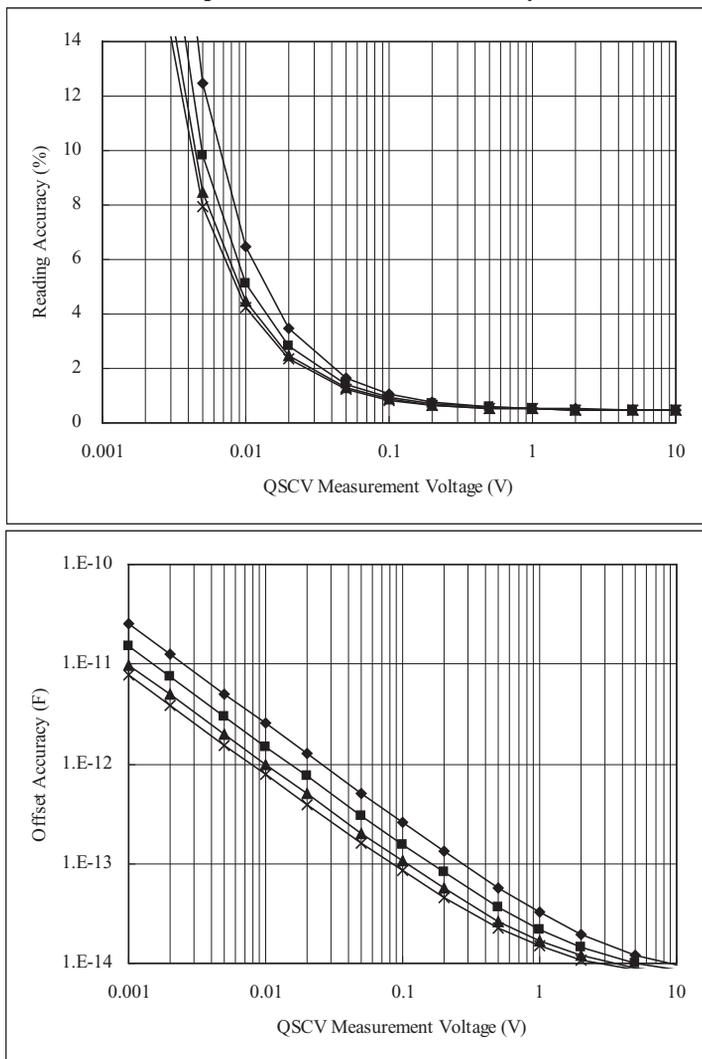
Integration Time: 2, 1, 0.5, 0.3 s corresponding to the lines from top to bottom

Equivalent Parallel Resistance of DUT: 10 M Ω

Guard Capacitance of Measurement Path: 200 pF

Figure 9-25

Calculation Example of Measurement Accuracy: HRSMU, ASU+SMU



Conditions:

QSCV Operating Mode: 4155C/4156C compatible

Measurement Range: 10 pA

Output Range: 20 V

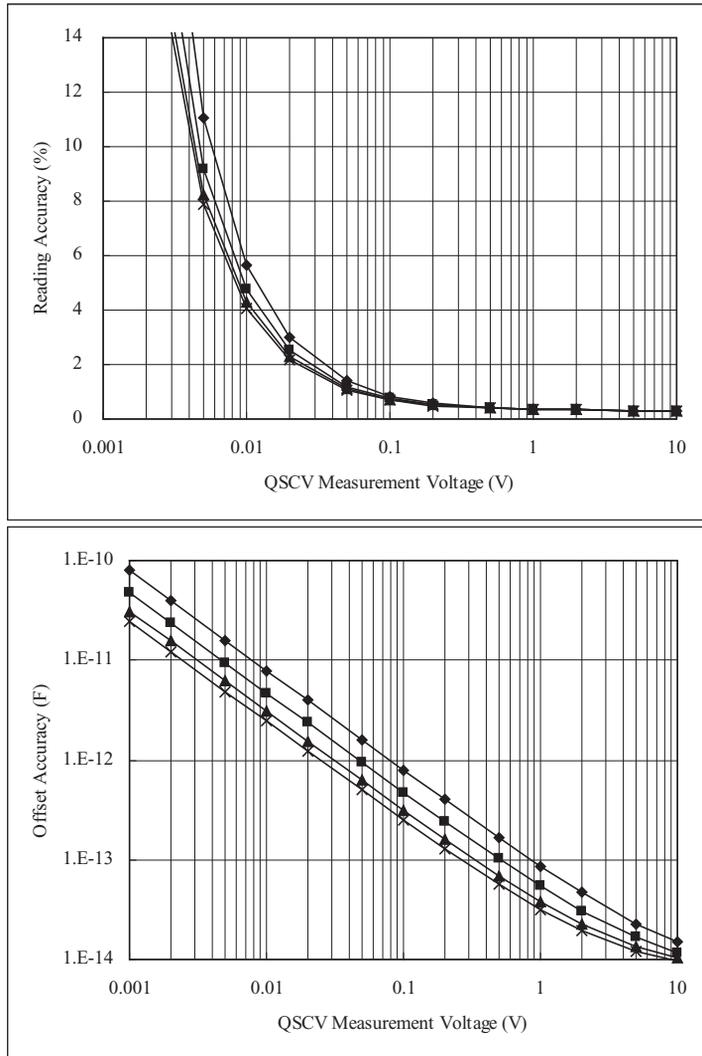
Integration Time: 2, 1, 0.5, 0.3 s corresponding to the lines from top to bottom

Equivalent Parallel Resistance of DUT: 10 T Ω

Guard Capacitance of Measurement Path: 200 pF

Figure 9-26

Calculation Example of Measurement Accuracy: HRSMU, ASU+SMU



Conditions:

QSCV Operating Mode: 4155C/4156C compatible

Measurement Range: 100 pA

Output Range: 20 V

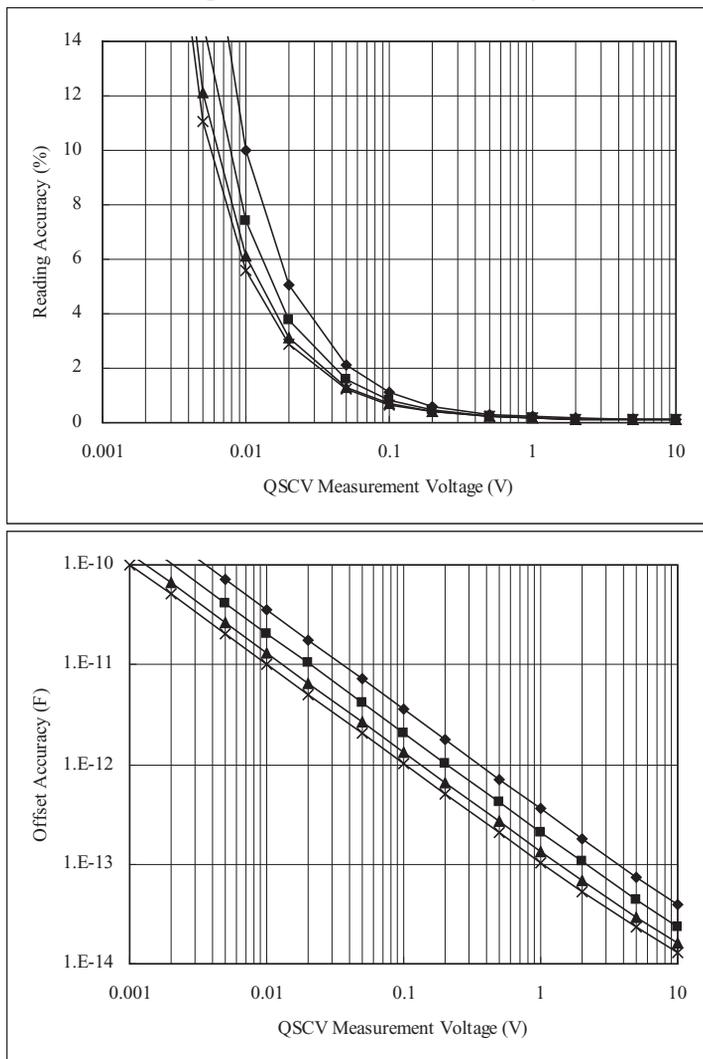
Integration Time: 2, 1, 0.5, 0.3 s corresponding to the lines from top to bottom

Equivalent Parallel Resistance of DUT: 10 TΩ

Guard Capacitance of Measurement Path: 200 pF

Figure 9-27

Calculation Example of Measurement Accuracy: MP/HRSMU, ASU+SMU



Conditions:

QSCV Operating Mode: 4155C/4156C compatible

Measurement Range: 1 nA

Output Range: 20 V

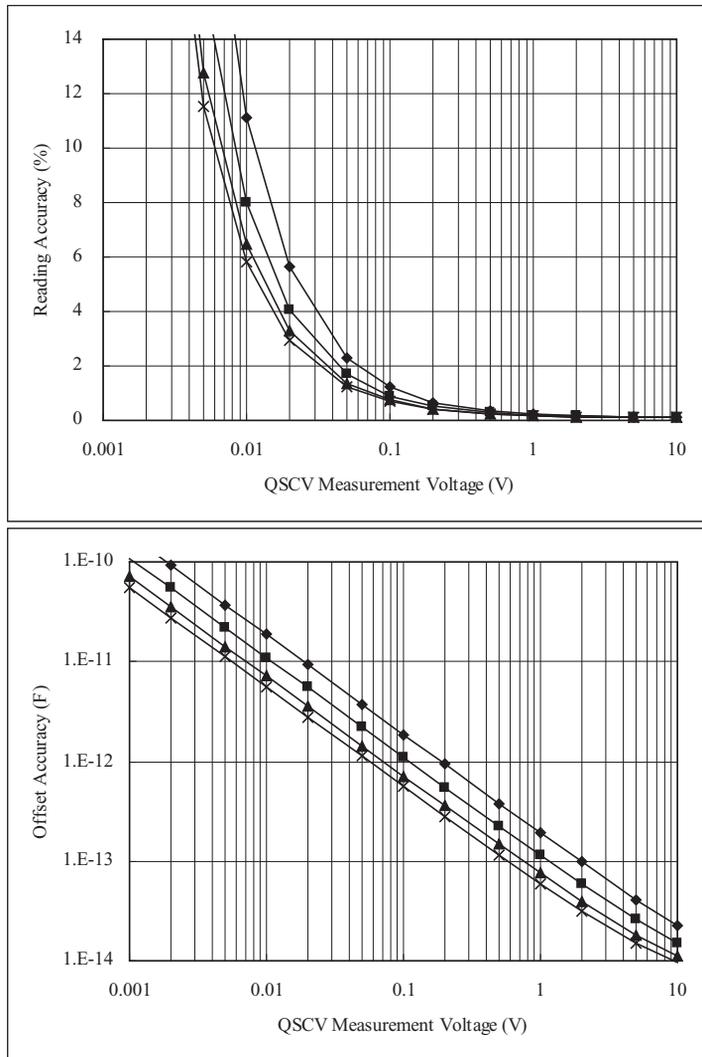
Integration Time: 2, 1, 0.5, 0.3 s corresponding to the lines from top to bottom

Equivalent Parallel Resistance of DUT: 10 TΩ

Guard Capacitance of Measurement Path: 200 pF

Figure 9-28

Calculation Example of Measurement Accuracy: MP/HRSMU, ASU+SMU



Conditions:

QSCV Operating Mode: 4155C/4156C compatible

Measurement Range: 10 nA

Output Range: 20 V

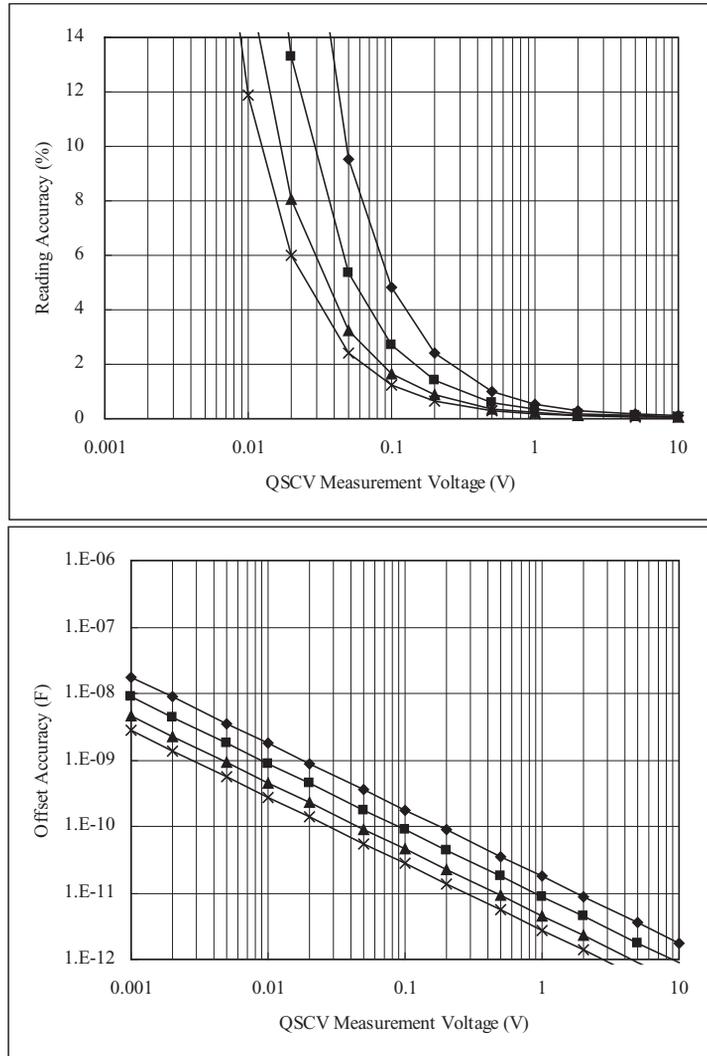
Integration Time: 2, 1, 0.5, 0.3 s corresponding to the lines from top to bottom

Equivalent Parallel Resistance of DUT: 10 TΩ

Guard Capacitance of Measurement Path: 200 pF

Figure 9-29

Calculation Example of Measurement Accuracy: MP/HRSMU, ASU+SMU



Conditions:

QSCV Operating Mode: 4155C/4156C compatible

Measurement Range: 100 nA

Output Range: 20 V

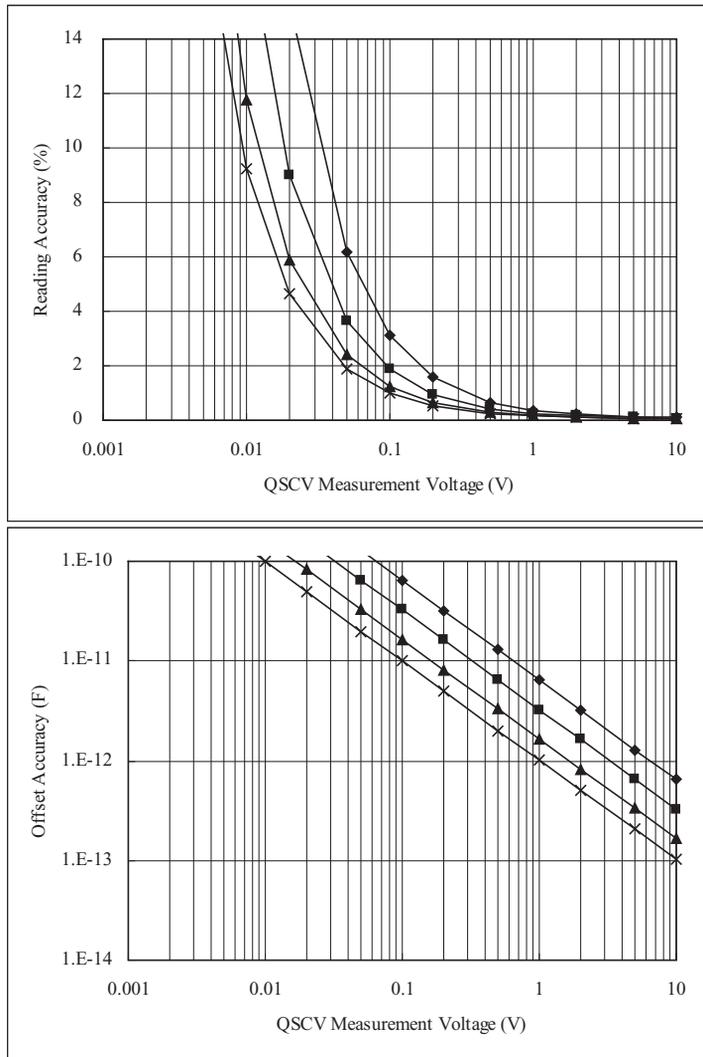
Integration Time: 2, 1, 0.5, 0.3 s corresponding to the lines from top to bottom

Equivalent Parallel Resistance of DUT: 10 T Ω

Guard Capacitance of Measurement Path: 200 pF

Figure 9-30

Calculation Example of Measurement Accuracy: MP/HRSMU, ASU+SMU



Conditions:

QSCV Operating Mode: 4155C/4156C compatible

Measurement Range: 1 μ A

Output Range: 20 V

Integration Time: 2, 1, 0.5, 0.3 s corresponding to the lines from top to bottom

Equivalent Parallel Resistance of DUT: 10 T Ω

Guard Capacitance of Measurement Path: 200 pF

If You Have a Problem

This chapter explains how to solve problems if you encounter some problems. This chapter consists of the following sections.

- “When You Operate B1500”
- “When You Perform Measurement”
- “Notice for Migrating from 4155/4156”
- “Before Shipping to Service Center”
- “Data Backup and Recovery”
- “Updating EasyEXPERT”
- “Performing a Clean Install of EasyEXPERT”
- “B1500 System Recovery”

If error occurs, find solutions in the following sections and solve problems. However, if problems still remain, perform self-test. Also see [Chapter 11, “Error Message.”](#)

If Keysight B1500 fails self-test, contact Keysight Technologies.

To get the latest firmware/software/manual/support information, go to www.keysight.com/find/easyexpert.

NOTE

This manual uses the following conventions.

- For Windows 7/8.1/10 64 bit version
 - <program folder>: <system drive>\Program Files (x86)
 - <common data folder>: <system drive>\ProgramData
 - For Windows Vista, 7/8.1/10 32 bit version
 - <program folder>: <system drive>\Program Files
 - <common data folder>: <system drive>\ProgramData
 - For Windows XP
 - <program folder>: <system drive>\Program Files
 - <common data folder>:
 - <system drive>\Documents and Settings\All Users\Application Data
 - <system drive>: Drive the EasyEXPERT has been installed
-

When You Operate B1500

This section covers the following basic problems that you may encounter when you install or operate the B1500, and the solutions.

- “Power On Trouble”
- “SCUU is not Detected”
- “ASU is not Detected”
- “N1265A/N1266A/N1268A is not Detected”
- “GPIB Devices are not Detected”
- “To Simplify the Connections”

To set up the B1500 built-in Windows, see Keysight B1500 *User’s Guide*.

If you need to reinstall Keysight EasyEXPERT software, see “[Performing a Clean Install of EasyEXPERT](#)” on page 10-21

Power On Trouble

- Connect the power cable to the instrument firmly.
- Connect the power cable to power outlet firmly.
- Open the measurement terminals, and set the Standby switch to the ON position.

NOTE

Open the measurement terminals at the device side when turning the B1500 on. Also disconnect the device from the measurement terminals and open the measurement terminals after the measurement. If you leave the connection with the device, the device may be damaged by unexpected operations or charge-up of measurement cables.

SCUU is not Detected

If EasyEXPERT cannot detect SCUU (SMU CMU unify unit), turn the instrument off, check the cable connection, and reboot it.

For the installation and connection of SCUU, see Keysight B1500A *User’s Guide*.

If You Have a Problem
When You Operate B1500

ASU is not Detected

If EasyEXPERT cannot detect ASU (atto sense/switch unit), turn the instrument off, check the cable connection, and reboot it.

For the installation and connection of ASU, see *User's Guide* of the instrument.

NOTE

Connect ASU to dedicated SMU

The specifications are satisfied and guaranteed for the exclusive combination of the ASU and the SMU. So confirm the serial number of the ASU and connect it to the dedicated SMU properly.

N1265A/N1266A/N1268A is not Detected

If EasyEXPERT cannot detect any of the following fixtures, turn the instrument off, check the cable connection, and reboot it.

- N1265A Ultra High Current Expander/Fixture
- N1266A HVSMU Current Expander
- N1268A Ultra High Voltage Expander

For the installation and connection of these fixtures, see Keysight B1505A *User's Guide* and *Configuration and Connection Guide*.

GPIB Devices are not Detected

If EasyEXPERT cannot detect the GPIB devices, turn the all GPIB devices off, check the GPIB cable connection, and reboot them.

NOTE

For GPIB connection between the instruments, use Keysight 82350B/C (for PCI bus), Keysight 82351A/B (for PCIe bus), Keysight 82357A/B (for USB/GPIB), or National Instrument GPIB-USB-HS.

When using the USB/GPIB interface, Keysight recommends to set the GPIB address of the instrument to even address. Error may occurs at serial polling due to the differences of internal communication system. It is reported that even GPIB address reduces the occurrence of this error remarkably.

If you control GPIB devices from the B1500, see the following consideration.

1. Confirm if the B1500 is set to the system controller. To enable the system controller, see Keysight B1500 *User's Guide*.

2. If the problem still remains, confirm if the B1500 is connected to USB0. Open Keysight Connection Expert, check Instrument I/O on this PC. The USB0 in this area must show the information as shown below.

```
USB0
+ B1500A(USB0::xxxx::x::xxxx::x::INSTR)
+ agb1500a
+ UsbDevice1
```

If “agb1500A” and “UsbDevice1” are not listed, add them by using a dialog box which is opened by right-clicking on B1500A(USB0:: . . ::INSTR) and selecting “Add VISA Alias” from the menu. For more information, see *Connectivity Guide* opened from the Help menu on the Connection Expert window.

To Simplify the Connections

If you want to simplify the cable connections of the SMU such as Keysight B1500/E5260/E5270 which has the Kelvin triaxial measurement terminals, use the triaxial cables instead of the Kelvin triaxial cables, and connect the triaxial cables between the Force terminals and the test fixture or the connector plate. Then the Sense terminals must be opened.

NOTE

Typical SMU has the Force and Sense terminals to make the Kelvin connection. And the Kelvin triaxial cables are effective to extend the measurement terminals near by the device under test. Connecting the Force and Sense lines together at the device terminals can minimize the measurement error caused by the residual resistance of the connection cables. The Kelvin connection is effective for the low resistance measurement and the high current measurement. Also it is one of the conditions to satisfy the measurement specifications of the SMU.

When You Perform Measurement

This section covers the following basic problems that you may encounter when you making a measurement, and the solutions.

- “Measurement Takes More Time than Specified”
- “Noise Affects the Measured Values”
- “Voltage Measurement Error is Large”
- “SMU Oscillates for High-Frequency Device Measurements”
- “SMU Oscillates for Negative Resistance Measurements”
- “Large Current Causes High Temperature (Thermal Drift)”
- “Measurement Damages the Device under Test”
- “Leaving Connections Damages Devices after Measurement”
- “Unexpected Sampling Measurement Data is Returned”
- “MFCMU Causes Unbalance Condition”

Measurement Takes More Time than Specified

If you set many measurement channels, auto ranging mode, or too long integration time, measurement takes a longer time.

To solve this problem:

Depending on your measurement requirements, perform following:

- Decreases measurement channels.
- Uses limited auto ranging mode.
- Uses fixed range.
- Decreases averaging samples of the high-speed A/D converter.
- Decreases integration time of the high-resolution A/D converter.
- Disables the ADC zero function.

Noise Affects the Measured Values

When you measure low current of a DUT, the measured values may not be stable.

To solve this problem:

- Set the power line frequency correctly. The value affects the integration time. So the wrong value causes the measurement error by the power line noise. You can set the power line frequency by using the Configuration window of the EasyEXPERT.
- Use guarding to reduce the leakage current between your prober and the B1500. Note that long wires cause oscillation because of their large inductance.
- If some high-power electric machines are operating around the instrument, turn off the machines, then perform the measurements. The machines affect the power line waveform.
- Shut the lid of test fixture or shield box to prevent effects of light.
- If these are vibrations due to nearby machines or due to air flow, put cushioning material under prober, cable, and the instrument; install stabilizer on the prober; and make the cables stable by taping.
- Wait several minutes after connecting cables or moving probe needles. Because these operations cause electromotive force.
- If you use only Force terminal and triaxial cables, connect an open cap to Sense terminal.
- Keep constant temperature in the room. Shift of 1 °C may shift the measurement values. Temperature change causes the following.
 - Offset current in the SMU.
 - Thermoelectromotive force in DUT, which causes low current.
 - Expansion and contraction of cables, which causes noise.

If You Have a Problem
When You Perform Measurement

Voltage Measurement Error is Large

Voltage measurement error may be large because of the effects of the cable resistance when forcing a large current.

To solve this problem:

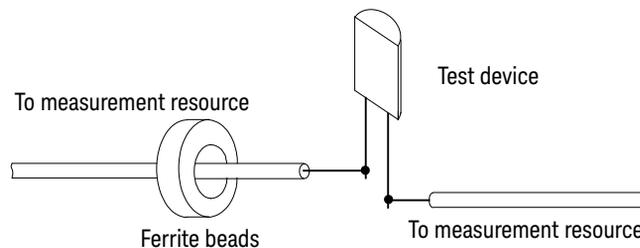
- Use kelvin connections between SMUs and DUT. To cancel the effects of cable resistance, connect the sense line as close as possible to the terminal of the DUT.

SMU Oscillates for High-Frequency Device Measurements

When measuring parameters of high-frequency devices, such as GaAs MESFETs or high-frequency bipolar transistors, oscillation may cause measurement problems. Normal measurement cannot be performed because of oscillation.

To solve this problem:

- For FETs, add resistive ferrite beads as close as possible to the gate.
- For bipolar transistors, add resistive ferrite beads as close as possible to the base or emitter.
- Make connection cables as short as possible. Long wires cause oscillation because of their large inductance.



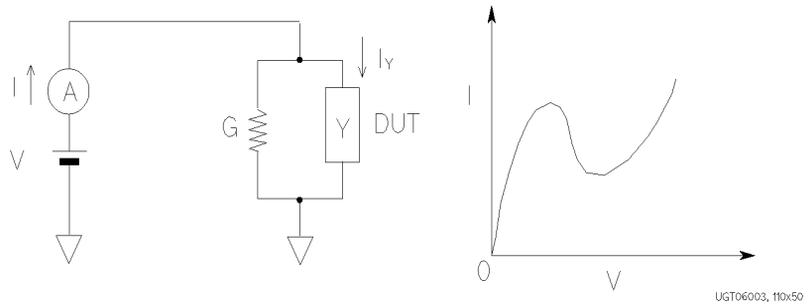
SMU Oscillates for Negative Resistance Measurements

If the DUT has negative resistance characteristics, SMUs may oscillate. Because the positive feedback may be configured by the DUT and the SMUs.

To solve this problem:

- For voltage controlled negative resistance device
 - Connect G in parallel with your DUT to cancel negative resistance. To obtain an output I-V curve, use the following equation.

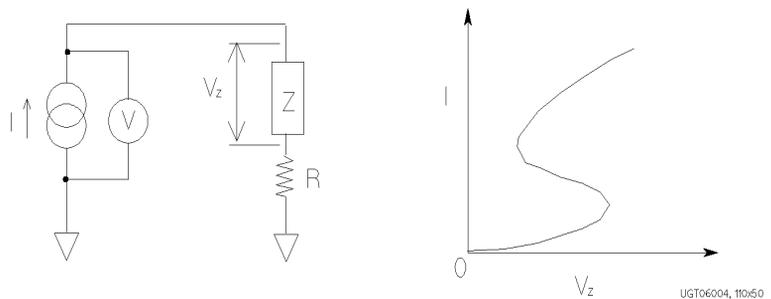
$$IY = I - G \times V$$



- For current controlled negative resistance device
 - Connect R in series with your DUT to cancel negative resistance. To obtain an output I-V curve, use the following equation.

$$VZ = V - R \times I$$

- If the resistance of the DUT is less than 1 MΩ, you can use a series resistor built into the SMU.



If You Have a Problem
When You Perform Measurement

Large Current Causes High Temperature (Thermal Drift)

If a large current is forced to a DUT, the temperature of the DUT may increase, which may cause characteristics to drift.

To solve this problem:

- Use the pulse output mode of the SMU.

For large currents, the SMU should be set to pulse output mode. This decreases the average power output to prevent temperature rise of DUT.

Measurement Damages the Device under Test

When performing breakdown measurements, DUTs may be damaged.

When voltage is forced from an SMU, the current is limited by the compliance setting, which prevents the DUT from being damaged by a large current. But when the current rapidly increases, the current limiter in the SMU cannot follow the rapid current increase, so a large amount of current may flow through the DUT for a moment, which may damage the DUT.

To solve this problem:

- Insert a protecting resistor as close as possible to DUT. You can also use a series resistor built into the SMU.

Leaving Connections Damages Devices after Measurement

After the measurements, open the measurement terminals or disconnect the device under test from the measurement terminals. If you leave the connection with the device, the device may be damaged by unexpected operations.

Do not leave the connection over 30 minutes after the measurement if the auto calibration is set to ON. Then, the instrument performs the self-calibration automatically every 30 minutes after the measurement. The calibration requires to open the measurement terminals.

NOTE

Open the measurement terminals and never connect anything when the calibration is performed.

Unexpected Sampling Measurement Data is Returned

If sampling interval is set to a short time and if FILTER ON is set, you may get unwanted data. FILTER ON causes a slower rise time, so short initial interval will sample during this rise time.

To solve this problem:

- Set FILTER field to OFF if you set initial interval to a short time.

Some data may be skipped because measurement takes a long time. Measurement takes a long time if measurement is performed in a low current range, if many measurement channels are set up, or if analysis, such as moving a marker, is performed during measurements.

To solve this problem:

- Measure current using a fixed range that is more than 10 μA . For measurement ranges 10 μA or less, measurement takes longer than the specified integration time.
- Do not perform analysis operation during measurement state.

MFCMU Causes Unbalance Condition

Extending measurement cables may cause the unbalance condition of the MFCMU.

To solve this problem:

- Perform the phase compensation. See “CMU Calibration” in “Calibration”, Chapter 1, User’s Guide Vol. 1.
- The signal path from MFCMU to DUT must be as short as possible.
- Reduce stray capacitance and guard capacitance on the signal line.

Do not connect the Low (Lcur, Lpot) terminal to the wafer chuck. If the MFCMU must be connected to the wafer chuck, use the High (Hcur, Hpot) terminal to connect to the wafer chuck.

Notice for Migrating from 4155/4156

The measurement instruments have individual integration time settings depending on the hardware. It is called as Default Integration Time. When migrating from 4155/4156, consider the difference of the default integration time between the instruments shown in the following tables.

Table 10-1

Instrument's Default Integration Time for Current Measurement Using HR-ADC (N PLC, N≥2)

Current Measurement Range	B1500A/E5270B (HR/MP/HPSMU)	4155/4156 (Long)	
		HRSMU	MP/HPSMU
1 pA	Setting × 1	N/A	
10 pA	Setting × 1	Always 100 PLC	N/A
100 pA	Setting × 1	Setting × 10	N/A
1 nA	Setting × 1	Setting × 5	Setting × 1
10 nA to 100 mA	Setting × 1	Setting × 1	
1 A	Setting × 1	Setting × 1	

Table 10-2

Instrument's Default Integration Time for Current Measurement Using HR-ADC (1 PLC)

Current Measurement Range	B1500A/E5270B (HR/MP/HPSMU)	4155/4156 (Medium)	
		HRSMU	MP/HPSMU
1 pA	Setting × 1	N/A	
10 pA	Setting × 1	50 PLC	N/A
100 pA	Setting × 1	10 PLC	N/A
1 nA	Setting × 1	5 PLC	3 PLC
10 nA to 100 mA	Setting × 1	1 PLC	
1 A	Setting × 1	N/A	1 PLC

Table 10-3 Instrument's Default Integration Time for Current Measurement Using HR-ADC (Short/Auto)

Current Measurement Range	Voltage Force Range														
	B1500A/E5270B ^a (HR/MP/HPSMU)					4155/4156 (HRSMU)				4155/4156 (MP/HPSMU)					
	≤ 5 V	20 V	40 V	100 V	200 V	2 V	20 V	40 V	100 V	2 V	20 V	40 V	100 V	200 V	
1 pA	16 samples				N/A	N/A				N/A					
10 pA	16 samples				N/A	10 PLC				N/A					
100 pA	8 samples				N/A	2 PLC				N/A					
1 nA	4 samples			8 samples		1 PLC				Setting × 1		Setting × 2	Setting × 4		
10 nA	4 samples			8 samples		Setting × 4				Setting × 1					
100 nA	10 samples	16 samples		20 samples		Setting × 2		Setting × 4		Setting × 1		Setting × 2	Setting × 4	Setting × 8	
1 μA	1 sample					Setting × 1				Setting × 1			Setting × 2		
10 μA	2 samples			4 samples		Setting × 1	Setting × 2			Setting × 1		Setting × 2	Setting × 3	Setting × 6	
100 μA to 100 mA	1 sample					Setting × 1				Setting × 1					
1 A	1 sample					N/A				Setting × 1		N/A			

a. 1 sample is 80 μs.

Before Shipping to Service Center

Before shipping Keysight B1500 to the Service Center, you have to do following:

- “To Make Backup”
- “To Check Module Slots”
- “To Check ASU/SMU Combination”
- “To Collect Equipment and Accessories”

To Make Backup

If the internal solid state drive (SSD) is failed, you will lose all data stored in the SSD. So it is important to make backup constantly.

Before shipping the B1500 to the service center, make backup of data in the SSD. And keep the backup media in trust. You may need to perform data recovery of the B1500 returned from the service center.

If the SSD is replaced, the B1500 will be returned with the latest revision of the software.

To Check Module Slots

Do not remove the plug-in module from the mainframe. The B1500 must be shipped with all modules. The module cannot be repaired without the mainframe. If a module is removed and installed by anyone who is not a service personnel of Keysight Technologies, the specifications are not guaranteed.

To Check ASU/SMU Combination

When you ship the B1500A used with the atto sense/switch unit (ASU), disconnect the ASU cable set (triaxial and Dsub) between the ASU and the SMU, and ship the mainframe, the ASU cable set, and the ASU. The ASU can be used with the exclusive SMU. To confirm the ASU/SMU combination, check the serial number. See “ASU” in “Configuration”, Chapter 1, User’s Guide Vol. 1.

To Collect Equipment and Accessories

All equipment and accessories used with Keysight B1500 are required for servicing and must be shipped to the Service Center. For details, contact the Service Center.

- B1500 mainframe with all plug-in modules installed
- Test fixture and system cable furnished with the B1506A/B1507A
- ASU and connection cable set between ASU and SMU
- RSU and connection cable set between RSU and WGF MU
- N1265A ultra high current expander/fixture and connection cables
- N1266A HVSMU current expander and connection cables
- N1267A HVSMU/HCSMU fast switch and connection cables
- N1268A ultra high voltage expander and connection cables

For returning ASU or RSU, do not forget to notify the combination of the unit, connection cable, and module channel.

The connection cable set between ASU and SMU means one of the following.

- E5288A-001 Triaxial and D-sub cables, 1.5 m
- E5288A-002 Triaxial and D-sub cables, 3 m

The connection cable set between RSU and WGF MU means one of the following.

- 16493R-003 3 m Cable between WGF MU and RSU
- 16493R-004 5 m Cable between WGF MU and RSU
- 16493R-006 1.5 m Cable between WGF MU and RSU
- 16493R-001 and 002 60 cm Cable and 2.4 m Cable between WGF MU and RSU
- 16493R-001 and 005 60 cm Cable and 4.4 m Cable between WGF MU and RSU

WARNING

To prevent electrical shock, turn off Keysight B1500 and remove the power cable before removing the connection cables.

Data Backup and Recovery

Unexpected trouble of SSD (solid state drive), operation mistake, or malfunction may cause elimination of valuable data. To avoid this kind of risk, make backup of data in the SSD as frequently as possible.

- “Folders to Backup”
- “To Make Database Backup”
- “To Restore Database Backup”
- “To Make Backup of Other Data”
- “To Restore Backup of Other Data”
- “To Move the EasyEXPERT Database”

NOTE

Drive for making backup

Make backup into the storage device that has large free space and can be accessed by the B1500 directly. The device may be the D drive, a USB memory, an external HDD with USB interface and such.

If you make backup into the B1500 internal SSD, C drive or D drive, make a copy of the backup into an external storage device or backup media, CD-ROM, CD-RW, USB memory and such.

Folders to Backup

Backup should be made for the following data areas.

- EasyEXPERT database and setup files
See [Table 10-4](#).
- Personal folders, below *C:\Users*
Example: *C:\Users\B1500user*
- Folders that store the data exported by EasyEXPERT
- Other folders that store the data to be saved

Table 10-4 **Location of EasyEXPERT Database and Setup Files**

Platform	Database	Setup Files
B1500 mainframe	D:\Agilent\EasyEXPERT\1	D:\Agilent\EasyEXPERT\User
External PC installed with Windows XP	C:\Program Files\Agilent\B1500\EasyEXPERT\User\1	C:\Program Files\Agilent\B1500\EasyEXPERT\User ^a
External PC installed with Windows Vista, Windows 7/8.1/10	C:\ProgramData\Agilent\EasyEXPERT\User\Database\1	C:\ProgramData\Agilent\EasyEXPERT ^a

- a. This folder contains the EasyEXPERT database.

To Make Database Backup

EasyEXPERT database backup can be made by the following procedure.

1. Launch Start EasyEXPERT.
2. Click Option > EasyEXPERT Database > Backup EasyEXPERT Database in the Start EasyEXPERT window.
3. Follow the EasyEXPERT Database Backup Creation wizard, and make backup into the D drive. The extension of the backup file is xdb.
4. Make a copy of the xdb file into an external storage device or backup media.

Example: `COPY EasyEXPERT_backup_1.xdb F:\`

To Restore Database Backup

EasyEXPERT database can be restored by the following procedure.

1. Make a copy of the database backup file (xdb file) into the D drive.
2. Launch Start EasyEXPERT.
3. Click Option > EasyEXPERT Database > Restore EasyEXPERT Database in the Start EasyEXPERT window.
4. Follow the EasyEXPERT Database Restoration wizard, and restore the backup of EasyEXPERT database.

NOTE

If the backup is not the xdb file

The backup for recovery must be “a copy of the folder that contains the EasyEXPERT database image”. And it must be stored in the location other than the following folders.

- D:\Agilent folder
- EasyEXPERT database folder

For the compressed backup (zip file or other) or the Windows backup (bkf file), uncompress the backup file at the location other than the above folders. And launch the wizard after the uncompression is completed.

Also, for the Backup Type Selection of the wizard, select “A Copy of the folder that contains the EasyEXPERT database image” and follow the wizard.

To Make Backup of Other Data

Backup of the data other than the EasyEXPERT database can be made by the following procedure.

1. Connect an external storage device, USB memory, HDD with USB interface and such, to the B1500.
2. Make a copy of the folder into the external storage device.

Example: XCOPY Folder_user_1 F:\Backup_user_1

To Restore Backup of Other Data

Data other than the EasyEXPERT database can be restored by the following procedure.

1. Connect the external storage device which stores the backup to the B1500.
2. Make a copy of the backup into the D drive.

Example: `XCOPY F:\Backup_user_1 Backup_user_1`

3. Delete the original folder.

Example: `RMDIR /S Folder_user_1`

4. Change the name of the backup to the original one.

Example: `RENAME Backup_user_1 Folder_user_1`

To Move the EasyEXPERT Database

When the SDD (solid state drive) is full, add a humongous drive and move the EasyEXPERT database to it. To move the database, follow the procedure below. Required time depends on the database size.

1. Launch Start EasyEXPERT.

If the Execution Mode dialog box is opened, click the Cancel button.

If Easyexpert is running, exit it to open the Start EasyEXPERT window.

2. Click Option > EasyEXPERT Database > Move EasyEXPERT Database. The EasyEXPERT Database dialog box is displayed.
3. Enter the destination folder name into the Move To field. For example, enter `C:\EasyEXPERT_user_1\database`.
4. Click the OK button to start the database move operation.

Click the Cancel button to cancel the move operation.

Updating EasyEXPERT

NOTE

The latest revision of the update package can be obtained from Keysight Technologies web site.

NOTE

The revision 3.2 or later does not require the administrator privilege. However, if the software is updated from a previous revision to the revision 3.2 or later, it still requires the administrator privilege.

Preparation

If you update the EasyEXPERT to the revision 5.5 or later, prepare the license file for EasyEXPERT.

If you do not have the license file, prepare the Software Entitlement Certificate sheet provided with the option SWS. And get the license file as described in this sheet.

Procedure

1. Confirm the current revision of EasyEXPERT and get the update package.
2. Make a backup of EasyEXPERT database. See [“To Make Database Backup” on page 10-17.](#)
3. Install the required software described in README file included in the update package. If it is already installed, go to the step 4.
4. Update the EasyEXPERT by following the procedure described in the README file.
5. After the update is completed, make a backup of EasyEXPERT database.

If update fails

If EasyEXPERT could recover to the revision before starting the update procedure, perform the following procedure.

1. Restore the backup made by “Procedure” step 2. See [“To Restore Database Backup” on page 10-18.](#)
2. Perform “Procedure” step 3 to 5.

If EasyEXPERT could not recover, see [“Performing a Clean Install of EasyEXPERT” on page 10-21](#) and install EasyEXPERT of the revision before starting the update procedure. After that, perform “Procedure” step 3 to 5.

Performing a Clean Install of EasyEXPERT

This section explains how to clean install EasyEXPERT.

1. Confirm the current revision of EasyEXPERT and get the same revision of the EasyEXPERT software installation package.
2. Make a backup of the EasyEXPERT database. See [“Data Backup and Recovery” on page 10-16](#) for the procedure.
3. Terminate the EasyEXPERT and logoff the Windows. And login again.
4. By using the Explorer of Windows, move the folder for EasyEXPERT setup files. For example, move it to the Temp folder. See [Table 10-4 on page 10-17](#) for the location of the setup files.
5. By using the Control Panel of Windows, uninstall the EasyEXPERT software. If the multiple revisions have been installed, uninstall all revisions.
6. By using the Explorer, delete the EasyEXPERT program folder. See [Table 10-5](#) for the location of the program folder.
7. Re-install the EasyEXPERT of the revision confirmed in the step 1.
For more information, see [“To Install EasyEXPERT in External PC” on page 7-6](#).
8. Confirm that the EasyEXPERT starts and works normally.
9. Restore the database from the backup.
10. If you need, restore your desired files from the folder moved in the step 4.

Table 10-5 **Location of EasyEXPERT Program Folder**

Operating system	Location
Windows XP, Vista, 7/8.1/10 32 bit version	C:\Program Files\Agilent\B1500\EasyEXPERT
Windows 7/8.1/10 64 bit version	C:\Program Files (x86)\Agilent\B1500\EasyEXPERT

B1500 System Recovery

The system recovery is not required in normal situation. Perform it only if you would like to restore factory shipped condition in some reason or Keysight support engineer asks for the problem solving.

- [“Before Performing System Recovery”](#)
- [“Preparation”](#)
- [“To Perform System Recovery”](#)
- [“To Initialize Database”](#)
- [“To Restore Database”](#)

Before Performing System Recovery

The system recovery will restore the C drive to the factory shipped condition. Be aware of the followings before performing the system recovery.

- Before performing the system recovery, make a backup of the user data and store it in a device other than the C drive.
- The system recovery is not performed for the D drive, where the EasyEXPERT database is stored, and performed only for the C drive. If you would like to initialize the EasyEXPERT database, see [“To Initialize Database” on page 10-26](#).
- If the EasyEXPERT has been updated after factory shipment, the factory shipped revision of EasyEXPERT may not be able to read the current database. To read the current database, update the EasyEXPERT to the current revision or the latest revision after the system recovery.

Preparation

1. Note the computer name of your B1500.
This is required to set the same computer name again after System Recovery is completed. You can find it on System Properties displayed by Control Panel > System.
2. Note all user account if you added the accounts.
This is required to add the same user accounts again after System Recovery is completed. You can check it on User Accounts displayed by Control Panel > User Accounts.
3. Make backup of data in the SSD. See [“Data Backup and Recovery” on page 10-16](#).
4. Confirm the current revision of EasyEXPERT and prepare the same revision of the EasyEXPERT software installation package.

To Perform System Recovery

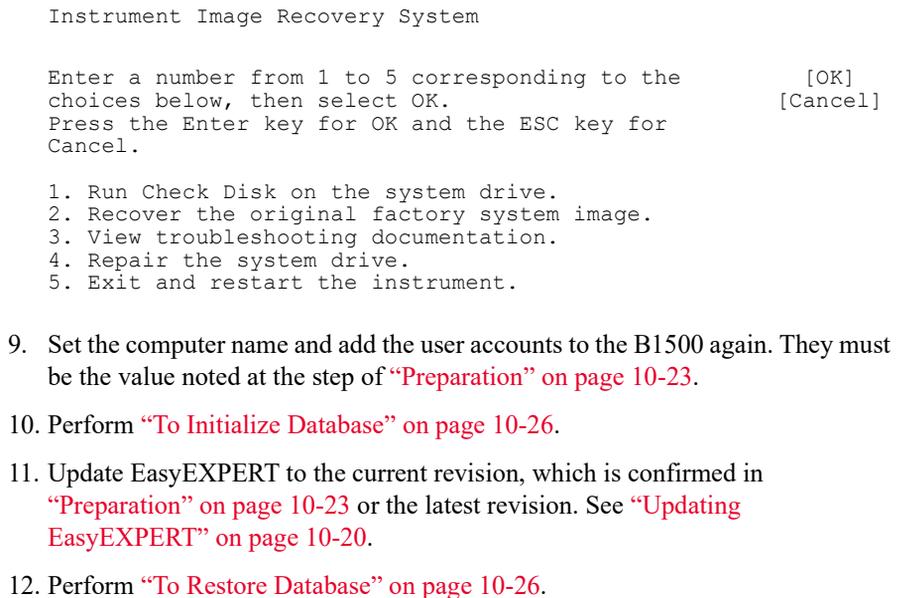
B1500 system recovery can be performed by the following procedure.

For Windows 10 based B1500

1. Set the B1500 Standby switch to the OFF position.
2. Disconnect all USB devices from the B1500.
3. Connect the USB keyboard to a USB port of the B1500.
4. Set the B1500 Standby switch to the ON position.
5. Before Windows boots up, press the F8 key to display the boot system selection menu. This step may not be needed.
6. On the boot system selection menu, select Instrument Image Recovery System, and press Enter key. To select the system, use arrow keys.
The Instrument Image Recovery System window is opened. See [Figure 10-1](#).
7. Enter 2 and press “OK”. Message will be displayed for asking if you allow to overwrite the C drive.
8. For the message, press “OK”. System recovery starts.

After the recovery completes successfully, the system will restart automatically.

Figure 10-1 Instrument Image Recovery System Screen



For Windows 7 based B1500

1. Set the B1500 Standby switch to the OFF position.
2. Disconnect all USB devices from the B1500.
3. Connect the USB keyboard to a USB port of the B1500.
4. Set the B1500 Standby switch to the ON position.
5. Before Windows boots up, press the F8 key to display the boot system selection menu.
6. On the boot system selection menu, select Keysight Recovery System, and press Enter key. To select the system, use arrow keys.

The Command Prompt window is opened. See **Figure 10-2**.

Where, 2 is not valid now. 3 should be entered for rebooting the B1500 without performing system recovery.
7. For the message “Enter a Choice:”, enter 1 and press the Enter key. Message will be displayed for asking if you allow to overwrite the C drive.
8. For the message, enter 1 and press the Enter key. System recovery starts.

After the recovery completes successfully, the Command Prompt window displays the message as shown in [Figure 10-3](#).

Enter 1 for rebooting the B1500.

Enter 2 for turning off the B1500.

Figure 10-2 Keysight System Recovery Screen 1

```
Keysight Technologies System Utilities  
Recovery Options
```

```
Choose one of the following:  
-----
```

1. Recover Factory Backup Image.
2. Update System.
3. Exit

```
-----  
Enter a Choice:
```

Figure 10-3 Keysight System Recovery Screen 2

```
Choose one of the following:  
-----
```

1. Restart
2. Shut down

```
-----  
Enter a Choice:
```

9. Set the computer name and add the user accounts to the B1500 again. They must be the value noted at the step of [“Preparation” on page 10-23](#).
10. Perform [“To Initialize Database” on page 10-26](#).
11. Update EasyEXPERT to the current revision, which is confirmed in [“Preparation” on page 10-23](#) or the latest revision. See [“Updating EasyEXPERT” on page 10-20](#).
12. Perform [“To Restore Database” on page 10-26](#).

To Initialize Database

EasyEXPERT database can be initialized by the following procedure. You can use EasyEXPERT after this procedure is completed.

1. Exit Start EasyEXPERT.
2. Rename *D:\Agilent\EasyEXPERT\1* folder (EasyEXPERT database).

Example: CHDIR /D D:\Agilent\EasyEXPERT
 RENAME 1 1-backup

3. Create *D:\Agilent\EasyEXPERT\1* folder.

Example: MKDIR 1

4. Copy all files and folders in the *D:\Agilent\EasyEXPERT\Copy of 1* folder, and paste them to the *D:\Agilent\EasyEXPERT\1* folder.

Example: CHDIR Copy of 1
 XCOPY * ..\1 /s /e /q /i

To Restore Database

EasyEXPERT database can be restored by the following procedure.

In the example shown in **“To Initialize Database”**, the EasyEXPERT database backup is the whole *D:\Agilent\EasyEXPERT\1-backup* folder. The database can be restored by using the data in this folder.

- For EasyEXPERT revision 2.10 and earlier
The database reconfiguration tool is required. Obtain it from Keysight Technologies web site. For the execution procedure, see the readme text file included in the package.
- For EasyEXPERT revision 2.11 and later
 1. Launch Start EasyEXPERT.
 2. Click Option > EasyEXPERT Database > Restore EasyEXPERT Database in the Start EasyEXPERT window.
 3. Follow the EasyEXPERT Database Restoration Wizard and complete the restoration of EasyEXPERT database.

11 **Error Message**

Error Message

This chapter lists the Keysight B1500 error code.

- “Keysight EasyEXPERT Operation Error”
- “Keysight FLEX Execution Error”
- “Keysight B1500 Self-test/Calibration Error”
- “Setup File Converter Execution Error”
- “MDM File Converter Execution Error”

NOTE

This manual uses the following conventions.

- For Windows 7/8.1/10 64 bit version
 - <program folder>: <system drive>\Program Files (x86)
 - <common data folder>: <system drive>\ProgramData
 - For Windows Vista, 7/8.1/10 32 bit version
 - <program folder>: <system drive>\Program Files
 - <common data folder>: <system drive>\ProgramData
 - For Windows XP
 - <program folder>: <system drive>\Program Files
 - <common data folder>:
 - <system drive>\Documents and Settings\All Users\Application Data
- <system drive>: Drive the EasyEXPERT has been installed
- <database folder> for EasyEXPERT on B1500:
D:\Agilent\EasyEXPERT\1
- <database folder> for EasyEXPERT on external PC:
<common data folder>\Agilent\EasyEXPERT\User\Database\1
-

Keysight EasyEXPERT Operation Error

When Keysight B1500 causes errors in Keysight EasyEXPERT execution environment, the B1500 returns the following error codes and error messages.

- 101001** Log repository operation failed.
Consult the detail messages and solve the problems.
- 101002** Log file operation failed.
Consult the detail messages and solve the problems.
- 101003** Log record operation failed.
Consult the detail messages and solve the problems.
- 102001** Service started successfully.
- 102002** Service stopped successfully.
- 102003** Service starting process failed.
Restart the B1500/EasyEXPERT. If this error still arises, contact your nearest Keysight Technologies.
- 102004** Service stopping process failed.
Restart the B1500/EasyEXPERT. If this error still arises, contact your nearest Keysight Technologies.
- 103001** USB488 error occurred. Alias: *A*, Reason: *B*
Consult Alias and Reason, and solve the problems. After that, turn the B1500 off, remove the power cable, connect it again, and restart the B1500/EasyEXPERT.
- 103002** USB488 device was not found. Alias: *A*, Reason: *B*
Consult Alias and Reason, and add the B1500 by using the Connection Expert of Keysight IO Library.
- 103003** USB488 timeout occurred. Alias: *A*, Timeout: *B* [ms]
Contact your nearest Keysight Technologies. Then present the command history included in the detail messages.
- 103004** GPIB error occurred. Interface: *A*, Address: *B*, Reason: *C*

Error Message

Keysight EasyEXPERT Operation Error

- Consult Interface, Address, and Reason, check the status of the target GPIB instrument, and solve the problems.
- 103005** GPIB address must be between 0 and 31. Interface: *A*, Address: *B*
Set the GPIB address to the one between 0 and 31.
- 103006** Duplicate GPIB address was found. GPIB address must be unique. Interface: *A*, Address: *B*
Assign an unique address to each GPIB instrument.
- 103007** GPIB device was not found. Interface: *A*, Address: *B*, Reason: *C*
Consult Interface, Address, and Reason, check the GPIB address, the cable connection, and the status of the target GPIB instrument, and solve the problems.
- 103008** GPIB timeout occurred. Interface: *A*, Address: *B*, Timeout: *C* [ms]
Consult Interface, Address, and Timeout, check the GPIB address, the cable connection, and the status of the target GPIB instrument, and solve the problems. Or, long timeout setting may solve the problem.
- 104001** Module (*A*) is not available.
If the target module fails the self-test, contact your nearest Keysight Technologies for repair. Or else, check the module configuration and specify the available module.
- 105001** Generic setup error occurred. Code: *A*, Reason: *B*
Firmware error. If this error code occurs as the top level error, contact your nearest Keysight Technologies. Then present Code and Reason.
- 105002** Duplicate data name was found. Data name must be unique. Data name: *A*
Assign an unique name to each variable defined in the test setup.
- 105003** Operation is not supported in offline mode.
Change the operation mode to Online to perform this operation.
- 105004** Interlock circuit is open. Interlock circuit must be closed for setting voltage source/compliance absolute value exceeding *A* V.
Close the Interlock circuit to apply the channel setup over *A* V.
- 105005** Output series resistor cannot be used for SMU with ASU.
Set NONE to Series R of the Unit: SMU n :HR/AS.

- 105006** Source wait time coefficient must be between *A* and *B*.
Set Output Wait to the value between *A* and *B*.
- 105008** Monitor wait time coefficient must be between *A* and *B*.
Set Measurement Wait to the value between *A* and *B*.
- 105010** Series resistor is not available for HPSMU using the 1 A range.
Set NONE to Series R of the Unit: SMU n :HP if the HPSMU is used over 100 mA. If 1MOHM is set, use the HPSMU within 100 mA.
- 105011** I/V Staircase Sweep needs at least one monitoring channel.
Define one or more measurement variables (data used for data display or calculation) in the test setup for the staircase sweep measurement.
- 105012** I/V Pulsed Sweep needs exactly one monitoring channel.
Define one measurement variable (data used for data display or calculation) in the test setup for the pulsed sweep measurement.
- 105013** I/V Sweep with pulsed bias needs exactly one monitoring channel.
Define one measurement variable (data used for data display or calculation) in the test setup for the staircase sweep with pulsed bias measurement.
- 105014** I/V-t Sampling needs at least one monitoring channel.
Define one or more measurement variables (data used for data display or calculation) in the test setup for the sampling measurement.
- 105015** C-V Sweep needs at least one monitoring channel.
Define one or more measurement variables (data used for data display or calculation) in the test setup for the C-V sweep measurement.
- 105016** At least one measurement channel is required for Multi Channel I/V Sweep measurement.
Define one or more measurement variables (data used for data display or calculation) in the test setup for the multi channel sweep measurement.
- 105017** Only one measurement channel can be used for I/V-t linear sampling measurement of interval < 2 ms.
Define one measurement variable (data used for data display or calculation) in the test setup for the sampling measurement with the interval less than 2 ms using the Keysight 4155B/C or 4156B/C.

Error Message
Keysight EasyEXPERT Operation Error

- 105018** Base hold time is not available for 4155B/C and 4156B/C. The value must be 0.
Set Base Hold Time to 0 for the sampling measurement using the 4155B/C or 4156B/C.
- 105020** Interlock circuit is open. Interlock circuit must be closed to set an output or compliance value greater than ± 40 V.
This is for using the 4155B/C or 4156B/C. Close the Interlock circuit to apply the channel setup over ± 40 V.
- 105021** Current source value of A must be between B A and C A.
For the Unit: A , set the current output value to the value between B A and C A.
- 105022** Voltage compliance value of A must be between B V and C V.
For the Unit: A , set Compliance to the value between B V and C V.
- 105023** Voltage source value of A must be between B V and C V.
For the Unit: A , set the voltage output value to the value between B V and C V.
- 105024** Current compliance value of A must be between B A and C A.
For the Unit: A , set Compliance to the value between B A and C A.
- 105025** Power compliance value of A must be between B W and C W.
For the Unit: A , set Pwr Comp to the value between B W and C W.
- 105026** A power compliance must be OFF.
For the Unit: A , set Pwr Comp to OFF.
- 105027** Measurement unit emergency reset occurred.
Code: A , Reason: B
Consult Code and Reason, specify the cause of emergency, and solve the problems.
- 105031** The product of voltage source value and current compliance value of A exceeds its output power range. Please set the current compliance value between B A and C A.
For the Unit: A , set Compliance to the value between B A and C A.

- 105032** The product of current source value and voltage compliance value of A exceeds its output power range. Please set the voltage compliance value between B V and C V.
For the Unit: A , set Compliance to the value between B V and C V.
- 105033** The polarity of peak value(s) and the base value of SMU current pulse must be the same.
For the base and peak values, set the values of the same polarity.
- 105034** The start value and stop value of SMU log sweep must be non-zero and have same polarity for primary sweep source (and synchronous sweep source).
For the start and stop values, set the non-zero values of the same polarity.
- 105035** Invalid value (A) was specified for SMU I/V Sweep stop condition.
Valid option(s): B
The value A is not available for the setting of the sweep abort condition. Select one from the available choices B . If you use a formula, the calculation result must show the available value.
- 105036** The hold time for SMU I/V Sweep must be between A s and B s.
Set Hold to the value between A s and B s.
- 105037** The delay time for SMU I/V Sweep must be between A s and B s.
Set Delay to the value between A s and B s.
- 105038** SMU pulse width must be between A s and B s.
Set Width to the value between A s and B s.
- 105039** SMU pulse period must be between A s and B s.
Set Period to the value between A s and B s.
- 105040** SMU pulse width and period must conform following conditions.
For pulse width A s or less: The period must be B s longer or more than the pulse width.
For pulse width longer than A s: The period must be C s longer or more than the pulse width.
Set the values which satisfy the above conditions to Width and Period.

Error Message
Keysight EasyEXPERT Operation Error

- 105041** Invalid value (*B*) was specified for current monitor ranging mode of *A*. Valid option(s): *C*
Set the ranging mode (*C*) available for the Unit: *A*.
- 105042** Invalid value (*B*) was specified for current monitor range of *A*. Valid option(s): *C*
Set the value (*C*) available for Range of the Unit: *A*.
- 105043** Invalid value (*B*) was specified for current monitor ranging rule of *A*. Valid option(s): *C*
Set the value (*C*) available for Range Change Rule of the Unit: *A*.
- 105044** Invalid value (*B*) was specified for voltage monitor ranging mode of *A*. Valid option(s): *C*
Set the ranging mode (*C*) available for the Unit: *A*.
- 105045** Invalid value (*B*) was specified for voltage monitor range of *A*. Valid option(s): *C*
Set the value (*C*) available for Range of the Unit: *A*.
- 105046** Invalid value (*A*) was specified for the integral mode of High-Resolution ADC. Valid option(s): *B*
Set the value (*B*) available for Mode of the High Resolution ADC.
- 105047** The coefficient for High Resolution ADC *A* integral mode must be between *B* and *C*.
Set the value between *B* and *C* to Factor of the High Resolution ADC.
- 105048** Invalid value (*A*) was specified for the averaging mode of High-Speed ADC. Valid option(s): *B*
Set the value (*B*) available for Mode of the High Speed ADC.
- 105049** The coefficient for High Speed ADC *A* averaging mode must be between *B* and *C*.
Set the value between *B* and *C* to Factor of the High Speed ADC.
- 105050** Invalid value (*A*) was specified for the integral mode of ADC. Valid option(s): *B*
Set the value (*B*) available for Mode of the High Speed ADC.
- 105051** Invalid value (*A*) was specified for the sweep direction. Valid option(s): *B*

- Set the value (*B*) available for Direction.
- 105052** Invalid value (*A*) was specified for the sweep stop condition. Valid option(s): *B*
Set the value (*B*) available for the sweep stop condition (Sweep status).
- 105053** Invalid value (*A*) was specified for the impedance measurement model. Valid option(s): *B*
Set the value (*B*) available for Model of C-V measurement.
- 105054** Hold time value must be between *A* s and *B* s.
Set Hold to the value between *A* s and *B* s.
- 105055** Delay time value must be between *A* s and *B* s.
Set Delay to the value between *A* s and *B* s.
- 105056** Voltage source value of *A* must be between *B* V and *C* V.
Set the CMU voltage output value to the value between *B* V and *C* V.
- 105057** Frequency value of *A* must be between *B* Hz and *C* Hz.
Set Frequency List to the value between *B* Hz and *C* Hz.
- 105058** Coefficient value of *A* integral mode must be between *B* and *C*.
Set the value between *B* and *C* to Factor of Integration Time.
- 105059** AC Level value of *A* must be between *B* mV and *C* mV.
Set AC Level to the value between *B* mV and *C* mV.
- 105060** Invalid value (*B*) was specified for monitor ranging mode of *A*. Valid option(s): *C*
Set the ranging mode (*C*) available for CMU.
- 105061** SMU pulse period must be *A* s longer than the pulse width.
For the SMU pulse output using the 4155B/C or 4156B/C, set Period and Width to the values which satisfy $\text{Period} \geq \text{Width} + A$.
- 105062** Primary sweep source step value must be greater than the setup resolution.
For the sweep measurement using the 4155B/C or 4156B/C, set Step of VAR1 to the value greater than or equal to the minimum setting resolution.

Error Message
Keysight EasyEXPERT Operation Error

- 105063** Synchronous sweep source step value must be greater than the setup resolution. Adjust the offset value and the ratio value, or change the primary sweep source settings.
For the sweep measurement using the 4155B/C or 4156B/C, set Offset and Ratio of VAR1' and Step of VAR1 to the values so that the VAR1' source step value is greater than or equal to the minimum setting resolution.
- 105064** Compliance absolute value must be A A or greater if the channel is the SMU pulse source and the output value is B Vpp.
For the B Vpp pulse output using SMU of the 4155B/C or 4156B/C, set Compliance to $\pm A$ A or above.
- 105065** Compliance value must be ± 2 V or less if the channel is the SMU pulse source and the output value is 0 A to 10 μ A.
For the pulse output up to 10 μ A using the 4155B/C or 4156B/C, set Compliance to the value within ± 2 V.
- 105066** Current compliance must be 100 mA for VSU.
For using VSU of the 4155B/C or 4156B/C, set Compliance to 100 mA.
- 105067** Power compliance must be OFF for VSU.
For using VSU of the 4155B/C or 4156B/C, set Pwr Comp to OFF.
- 105071** Sampling interval for I/V-t sampling must be between A s and B s.
Set Interval to the value between A s and B s.
- 105072** Number of samples for I/V-t A sampling must be between B and C .
Set No of Samples to the value between B and C .
- 105073** Hold time for I/V-t sampling must be between A s and B s.
Set Hold Time to the value between A s and B s.
- 105074** Multiplying the number of monitor channels by No of Samples must be between A and B .
In the test setup for the sampling measurement, adjust No of Samples and the number of measurement channels so that the total number of measurement data, which is equal to the number of measurement channels multiplied by No of Samples, is between A and B .

- 105075** Invalid value A specified for I/V-t sampling Lin/Log setting.
Valid option(s): B
Set the value (B) available for Lin/Log.
- 105076** Base hold time for I/V-t sampling must be between A s and B s.
Set Base Hold Time to the value between A s and B s.
- 105077** Invalid value A specified for I/V-t sampling output sequence.
Valid option(s): B
Set the value (B) available for Output Sequence.
- 105078** Sampling interval for I/V-t A sampling must be between B s and C s.
Set Interval to the value between B s and C s.
- 105079** Hold time for I/V-t A sampling must be between B s and C s.
Set Hold Time to the value between B s and C s.
- 105080** Hold time for I/V-t A sampling with interval of B s or longer must be between C s and D s.
Set Hold Time to the value between C s and D s.
- 105081** Hold time for I/V-t A sampling with interval shorter than B s must be between C s and D s.
Set Hold Time to the value between C s and D s.
- 105082** The polarity of base value and the source value of SMU current sampling must be the same.
For Base and Source, set the values of the same polarity.
- 105083** The number of VAR1 steps multiplied by the number of VAR2 steps must be between A and B in I/V Sweep, I/V List Sweep and Multi Channel I/V Sweep.
Set the sweep output, Start/Stop/Step/No of Step/Sources, so that the total number of sweep steps, which is equal to the number of steps for VAR1 multiplied by the number of steps for VAR2, is between A and B .
- 105091** List length of VAR1 sweep must be between A and B for the I/V List Sweep measurement. Length C is not applicable.
Define Sources vector data for VAR1 so that its number of data is between A and B .

Error Message
Keysight EasyEXPERT Operation Error

- 105092** List length of VAR2 sweep must be between A and B for the I/V List Sweep measurement. Length C is not applicable.
Define Sources vector data for VAR2 so that its number of data is between A and B .
- 105093** List length of delay time must be between A and B for the I/V List Sweep measurement. Length C is not applicable.
Define Delay vector data so that its number of data is between A and B .
- 105094** Time until the first step measurement, (hold time + delay time), must be between A and B s for the I/V List Sweep measurement using SMU pulse.
Set Hold and Delay(1), so that Hold + Delay(1) is between A s and B s. Delay(1) indicates the first data in the Delay vector data.
- 105095** A does not support current measurement.
Specify the measurement resource which supports current measurement.
- 105096** At least one measurement channel is required for I/V List Sweep measurement.
Define one or more measurement variables (data used for data display or calculation) in the test setup for the I/V List Sweep measurement.
- 105801** Invalid value A specified for *Output Value after Measurement* in the Advanced Setup dialog box. Valid option(s): B
Set the value (B) available for Output Value after Measurement.
- 105802** Invalid value A specified for *Bias Hold after Measurement* in the Advanced Setup dialog box. Valid option(s): B
Set the value (B) available for Bias Hold after Measurement.
- 105803** Bias hold function execution error. All channel outputs or voltage compliance must be at $\pm A$ V or less to control the output switch or the series resistor.
Before controlling the output switch or the series resistor, set all channel output and compliance values to within $\pm A$ V. Or set Bias Hold after Measurement to OFF.
- 105804** Bias hold function execution error. Output voltage or voltage compliance must be ± 40 V or less to control the output switch or the series resistor.

Before controlling the output switch or the series resistor, set all channel output and compliance values to within ± 40 V. Or set Bias Hold after Measurement to OFF.

- 105811** Invalid value *A* was specified for Semiconductor Relays (*B*) of Advanced Setup. Valid option(s): *C*
Set the value (*C*) available for Semiconductor Relays (*B*).
- 105821** Invalid value *A* was specified for Type of SPGU Pulse Setup. Valid option(s): *B*, VName: *C*
For SPGU Pulse Setup, set the value (*B*) available for Type of VName *C*.
- 105822** Invalid value *A* was specified for SW Sync of Pulse Switch Setup. Valid option(s): *B*, VName: *C*
For Pulse Switch Setup of SPGU, set the value (*B*) available for SW Sync of VName *C*.
- 105823** Invalid value *A* was specified for Normal of Pulse Switch Setup. Valid option(s): *B*, VName: *C*
For Pulse Switch Setup of SPGU, set the value (*B*) available for Normal of VName *C*.
- 105824** Delay value of Pulse Switch Setup must be between *A* s and *B* s. VName: *C*
For Pulse Switch Setup of SPGU, set Delay of VName *C* to the value between *A* s and *B* s.
- 105825** Width for pulse switch must be between *A* s and *B* s. VName: *C*
For Pulse Switch Setup of SPGU, set Width of VName *C* to the value between *A* s and *B* s.
- 105826** Sum of Delay and Width of Pulse Switch Setup must be within Period value. VName: *A*
For Pulse Switch Setup of SPGU, set Delay and Width of VName *A* so that Delay+Width is shorter than or equal to Period.
- 105830** Load Z value must be between *A* ohm and *B* ohm. VName: *C*
For Load Z Setup of SPGU, set Load Z of VName *C* to the value between *A* Ω and *B* Ω .
- 105831** Period value of SPGU Pulse Setup must be between *A* s and *B* s.

Error Message
Keysight EasyEXPERT Operation Error

- For SPGU Pulse Setup, set Period to the value between *A* s and *B* s.
- 105832** PULSE COUNT value of SPGU Pulse Setup must be between *A* and *B*.
For SPGU Pulse Setup, set PULSE COUNT to the value between *A* and *B*.
- 105833** DURATION value of SPGU Pulse Setup must be between *A* s and *B* s.
For SPGU Pulse Setup, set DURATION to the value between *A* s and *B* s.
- 105834** Base value of SPGU Pulse Setup must be between *A* V and *B* V.
VName: *C*
For SPGU Pulse Setup, set Base of VName *C* to the value between *A* V and *B* V.
- 105835** Peak value of SPGU Pulse Setup must be between *A* V and *B* V.
VName: *C*
For SPGU Pulse Setup, set Peak of VName *C* to the value between *A* V and *B* V.
- 105836** Delay value of SPGU Pulse Setup must be between *A* s and *B* s.
VName: *C*
For SPGU Pulse Setup, set Delay of VName *C* to the value between *A* s and *B* s.
- 105837** Width value of SPGU Pulse Setup must be between *A* s and *B* s.
VName: *C*
For SPGU Pulse Setup, set Width of VName *C* to the value between *A* s and *B* s.
- 105838** Leading value of SPGU Pulse Setup must be between *A* s and *B* s.
VName: *C*
For SPGU Pulse Setup, set Leading of VName *C* to the value between *A* s and *B* s.
- 105839** Trailing value of SPGU Pulse Setup must be between *A* s and *B* s.
VName: *C*
For SPGU Pulse Setup, set Trailing of VName *C* to the value between *A* s and *B* s.
- 105840** Leading \times 1.25 must be within Width value. VName: *A*

- For SPGU Pulse Setup, set Leading of VName *A* so that $\text{Leading} \times 1.25$ is shorter than or equal to Width.
- 105841** Sum of Delay, Width, and Trailing $\times 1.25$ must be within Period value.
VName: *A*
- For SPGU Pulse Setup, set Delay/Width/Trailing of VName *A* so that $\text{Delay} + \text{Width} + \text{Trailing} \times 1.25$ is shorter than or equal to Period.
- 105842** Invalid value *A* was specified for PGU output impedance.
Valid option(s): *B*, VName: *C*
- For using PGU of 4155B/C or 4156B/C, set the value (*B*) available for Output Impedance of VName *C*.
- 105843** SPGU cannot be used for bias source of I/V-t linear sampling measurement of interval < 2 ms.
- Set Interval to 2 ms or above for using SPGU as a bias source of the sampling measurement. Or else, do not use SPGU.
- 105844** $|\text{Peak} - \text{Base}|$ value of PGU pulse must be between *A* V and *B* V.
VName: *C*
- Set Peak and Base of VName *C* so that $|\text{Peak} - \text{Base}|$ is between *A* V and *B* V.
- 105845** Period, Width, and Delay values of PGU pulse must be in the same setting range. And Leading and trailing values must be in the same setting range.
- Set Period, Width, and Delay so that the values belong to the same group. Also, set Leading and Trailing so that the values belong to the same group. For the group, see the PGU specifications.
- 105846** SPGU cannot output the specified voltage. Change Load Z value or output voltage.
- Change Load Z value or setup voltage to apply the setting value correctly.
- 105881** N1272A/B1506A/B1507A Device Capacitance Selector is not found.
- Check the status of the N1272A and the communication cable connections for N1272A/B1506A/B1507A, and solve the problems.
- 105882** Communication with N1272A/B1506A/B1507A Device Capacitance Selector interrupted. Connect the cable properly.

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- Check the communication cable connections for N1272A/B1506A/B1507A, and solve the problems.
- 105883** N1272A/B1506A/B1507A Device Capacitance Selector is turned off. Connect the power cable properly and check the power switch.
- Check the power cable connections for N1272A/B1506A/B1507A, and solve the problems.
- 105885** Input units for Device Capacitance Selector are not assigned. Please assign the units on the Configuration window's Device Capacitance Selector tab.
- 105891** No current load control SMU is assigned. Please assign the current load control SMU on the Configuration window's Gate Charge Adapter tab.
- 105892** Current load adjustment failed. Please check the High Current Switching Waveform.
- Confirm the voltage/current waveform and change the load current appropriately.
- 105893** Resistive load bias adjustment failed. Please check the High Current Switching Waveform.
- Confirm the voltage/current waveform and change the load current appropriately.
- 105894** Extraction of Gate Charge lines and parameters failed. Please check the Switching Waveform whether Vgs curve crosses both Vgs(on) and Vgs(off) or not.
If not, please increase Ig or OnPeriod for complete switching.
- Confirm the voltage/current waveform and change the values appropriately.
- 105895** Extraction and derivation of Gate Charge lines and parameters from High Current Gate Charge characteristics and High Voltage Gate Charge characteristics failed. Please check whether the both characteristics are extracted successfully.
- Confirm the voltage/current waveform and change the values appropriately.
- 105896** Gate Charge Adapter configuration is not applied. Please apply Gate Charge Adapter configuration on the Configuration window's Gate Charge Adapter tab.
- 105897** Calibration failed. Please check the open/short connection.

If the calibration is still failed, contact your nearest Keysight Technologies

- 105901** Over voltage was applied to SMU measurement terminal.
Check and correct connections of cables and measurement terminals.
- 105902** Over current was applied to SMU measurement terminal.
Check and correct connections of cables and measurement terminals.
- 105903** Cannot use the specified module that failed self-test.
To use the specified module, contact your nearest Keysight Technologies for servicing the instrument.
- 105904** *A* cannot be set to Additional Data Variables. Only the channels defined in Channel Definition can be set.
In the Direct Control test setup, use the pull-down menu to set the Unit and the Type of the Additional Data Variables.
- 105905** Entry is already defined in Additional Data Variables. It is not necessary to redefine the entry. Unit: *A*, Type: *B*
In the Direct Control test setup, delete duplication from the Additional Data Variables.
- 105906** Variable name specified in Additional Data Variables is used for another variable. Specify a different name. Variable name: *A*
In the Direct Control test setup, change the variable name so that no duplication is found in the Additional Data Variables.
- 105907** Format parameter of FMT command must be 13.
In the Command Setup of the Direct Control test setup, set 13 to the first argument of the FMT command.
- 105908** Impedance and Admittance cannot be measured simultaneously.
In the Direct Control test setup, use the pull-down menu to set the Type of the Additional Data Variables. Then do not set both of impedance (*Z*) and admittance (*Y*).
- 105909** Program number must range from *A* to *B*. number: *C*
In the Command Setup of the Direct Control test setup, specify the program number effective for the program memory.
- 105910** Variable number in program memory must range from *A* to *B*. number: *C*

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- In the Command Setup of the Direct Control test setup, specify the variable number effective for the program memory variable.
- 105911** Command field is empty. Choose a command from candidates.
In the Command Setup of the Direct Control test setup, set Command by using the pull-down menu. Do not leave it empty.
- 105912** Generic Setup error occurred in line *A* in Direct Control “*B*”.
sent command: *C*
In the Command Setup of the Direct Control test setup, check Command and Arguments of the line *A*, and set the command and the parameters properly.
- 105913** Incorrect usage of ST and END commands. Use them as a pair to store a command group into the program memory.
In the Command Setup of the Direct Control test setup, check how the ST and END commands are used, and correct the program. Put ST just before the code recorded to the program memory, and put END just after the code.
- 105914** Improper number of Arguments for the *A* command. Enter the Arguments correctly.
In the Command Setup of the Direct Control test setup, check the parameters for the command *A*, and set the Arguments properly.
- 105915** *A* pulse base must be between *B A* and *C A*.
Set Base to the value between *B A* and *C A*.
- 105916** *A* pulse peak must be between *B A* and *C A*.
Set the pulse peak value to the value between *B A* and *C A*.
- 105917** *A* pulse peak and base must be between *B V* and *C V*.
Set Base and the pulse peak value to the values between *B V* and *C V*.
- 105918** *A* compliance must be between *B V* and *C V*.
Set Compliance to the value between *B V* and *C V*.
- 105919** *A* compliance must be between *B A* and *C A*.
Set Compliance to the value between *B A* and *C A*.
- 105920** *A* pulse peak × compliance exceeds its output power limit. Compliance must be between *B V* and *C V*.

- Set Compliance to the value between $B V$ and $C V$.
- 105921** A pulse peak \times compliance exceeds its output power limit. Compliance must be between $B A$ and $C A$.
- Set Compliance to the value between $B A$ and $C A$.
- 105922** A pulse delay time must be between $B s$ and $C s$.
- Set Pulse Delay Time to the value between $B s$ and $C s$.
- 105923** A does not support pulse delay time. It must be 0.
- Set Pulse Delay Time to 0 s.
- 105924** SMU pulse measurement delay time must be between $A s$ and $B s$.
- Set Measurement Delay Time to the value between $A s$ and $B s$.
- 105925** SMU pulse averaging count must be between A and B .
- Set Pulse Averaging Count to the value between A and B .
- 105926** A pulse duty cycle must be $B \%$ or less if the pulse peak or compliance exceeds $C A$.
- Adjust Period and Width so that the pulse duty is $B \%$ or less, or set Compliance and the pulse peak value to $C A$ or less.
- 105927** A pulse width must be between $B s$ and $C s$ if the pulse peak or compliance exceeds $D A$.
- Set Width to the value between $B s$ and $C s$, or set Compliance and the pulse peak value to $D A$ or less.
- 105928** A pulse base must be between $B A$ and $C A$ if the pulse peak exceeds $D A$.
- Set Base to the value between $B A$ and $C A$, or set the pulse peak value to $D A$ or less.
- 105929** A pulse peak and base must be same polarity if the pulse output exceeds $B V$.
- For the pulse peak and base values, set the values of the same polarity. Or set the pulse output value to $B V$ or less.
- 105930** The coefficient for High Speed ADC TIME averaging mode must be between $A s$ and $B s$.
- On the setting of Mode: TIME for High Speed ADC in the Integration Time setup, set Factor to the value between $A s$ and $B s$.

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- 105931** Invalid value A was specified for the series resistor of B .
Valid option(s): C
- In the Application Test definition, invalid value A was passed to Series R. Correct the setup so that the available value (C) is set.
- 105932** N1258A selector is not found.
- Check the status of the N1258A and the communication cable connection, and solve the problems.
- 105933** Communication with N1258A selector interrupted. Connect the cable properly.
- Check the connection of communication cable, and solve the problems.
- 105934** N1258A selector is turned off. Connect the power cable properly.
- Check the connection of power cable, and solve the problem.
- 105935** N1258A selector can make an input-output path. Multiple input channels cannot be specified.
- Use one of the measurement resources connected to the N1258A inputs.
- 105936** Invalid value (A) was specified for SMU I/V sweep Linear/Log.
Valid option(s): B
- For the I/V Sweep test setup, set Linear/Log to the available value (B).
- 105937** Invalid value (A) was specified for C-V sweep Linear/Log.
Valid option(s): B
- For the C-V Sweep test setup, set Linear/Log to the available value (B).
- 105938** The start value and stop value of C-V log sweep must be non-zero and have same polarity.
- Set Start and Stop to the non-zero values of the same polarity.
- 105939** SMU cannot set the voltage or current exceeds Setting Limit defined in the SMU Output Setting Limits tab screen on the Configuration window.
- Change the setting of the SMU Output Setting Limits tab screen, or set the output value to the value up to Voltage/Current Setting Limit.
- 105940** SMU pulse period must be A s longer than measurement delay time + measurement time. Measurement Delay Time: B s, Measurement Time: C s, Pulse Period: D s

Set Period and Measurement Delay Time so that Period is longer than or equal to $A + B + C$ s.

- 105941** Measurement time must be equal to or less than pulse delay time + pulse width in case of AUTO measurement delay setting.
Channel: A , Pulse Delay Time: B s, Pulse Width: C s, Measurement Time: D s

Set Pulse Delay Time and Width so that the measurement time (D) is shorter than or equal to $B + C$ s. Or set Measurement Delay Time to non-AUTO value.

- 105942** SMU pulse period must be A s longer than pulse delay time + pulse width. Channel: B , Pulse Delay Time: C s, Pulse Width: D s, Pulse Period: E s

Set Period, Width, and Pulse Delay Time so that Period is longer than or equal to $A + C + D$ s.

- 105943** Total setting current exceeds the capacity of main frame power supply. Reduce setting current.

Check the current output value of all modules. And adjust the value so that the total power consumption is within the limit of the mainframe. For the power consumption, see Specifications.

- 105951** HCSMU detected open sense condition. Connect the cables properly between HCSMU and DUT, then use Kelvin connection.

Confirm the HCSMU cable connection, and make the Kelvin connection properly to the terminals of DUT.

- 105952** HCSMU detected overvoltage condition. HCSMU output terminals may be open. Connect the cables properly between HCSMU and DUT, then use Kelvin connection.

Confirm the HCSMU cable connection, and make the Kelvin connection properly to the terminals of DUT.

- 105953** MCSMU detected overvoltage condition. MCSMU output terminals may be open. Connect the cables properly between MCSMU and DUT, then use Kelvin connection.

Confirm the MCSMU cable connection, and make the Kelvin connection properly to the terminals of DUT.

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- 105960** Module set to the HCSMU field on the Module Selector tab screen cannot be set to the Primary HCSMU or Secondary HCSMU field on the Dual HCSMU Combination tab screen. Empty the HCSMU field and then set the Dual HCSMU Combination tab screen.
- Check the Module Selector tab screen of the Configuration window. And empty the HCSMU field to configure the Dual HCSMU.
- 105970** N1265A/B1506A Ultra High Current Expander / Fixture is not found.
- Check the status of the N1265A/B1506A and the communication cable connection, and solve the problems.
- 105971** Communication with N1265A/B1506A Ultra High Current Expander / Fixture interrupted. Connect the cable properly.
- Check the connection of communication cable, and solve the problems.
- 105972** N1265A/B1506A Ultra High Current Expander / Fixture is turned off. Connect the power cable properly and check the power switch.
- Check the connection of power cable, and solve the problem.
- 105973** N1265A/B1506A Ultra High Current Expander / Fixture can make an drain input-output path. Multiple drain input channels cannot be specified.
- Use one of the measurement resources connected to the N1265A/B1506A Selector Input and UHC Input.
- 105974** Same SMU cannot be specified for V Control SMU and I Control SMU of N1265A/B1506A Ultra High Current Expander / Fixture.
- Check the UHC Expander / Fixture tab screen of the Configuration window and set the different SMU to each of Voltage Control SMU and Current Control SMU.
- 105975** Failed to read correction data from EEPROM of N1265A/B1506A Ultra High Current Expander / Fixture. Default values for correction data will be applied.
- Contact your nearest Keysight Technologies.
- 105976** Over voltage is detected in Selector Output High Force, Low Force, or Low Sense terminal of N1265A/B1506A. Remove the causes of overvoltage.
- Check and correct connections of cables and measurement terminals. If necessary, perform reboot and self-test of the N1265A/B1506A.

- 105977** Over voltage is detected in Selector Output High Sense terminal of N1265A/B1506A. Remove the causes of overvoltage.
Check and correct connections of cables and measurement terminals. If necessary, perform reboot and self-test of the N1265A/B1506A.
- 105978** Pulse width overrun is detected in N1265A/B1506A. Check the assignment of control modules.
Check and correct the connections of the control SMU. If necessary, perform reboot and self-test of the N1265A/B1506A.
- 105979** Cooling fan failure is detected in N1265A/B1506A. Check the operation of the fan.
Make enough space for air flow. If necessary, perform reboot and self-test of the N1265A/B1506A. If the fan is defective, contact your nearest Keysight Technologies.
- 105980** N1266A HVSMU Current Expander is not found.
Check the status of the N1266A and the communication cable connection, and solve the problems.
- 105981** Communication with N1266A HVSMU Current Expander interrupted. Connect the cable properly.
Check the connection of communication cable, and solve the problems.
- 105982** N1266A HVSMU Current Expander is turned off. Connect the power cable properly and check the power switch.
Check the connection of power cable, and solve the problem.
- 105983** N1266A HVSMU Current Expander can make an input-output path. Multiple input channels cannot be specified.
Use either HVSMU or HVMCU.
- 105984** Same SMU cannot be specified for V Control SMU and I Control SMU of N1266A HVSMU Current Expander.
Check the HVSMU Current Expander tab screen of the Configuration window and set the different SMU to each of Voltage Control SMU and Current Control SMU.
- 105985** Failed to read correction data from EEPROM of N1266A HVSMU Current Expander. Default values for correction data will be applied.
Contact your nearest Keysight Technologies.

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- 105986** N1265A/B1506A Self-test failed. Code: *A*, Reason: *B*
Confirm the connection of the control modules and perform the self-calibration of the modules. Then try the self-test again.
If the N1265A/B1506A does not pass Self Test, contact your nearest Keysight Technologies.
- 105987** N1265A/B1506A Self-calibration failed. Code: *A*, Reason: *B*
Confirm the connection of the control modules and perform the self-calibration again.
If the N1265A/B1506A does not pass Self Calibration, contact your nearest Keysight Technologies.
- 105988** N1266A Self-test failed. Code: *A*, Reason: *B*
Confirm the connection of the control modules and perform the self-calibration of the modules. Then try the self-test again.
If the N1266A does not pass Self Test, contact your nearest Keysight Technologies.
- 105989** Cannot use the N1258A/N1265A's series resistor for HVSMU when the HVMCU is used.
Check the Module Selector tab screen of the Configuration window. To use HVMCU, remove the check from the "Enable Series Resistor (100k ohm) for HVSMU" check box.
- 105990** N1268A Ultra High Voltage Expander is not found.
Check the status of the N1268A and the communication cable connection, and solve the problems.
- 105991** Communication with N1268A Ultra High Voltage Expander interrupted. Connect the cable properly.
Check the connection of communication cable, and solve the problems.
- 105992** N1268A Ultra High Voltage Expander is turned off. Connect the power cable properly and check the power switch.
Check the connection of power cable, and solve the problem.
- 105993** Same SMU cannot be specified for V Control SMU and I Control SMU of N1268A Ultra High Voltage Expander.
Check the UHV Expander tab screen of the Configuration window and set the different SMU to each of Voltage Control SMU and Current Control SMU.

- 105994** *A is already used in B.*
Check the setting of the Configuration window and set the different SMU to each of the inputs for the selector and the expander control.
- 105995** Diagnosis failed. Code: *A*, Reason: *B*
Confirm the connections of modules and the connections of output terminals. Then try the diagnosis again.

If the N1265A does not pass Diagnosis, contact your nearest Keysight Technologies.
- 105996** Diagnosis failed. Code: *A*, Reason: *B*
Confirm the connections of modules and the open condition of output terminals. Then try the diagnosis again.

If the N1268A does not pass Diagnosis, contact your nearest Keysight Technologies.
- 105998** Main frame reset occurs.

Consult the detail messages and solve the problems.
- 105999** Communication errors for Digital I/O devices are detected.

Consult the detail messages and solve the problems.
- 106001** Logon request was rejected. The number of Logons already reaches the limit of the software regulation.

Restart EasyEXPERT. If this error still arises, restart the B1500.
- 107001** Workspace management error was occurred.

Contact your nearest Keysight Technologies.
- 107002** Workspace was not found.

Restart EasyEXPERT. If this error still arises, contact your nearest Keysight Technologies.
- 107003** Workspace could not be loaded.

Restart EasyEXPERT. If this error still arises, contact your nearest Keysight Technologies.
- 107004** The request to load or create Workspace was rejected. Workspace is already active.

Close the present Workspace and open the Workspace again.
- 107005** The operation cannot be executed because Workspace is in use now.

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Close the present Workspace and open the Workspace again.

- 107006** The workspace name is conflicting. It must be unique in system.
Specify a proper Workspace name and execute again.
- 107011** Cannot import Workspace. Specified file is not effective for Workspace. Specify the effective file. Path: *A*
- 107012** Cannot import Workspace. Specified file is not supported by this EasyEXPERT. EasyEXPERT must be updated to the revision *A* or later to import this file. Path: *B*
- 107013** Failed to import Workspace. Refer to the detail message, and retry after taking necessary measures. Path: *A*
Consult the detail messages and solve the problems.
- 107014** Failed to export Workspace. Refer to the detail message, and retry after taking necessary measures. Path: *A*
Consult the detail messages and solve the problems.
- 108001** Function Library management error occurred.
Contact your nearest Keysight Technologies.
- 108002** Function Library function has not been configured correctly or is not running.
Restart EasyEXPERT. If the problem still arises, contact your nearest Keysight Technologies.
- 108003** Invalid Function Module assembly file.
Restart EasyEXPERT. If the problem still arises, contact your nearest Keysight Technologies.
- 108004** Invalid Function Module.
Restart EasyEXPERT. If the problem still arises, contact your nearest Keysight Technologies.
- 108005** Function Module was not found.
Restart EasyEXPERT. If the problem still arises, contact your nearest Keysight Technologies.
- 108006** Function Module is inaccessible because it has been removed.
Restart EasyEXPERT. If the problem still arises, contact your nearest Keysight Technologies.

- 108007** The same process is running now.
Restart EasyEXPERT. If the problem still arises, contact your nearest Keysight Technologies.
- 108008** Profile was not found.
Restart EasyEXPERT. If the problem still arises, contact your nearest Keysight Technologies.
- 108009** Profile could not be loaded.
Restart EasyEXPERT. If the problem still arises, contact your nearest Keysight Technologies.
- 108010** The request to load or create Profile was rejected. Profile is already active.
Restart EasyEXPERT. If the problem still arises, contact your nearest Keysight Technologies.
- 108011** The following function module is incompatible with the installed EasyEXPERT software. Module ID: *A*, Path: *B*
Restart EasyEXPERT. If the problem still 108011, contact your nearest Keysight Technologies.
- 108020** An I/O error occurred during Function Library operation. Path: *A*
Restart EasyEXPERT. If the problem still occurs, contact your nearest Keysight Technologies.
- 108021** Failed to load a Function Module. Path: *A*
Restart EasyEXPERT. If the problem still occurs, contact your nearest Keysight Technologies.
- 108022** Failed to save a Function Module. Path: *A*
Restart EasyEXPERT. If the problem still occurs, contact your nearest Keysight Technologies.
- 109001** Auto calibration is in progress.
Wait for the completion of self-calibration.
- 109002** CMU phase compensation failed.
Check the cable connection and re-try the phase compensation.
- 109011** CMU open correction failed.
Check the cable connection and re-try the open correction.

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- 109012** The value of standard for CMU open correction must be finite as admittance.
- 109021** CMU short correction failed.
Check the cable connection and re-try the short correction.
- 109022** The value of standard for CMU short correction must be finite as impedance.
- 109031** CMU load correction failed.
Check the cable connection and re-try the load correction.
- 109032** The value of standard for CMU load correction must be finite in impedance (non-zero as admittance).
- 109041** Cannot define multiple standby settings for a SMU. Channel: *A*
- 109051** Direct Control execution status. Sweep measurement was aborted by the automatic abort function or the power compliance. Test setup: *A*
- 109052** Direct Control execution status. Quasi-static CV measurement was aborted by the automatic abort function. Test setup: *A*
- 109053** Direct Control execution status. Search measurement was aborted by the automatic abort function. Test setup: *A*
- 109054** Direct Control execution status. Sampling measurement was aborted by the automatic abort function. Test setup: *A*
- 109061** Duplicate SMU assignment was found. SMU assignment must be unique. SMU: *A*
- 110001** Configuration query completed.
- 111001** Data name (*A*) is invalid.
Use the usable characters for the data name.
- 111002** Function name (*A*) is invalid.
Use the usable characters for the function name.
- 111003** Function name (*A*) duplicates other data/function name.
Assign an unique name to each function/variable defined in the test setup.
- 111004** Definition expression of function (*A*) is invalid. expression: *B*
Check and correct the definition.

- 111005** The data (*A*) assigned with the data (*B*) is not defined.
In the External Variable Setup of the Application Test definition, specify a defined variable to the External variable.
- 111006** The data (*A*) assigned to the data (*B*) is not defined.
In the External Variable Setup of the Application Test definition, specify a defined variable to the Measurement data.
- 111007** The data (*A*) cannot be assigned to the data (*B*) for the mismatch of their types.
In the External Variable Setup of the Application Test definition, check the data type of variables for the External variable and the Measurement data. Assign the variables of the same type.
- 111008** Recursive definition is not allowed for function (*A*). Expression: *B*
Check and correct the expression *B*.
- 111011** Vector data expression is expected. Expression: *A*
Set a vector data expression.
- 111012** Numeric expression is expected. Expression: *A*
Set a numeric expression.
- 111013** String expression is expected. Expression: *A*
Set a string expression.
- 111014** Descriptor expression is expected. Expression: *A*
Set a descriptor expression.
- 111015** Module descriptor expression is expected. Expression: *A*
Set a module descriptor expression.
- 111016** ALWaveform type expression must be entered. Expression: *A*
Set a ALWaveform type expression.
- 111021** Test setup name cannot be an empty string.
Set the test setup name which is non empty string.
- 111022** Test setup name must be *A* characters or less.
Set the test setup name within *A* characters.
- 111031** Assign module parameter for ALWaveform type parameter.

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- In the Assign ALWaveform Output Channels of the Application Test definition, set the test parameters of the Module type.
- 111032** ALWG Pattern Name must be entered.
In the Define ALWG Waveform setup, specify Pattern Name.
- 111033** Invalid character is included in Name of module parameter assigned for ALWaveform type parameter. Module name: *A*, Invalid character: *B*
Use the usable characters for the Module parameter name.
- 111034** Invalid character is included in ALWG Pattern Name. ALWG pattern name: *A*, Invalid character: *B*
Use the usable characters for Pattern Name.
- 111035** No sequence is defined in the ALWG waveform data. Define one column or more.
- 111036** Pattern is not defined in the ALWG waveform data for the output channel *A*. Specify a pattern.
- 111037** ALWG waveform data contains an invalid pattern.
Name of the invalid pattern: *A*
- 111038** ALWG waveform data memory overflow. Delete unnecessary columns or points in a pattern, and increase free space.
Output channel: *A*, Required space: *B*, Maximum space: *C*
- 112001** Output function must be constant for the unit (*A*) in common mode.
In the Channel Definition of the Classic Test setup, set Function to CONST for the channel set to Mode: COMMON.
- 112002** Output function (*A*) must be assigned to any unit.
In the Channel Definition of the Classic Test setup, set Function to *A* for any channel.
- 112003** Output function (*A*) cannot be assigned to multiple units (*B* and *C*).
In the Channel Definition of the Classic Test setup, Function: *A* is available for a channel.
- 112004** Pulse mode cannot be assigned to multiple SMUs (*A* and *B*).
In the Channel Definition of the I/V Sweep test setup, the pulse mode (VPULSE or IPULSE) can be set to a channel.
- 112005** I/V mode of the primary sweep source and synchronous sweep source must be the same.

- In the Channel Definition of the I/V Sweep test setup, set the same source mode (voltage or current) to the VAR1 and VAR1' channels.
- 112006** Duplicate channel data name was found. Channel data name must be unique. Channel data name: *A*
- In the Channel Definition of the Classic Test setup, assign an unique name to each variable defined in the test setup.
- 112007** Duplicate channel unit assignment was found. Channel unit assignment must be unique. Channel unit: *A*
- In the Channel Definition of the Classic Test setup, a Unit is available for to a channel.
- 112008** No channel unit was assigned. At least one channel unit must be assigned.
- In the Channel Definition of the Classic Test setup, set a channel.
- 112009** Function (*A*) can be used for a maximum of *B* channel(s) in the *C* mode.
- In the Channel Definition of the Classic Test setup, Function: *A* is available for *B* channel(s).
- 112010** All SPGU channels must be set to the same output mode, VPULSE or ALWG.
- In the Channel Definition of the Classic Test setup, set the same output mode, VPULSE or ALWG, to all SPGU channels.
- 112011** SMU descriptor expression is expected. Expression: *A*
- In the Channel Definition of the Classic Test setup, set a SMU descriptor expression to Unit.
- 112012** CMU descriptor expression is expected. Expression: *A*
- In the Channel Definition of the Classic Test setup, set a CMU descriptor expression to Unit.
- 112013** SPGU descriptor expression must be entered. Expression: *A*
- In the Channel Definition of the Classic Test setup, set a SPGU descriptor expression to Unit.
- 112014** Mode must be V or COMMON for VSU (*A*).
- In the Channel Definition of the Classic Test setup, set Mode to V or COMMON for the VSU channel.
- 112015** VMU (*A*) must be defined as a constant current source.

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- In the Channel Definition of the Classic Test setup, set Mode to I for the VMU channel.
- 112016** Mode must be COMMON for GNDU.
In the Channel Definition of the Classic Test setup, set Mode to COMMON for the GNDU channel.
- 112021** Numeric expression is expected for power compliance. Expression: *A*
Set Pwr Comp to a numeric expression.
- 112022** No CMU was assigned. At least one CMU must be assigned.
In the Channel Definition of the C-V Sweep test setup, set the CMU channel.
- 112023** No SMU was assigned. At least one SMU must be assigned.
In the Channel Definition of the I/V-t Sampling test setup, set a SMU channel.
- 112024** At least one SPGU must be used for SPGU Control.
In the Channel Definition of the SPGU Control setup, set a SPGU channel.
- 112051** Auto analysis operation failed.
Consult the detail messages and solve the problems.
- 112052** Invalid value *A* specified for the switching matrix input setting. Specify a string, string variable, or module variable defined in the test definition or test setup.
Check the value entered into Input of the Switching Matrix Control setup, and enter the appropriate value.
- 112053** Enter a value for numeric variable *A*, used to specify the switching matrix output channel.
Check the value entered into Output of the Switching Matrix Control setup, and enter the appropriate value.
- 112054** A switch setup named *A* is already in the preset group *B*. The switch setup name must be unique in a preset group.
Assign an unique name to each switch setup stored in a preset group (My Favorite Setup).
- 112055** A preset group named *A* already exists. The preset group name must be unique.

- Assign an unique name to each preset group (My Favorite Setup).
- 112056** Enter a name for the switching matrix setup.
Set the switch setup name which is non empty string.
- 112057** Maximum length for a switching matrix setup name is A characters.
Set the switch setup name within A characters.
- 112058** Read Switch Setup operation failed. Set the switching matrix configuration mode to Normal. Could not read the setup for connecting multiple input ports to a output channel.
- 112059** The present couple port setting is different from that when this pattern was created. Therefore, there is a possibility that switching matrix will not be set just as you intend.
- 112060** Specified connection pattern is not available for the couple port A, B .
Check the connection pattern and specify the pattern effective for the couple port.
- 112061** Input port A uses a shared path. The path is currently connected to the other input port. The specified connection is not available.
Disconnect the input port presently connected to the shared path to apply the specified connection. Or use the other input port.
- 112071** SMU A cannot be used with CMU simultaneously, because it is connected to SCUU.
In the Channel Definition of the Direct Control test setup, use a SMU not connected to SCUU to set CMU channel and SMU channel.
- 112072** Invalid value A was specified for Enable/Disable of I/V-t Sampling Stop Condition. Valid option(s): B
Set the value (B) available for Enable/Disable.
- 112073** Invalid value A was specified for Name of I/V-t Sampling Stop Condition. Valid option(s): B
Set the value (B) available for Name.
- 112074** Invalid value A was specified for Event of I/V-t Sampling Stop Condition. Valid option(s): B
Set the value (B) available for Event.
- 112075** Invalid function was used in the definition of variable specified by Name of I/V-t Sampling Stop Condition.

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- Correct the definition of the variable set to Name.
- 112100** ALWG waveform data for *A* was not found. Set data of the ALWaveform type parameter properly.
Set ALWG Source to a ALWaveform type variable (*A*) which contains the sequence data. Or set the waveform data for the variable (*A*) properly.
- 112101** Multiple ALWG waveform data are specified for *A*. Set Properties of the ALWaveform type parameter properly.
Set Properties and waveform data properly for the variable (*A*) defined in Test Specification of Application Test.
- 112102** Primary sweep source of C-V Sweep must be V mode.
In the C-V Sweep test setup, set Mode to V for the SMU used for the sweep source (VAR1).
- 112103** *A* does not support *B* mode.
In the Channel Definition, set Mode to the value available for *A*.
- 112103** *A* does not support *B* mode.
In the Channel Definition, set Mode to the value available for *A*.
- 113002** Application test definition name cannot be an empty string.
Set the Application Test definition name which is non empty string.
- 113003** Application test definition of the same name is already existing. Test definition: *A* Test categories: *B*
Assign an unique name to each Application Test definition.
- 113011** Duplicate parameter name was found. Parameter name must be unique. Parameter name: *A*
Assign an unique name to each parameter defined in Test Specification of Application Test.
- 113012** Duplicate typical value *A* is assigned. Each typical value must be unique for a numeric parameter.
For setting Typical Values of a Numeric parameter defined in Test Specification of Application Test, set unique values.
- 113013** Symbol must not be an empty string.

- For setting Symbols of a Numeric parameter defined in Test Specification of Application Test, set Symbol which is non empty string.
- 113014** Symbol *A* is duplicated. Symbol must be unique for a numeric parameter.
For setting Symbols of a Numeric parameter defined in Test Specification of Application Test, set an unique symbol to each Symbol.
- 113015** Same value *A* is assigned to symbols *B* and *C*. Each symbol must have unique value for a numeric parameter.
For setting Symbols of a Numeric parameter defined in Test Specification of Application Test, assign an unique Value to each Symbol.
- 113016** Duplicate typical value *A* is assigned. Each typical value must be unique for a string parameter.
For setting Typical Values of a String parameter defined in Test Specification of Application Test, set unique values.
- 113017** Empty string is not allowed for the symbol.
For setting Symbols of a Vector parameter defined in Test Specification of Application Test, set Symbol which is non empty string.
- 113018** Symbol *A* is used for another vector parameter. Specify a different symbol.
For setting Symbols of a Vector parameter defined in Test Specification of Application Test, set an unique symbol to each Symbol.
- 113021** The type of evaluated value does not match the type of parameter *A*.
For the parameter defined in Test Specification of Application Test, set a value of the data type specified by Type.
- 113022** Value for numeric parameter is out of range. Value must be in range.
Parameter name: *A* Parameter value: *B* Parameter range: from *C* to *D*
For the Numeric parameter defined in Test Specification of Application Test, set a value between *C* and *D*.
- 113023** Value for string parameter is not contained in the enumeration. Value must be a member of the enumeration. Parameter name: *A*, Parameter value: *B*, Enumeration: *C*

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- For the String parameter defined in Test Specification of Application Test, set a value shown in *C*.
- 113024** Value for module parameter is invalid or is not compliant to the resource type of the parameter. Parameter name: *A*, Parameter value: *B*
For the Module parameter defined in Test Specification of Application Test, set a value which is an available resource included in Resource Types.
- 113025** Improper value specified for the vector parameter. The value must be within the following range.
Restriction: *A*, Specified value: *B*, Effective range: *C* to *D*
For the Vector parameter defined in Test Specification of Application Test, set values between *C* and *D*.
- 113031** Test setup *A* depends on an undefined application test *B*. Please import the application test *B* in advance.
- 114001** A preset group named *A* already exists. The preset group name must be unique.
Assign an unique name to each preset group (My Favorite Setup).
- 114002** Unnamed preset group cannot be exported. Please name the preset group in advance.
Before performing the export, set the preset group (My Favorite Setup) name which is non empty string.
- 114011** A test setup named *A* is already in the preset group *B*. The test setup name must be unique in a preset group.
Assign an unique name to each test setup in a preset group (My Favorite Setup).
- 114012** A test setup named *A* cannot be retrieved in the preset group *B*. Probably it had already been modified or deleted.
- 114021** Following test result record cannot be retrieved. Probably it had already been deleted. Test result record: *A*
- 114031** Change the file name in the File Name Format dialog box. Following elements can be used in the file name.
A Setup Name
B Date (Time stamp)
C Count

D Device ID

E Flag

F Remarks

Set the file name by using the usable elements. Or consult the detail messages and solve the problems.

- 114032** Change the file name in the File Name Format dialog box. Specified value contains an invalid character. Specified file name: *A*, Invalid character: *B*
- Set the file name by using the usable characters.
- 114101** File I/O error occurred during automatic data export. Refer to the detail message, and retry after taking necessary measures.
- 114102** Specify the folder path in the Test Result Data Folder Export dialog box or Test Result Data Auto Export dialog box.
- 114103** Change the folder path in the Test Result Data Folder Export dialog box or Test Result Data Auto Export dialog box. Specified value contains an invalid character. Specified folder path: *A*
- 114104** Folder creation failed during automatic data export. Specify the correct drive letter and folder path in the Test Result Data Folder Export dialog box or Test Result Data Auto Export dialog box.
- 114105** Change the file extension in the Test Result Data Folder Export dialog box or Test Result Data Auto Export dialog box. Specified value contains an invalid character.
Specified file extension: *A*
- 114106** Data file creation failed during data folder export or automatic data export. Refer to the detail message, and retry after taking necessary measures.
- 114107** Index file creation failed during data folder export or automatic data export. Refer to the detail message, and retry after taking necessary measures.
- 114151** Specify the XML Style Sheet File Path in the Test Result Data Folder Export dialog box or Test Result Data Auto Export dialog box.
- 114152** Change the XML Style Sheet File Path in the Test Result Data Folder Export dialog box or Test Result Data Auto Export dialog box. Specified value contains an invalid character. Specified path: *A*
- 115001** There is no working test setup. First preset the test setup.

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- 115011** The application test *A* depends on an undefined application test *B*. Import the application test *B* in advance.
- 115021** Test setup import operation failed. Probably the imported contents are not a test setup.
- 115022** Test setup conversion failed. Setup *A* is not available for the tests that use the model *B*.
Use a setup compatible with the model *B*.
To use the setup *A*, restart EasyEXPERT with the Model setting which is used for creating the setup *A*, and modify the setup so that it is compatible with the model *B*.
- 115031** Failed to invoke *A*.
Consult the detail messages and solve the problems.
- 115032** Repeat execution was aborted.
Consult the detail messages and solve the problems.
- 115041** Standby state was changed to OFF due to high voltage related error.
- 115042** Standby state was automatically changed to OFF by the measurement unit emergency reset.
- 116001** Connected model not supported by EasyEXPERT. Only model *A* is supported. Connected model: *B* (address: *C*)
Update the EasyEXPERT software.
- 116002** B1500A/B1505A firmware revision *A* is not supported by this revision of EasyEXPERT. Only revisions *B* and later are supported.
Update the B1500A/B1505A firmware to the revision *B* or later.
- 116003** Invalid argument specified for /gpib. Specified argument: /gpib:*A*
Example argument (valid): /gpib:gpib0::17
- 116004** EasyEXPERT does not support 4155/56 firmware revision *A*. Update the firmware to the revision *B* or later.
- 117001** Enter another label for the switching matrix input port. *A* is already used for another port.
- 117002** Do not use a colon (:) in the label for a switching matrix input port.
- 117003** Connect the switching matrix to use this function. To establish the GPIB connection, set the GPIB address on the Configuration window's Switching Matrix tab, and click the Poll button.

- 117004** Invalid value A for the switching matrix output channel. Value must be between B and C .
- In the Switching Matrix Control setup, set Outputs to the values between B and C .
- 117005** A to B is not a valid range for the switching matrix output channels. Use positive integers, with the first value no greater than the second.
- In the Switching Matrix Control setup, set Outputs so that the value in the right field is greater than the value in the left field. Then set integer greater than or equal to 1.
- 117006** Switching matrix close error. Enter odd numbers to specify output channels connected to couple input port A .
- 117007** Switching matrix open error. Enter odd numbers to specify output channels connected to couple input port A .
- 117008** Switching matrix input port A is a couple input port. Enter $A-1$ to specify the couple port.
- 117009** swmToModule(A) execution failed. Specified port number is out of the valid range (1 to 14). Otherwise, an invalid resource name has been defined in the switching matrix input port configuration. Enter the port number for an input that has a valid resource name.
- In the Switching Matrix tab screen of the Configuration window, assign the measurement resource (SMU, CMU, or GNDU) to the input port (SWM IN1 to SWM IN14). And set the argument of the swmToModule built-in function to one of the input port numbers 1 to 14 which is assigned to the measurement resource.
- 117010** Switching matrix command execution error. B2200 error code: A
B2200 error message: B
- See *Keysight B2200 User's Guide*.
- 117011** Connected model not supported by EasyEXPERT. Only model A is supported. Connected model: B
- Connect the switching matrix supported by EasyEXPERT, and set the GPIB address correctly.
- 117012** Capacitance compensation data file read error. Specified file is either corrupt, or is not a compensation data file.

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Open the Extended Configuration dialog box from the Switching Matrix tab screen of the Configuration window, and set User Compensation Data File to the name of a proper user defined compensation data file.

- 117013** Self test failed.
Restart the instruments. If this error still arises, contact your nearest Keysight Technologies.
- 117014** Your operation to the switching matrix was refused because other test is using it.
Re-try the operation after completing the operation controlled by the Switching Matrix Operation Panel or the Switching Matrix Control setup.
- 117015** Operation is not supported in offline mode.
Perform the operation in the On-line mode.
- 120000** Script program execution error.
- 120001** Duplicated variable name used.
In a script program, the local variable name must be unique. Change the name of the variable.
- 120002** Script program execution is aborted.
Program execution was paused by clicking the Pause button.
- 120003** Script program execution ended abnormally.
Program execution was stopped by an illegal operation or statement. Click the Detail button. And consult the detail messages and solve the problems.
- 120004** An error forced by ERROR statement.
Program execution was stopped by the ERROR statement. This is the status message in normal operation.
- 120005** Invalid value detected in flow control statement.
Correct the IF, FOR, or other flow control statement. Inappropriate expression is used in the statement.
- 120006** Pasting program component failed.

Specified program components cannot be pasted to the specified place. Cut or copy the appropriate program components, and paste them to the appropriate place.

- 120007** Variable type mismatch detected for assigning.
Enter the appropriate value to the variable. Data type must be the same.
- 120008** Unknown program component imported. Keyword Prefix: *A*, Keyword: *B*
Data import was completed for an application test definition that contains a statement to call a test definition not in this system. Then the statement was automatically commented out. Before importing the test definition, import the test definition to be called.
- 121000** Plug-in execution error.
- 121001** Plug-in execution aborted.
Plug-in execution was paused by clicking the Pause button.
- 121002** Plug-in execution ended abnormally.
- 122000** Script Error.
- 122001** Operator located in wrong place. Operator: *A*
Correct the expression. Put the operator in the correct place.
- 122002** Invalid expression is specified in user function definition.
User function: *A*, Expression: *B*
Correct the expression *B* defined in the user function or analysis function *A*. Click the Detail button for more information.
- 122003** Bracket Mismatch.
Add or delete parenthesis. Parentheses must be paired.
- 122004** Invalid expression is specified for function argument. Function: *A*, Argument: *B*
Correct the expression defined in the argument *B* of the function *A*. Click the Detail button for more information.
- 122005** Invalid type of data is specified as function argument.
Check the data type expected by the function and correct the argument.
- 122006** Incorrect data is specified as function argument.
- 122007** Specified argument is out of range.

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- Correct the value of the argument. The value must be within its allowable range.
- 122008** Invalid character is used for system symbol. System symbol: *A*, Invalid character: *B*
- 122009** Invalid character is used for user defined symbol. User defined symbol: *A*, Invalid character: *B*
Use the characters available for the user defined symbol.
- 122010** Missing operator. Index: *A*
Correct the expression. Put the operator on the correct place.
- 122011** Missing operand. Index: *A*
Correct the expression. Number of operands must be one for the monomial operators, and two for the binomial operators.
- 122012** Operand Type Mismatch. Operator: *A*
Correct the expression. The type of operands used in the expression must be the same.
- 122013** Undefined Symbol is used. Symbol: *A*
Correct the expression. Symbols must be defined before using them in the expression.
- 122014** Function failed to call. Function: *A*
Failed to call the function *A*. For more information, click the Detail button.
- 122015** Number of vector data elements must be *A* or less.
- 122016** Function execution ended abnormally.
Contact your nearest Keysight Technologies.
- 123000** Only literal value can be specified here.
In the Variable Inspector, enter a string available for a literal value.
- 130001** Transport function error occurred.
- 130002** A target package was not found.
Cannot perform file import because of defective file.
- 130003** The package is unusable because it includes incorrect data.
Cannot perform file import because of defective file.

- 130004** Package data is insufficient for this process.
Cannot perform file import because of defective file.
- 130005** File I/O error. Cannot find or access the package file.
Cannot perform file import/export because of access error or defective file.
- 130011** Data import failed. Data may be incompatible or corrupt. Data: *A*
If the data is defective, data import cannot be performed.
If the data was created by the new version of EasyEXPERT, update the EasyEXPERT software.
If the data is for the different model, restart EasyEXPERT with the Model setting which is used for creating the data, and modify the data so that it is compatible with the desired model.
- 131001** Conversion function error occurred.
Consult the detail messages and solve the problems.
- 131002** Invalid style sheet.
Cannot perform data export (to CSV or XMLSS). Check and correct the style sheet file.
- 131003** Invalid XML document.
Cannot perform data export (to CSV or XMLSS) because of defective file.
- 131004** Conversion process failed.
Cannot perform data export (to CSV or XMLSS). Check and correct the style sheet file.
- 131005** File I/O error. Cannot access the target file.
Cannot perform data export (to CSV or XMLSS) because of access error or defective file.
- 132001** Command interface error occurred.
Consult the detail messages and solve the problems.
- 132002** The process failed to execute the specified external command.
Check and correct the command file, check if the file is in the system path, and specify a proper file.

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- 133001** GPIB interface error occurred.
Consult the detail messages and solve the problems.
- 133002** Internal error occurred during GPIB operation.
Check GPIB configuration by using Keysight Connection Expert.
- 133003** The GPIB operation failed to complete within the specified timeout period.
Set a proper timeout value. Also check GPIB configuration by using Keysight Connection Expert.
- 133004** The specified expression does not match any device, or the GPIB resource was not found.
Set GPIB address properly. Also check GPIB configuration by using Keysight Connection Expert.
- 133005** The specified GPIB resources are invalid.
Set GPIB address properly. Also check GPIB configuration by using Keysight Connection Expert.
- 133006** The specified GPIB address value is invalid.
Set GPIB address properly. Also check GPIB configuration by using Keysight Connection Expert.
- 133007** The specified GPIB interface number value is invalid.
Set the correct GPIB interface number. Also check GPIB configuration by using Keysight Connection Expert.
- 133008** The specified timeout value is invalid.
Set a proper timeout value. Also check GPIB configuration by using Keysight Connection Expert.
- 133009** The specified delimiter characters are invalid.
Set a proper delimiter value. Also check GPIB configuration by using Keysight Connection Expert.
- 133010** Install Keysight IO Library.
- 133011** Cannot use the specified GPIB address *A* that assigned to B1500.
Assign the different GPIB address to the other GPIB devices. And set it properly.
- 134001** Dialog box interface error occurred.

- Consult the detail messages and solve the problems.
- 134002** The process failed to activate the message-box window.
Restart EasyEXPERT. If the problem still arises, contact your nearest Keysight Technologies.
- 134003** Message-box is already registered in the system.
Restart EasyEXPERT. If the problem still arises, contact your nearest Keysight Technologies.
- 134004** Message-box function is not available because it is unregistered.
Restart EasyEXPERT. If the problem still arises, contact your nearest Keysight Technologies.
- 134005** The message-box configuration with no button information is invalid.
In the message box setup, set Button properly.
- 135001** No value is entered in this field.
Enter the appropriate value in this field.
- 140001** Specified value range from *A* to *B* of the axis “*C*” is not valid.
Specified value is not allowed for the “*C*” axis of X-Y Graph. Enter a proper value.
- 140002** Specified scale type “*A*” of the axis “*B*” is not valid.
Set the scale type to LINEAR or LOG.
- 140003** Data for Auto Analysis is not found.
Cannot find the data that satisfy the automatic analysis condition.
Check and specify the analysis condition properly.
- 140004** Data Display Operation has not completed within specified time (*A* seconds).
Cannot complete the graph plot, automatic analysis, or data display properly. Re-try the operation. Also restart EasyEXPERT. If the problem still arises, contact your nearest Keysight Technologies.
- 140005** Invalid operation for the stream occurred.
Restart EasyEXPERT. If the problem still arises, contact your nearest Keysight Technologies.
- 140006** Duplicate data name was found. Data name must be unique. data name:
A

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- Assign an unique name for each parameter in the Data Display setup.
- 140007** No printers installed.
Add a printer.
- 140008** Operation for printing failed.
Check and set the printer setup properly.
- 140009** Failed to evaluate the read out function " A ".
Re-try the operation. Also restart EasyEXPERT. If the problem still arises, contact your nearest Keysight Technologies.
- 140010** Enable the X-Y Graph to use this read out function.
- 140011** Define the axis A to use this read out function.
Enable the axis A or use this function for the effective axis.
- 140012** There is no data for this read out function.
Execute measurement to get the data.
- 140013** Font size must be between A and B .
- 140014** Number of texts exceeds the limit. Maximum of A texts are allowed.
- 140015** Number of pointers exceeds the limit. Maximum of A pointers are allowed.
- 140016** Invalid value included in data specified by the marker. Pointer could not be added.
- 140017** Available number of decades for the log scale must be between A and B .
- 140101** Scalar data function call was failed because scalar data named A was not found.
Correct the test definition so that the data is set before the function is called.
- 140102** Vector data function call was failed because vector data named A was not found.
Correct the test definition so that the data is set before the function is called.
- 140103** Invalid value (A) was specified for axis scale. Valid option(s): B .
Correct the test definition so that the axis scale matches B .

- 141001** Maximum *A* Data Display windows can be opened other than the base window.
Close some Data Display windows to open new windows.
- 141002** Maximum *A* Base Data Display windows can be opened.
Close some Base Data Display windows to open new windows.
- 151001** Maximum *A* Data Display windows can be opened other than the base window.
Close some Data Display windows to open new windows. Or reduce the number of data traces to display from now.
- 151002** Test execution mode cannot be changed during the test.
Wait until the test is completed.
- 151003** Up to *A* data traces can be displayed in the Data Display window.
Reduce the number of data traces to display from now.
- 151004** Repeat Measurement Setup is not available when Data Record is OFF.
Check “Record Test Result Data Automatically” in the Run Option dialog box before performing the repeat measurement.
- 151005** Thermo-trigger list must be defined.
Set the thermo-trigger function on the Thermo-trigger List dialog box.
- 151006** Thermometer channel must be enabled.
In the UHC Expander / Fixture tab screen of the Configuration window, enable the thermometer channel and set the temperature measurement condition.
- 161001** Number of test definition windows must be *A* or less.
Close some Test Definition windows to open new windows.
- 170001** Failed in archive processing. reason: *A*
Failed in the database backup or recovery. Check if the .xdb file is defective. Also consult the reason and the detail messages, and solve the problems.
- 171001** Data compression failed. Program error. Contact Keysight Technologies.
- 171002** Specify a correct file for the import. Specified file is either unsupported or corrupt.

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- Check if the specified file is defective, and specify a proper file.
- 171003** File I/O failed during compressed data export. Could not access destination file. Specified file is either unsupported or corrupt. Specify a correct file for the export.
- 171004** Compression process or decompression process failed. Specified file is either unsupported or corrupt. Specify a correct file for the export or import. It may also be a program error.
- 200001** Select from the candidates.
Specify the value from the choices for this field.
- 200002** Input a numeric value.
The value must be numeric. Enter a numeric value.
- 200003** Number of grid data elements must be A or less.
In the Define vector data dialog box, set the vector data so that the number of data is within A .
- 200004** Data paste failed. Data format is unsupported or incorrect.
In the Define vector data dialog box, the Paste operation supports comma separated data (each data must be separated by a comma, and have a CR/LF or LF at the end of each line) and tab separated data (each data must be separated by a tab, and have a CR/LF or LF at the end of each line).
- 200005** Data paste failed. Data of size $A \times B$ cannot be pasted to position C, D . It must be pasted to a range of $E \times F$.
In the Define vector data dialog box, the size of this vector data is $E \times F$. Paste the data within this size.
- 201001** Failed to load image data. File A may not be an image file.
Specify a proper image file.
- 202001** The name A already exists.
Assign an unique name.
- 300001** SDA daemon is already running.
Cannot run the SDA daemon in parallel. If this error is caused by missing the termination process, end StaDaemon.exe by using Windows Task Manager or restart Windows.

- 300002** SDA daemon configuration file is corrupt. Check the file <common data folder>\Agilent\EasyEXPERT\Daemon\StaDaemon.exe.config.
- 300003** Specify a correct folder for the EasyEXPERT database. Specified folder not found.
Check the file <common data folder>\Agilent\EasyEXPERT\Daemon\StaDaemon.exe.config and confirm the database folder.
- 300004** Moving of EasyEXPERT database failed. Refer to the detail message, and re-try after taking necessary measures.
- 300005** Another user is running EasyEXPERT. EasyEXPERT does not support “switching user”.
- 300011** SDA daemon failed to start FLEX command service.
path: *A*, arguments: *B*, reason: *C*
Contact your nearest Keysight Technologies. Then present the log file <database folder>/log/latest.log and the reason shown in this message.
- 300012** FLEX command service was stopped by SDA daemon. After closing Keysight Connection Expert, launch Start EasyEXPERT or restart B1500.
- 300021** SDA daemon failed to start SDA service.
path: *A*, arguments: *B*, reason: *C*
Contact your nearest Keysight Technologies. Then present the log file <database folder>/log/latest.log and the reason shown in this message.
- 300031** SDA daemon failed to start SDA shell.
path: *A*, arguments: *B*, reason: *C*
Contact your nearest Keysight Technologies. Then present the log file <database folder>/log/latest.log and the reason shown in this message.
- 300041** SDA daemon failed to start model name inspection process.
Path: *A*, Arguments: *B*, Reason: *C*
Contact your nearest Keysight Technologies. Then present the detail messages and the reason shown in this message.
- 300042** Model name inspection failed. Set VISA interface ID and GPIB address correctly, or connect the GPIB cable properly. Reason: *A*
- 300051** SDA daemon failed to start database recovery process.
Path: *A*, Arguments: *B*, Reason: *C*

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Reinstall EasyEXPERT software. Or contact your nearest Keysight Technologies. Then present the detail messages and the reason shown in this message.

300052 Database recovery failed. Contact Keysight Technologies. Reason: *A*

Contact your nearest Keysight Technologies. Then present the detail messages and the reason shown in this message.

300061 SDA daemon failed to start SDA authentication.

path: *A*, arguments: *B*, reason: *C*

Contact your nearest Keysight Technologies. Then present the log file <database folder>/log/latest.log and the reason shown in this message.

300101 An error occurred during inspection of the specified database. Path: *A*

Specify another healthy database backup. See the log file <common data folder>\Agilent\EasyEXPERT\Daemon\StaDaemon.log if needed.

300102 The specified EasyEXPERT database is corrupted. Please replace it

with a healthy backup or use a copy of initial database.

Path: *A*, Reason: *B*

Specify another healthy database backup.

300103 The specified XDB archive is corrupted. Path: *A*

Specify another healthy database backup.

300104 Disk space is insufficient.

Drive: *A*, Current Space: *B* bytes, Required Space: *C* bytes

To increase disk free space, delete unnecessary files or use folder compression feature of Windows. After you got required space, please retry the operation.

300105 The specified drive *A* is not the drive *B* where EasyEXPERT database is located. Please specify a location on the drive *B*.

300106 Unnecessary content is in the backup. Different versions of databases may be contained in the backup. Content: *A*

Specify another healthy database backup.

300107 Necessary content is not found in the backup. Content: *A*

Specify another healthy database backup.

300108 The database of version *A* is not supported by installed EasyEXPERT software.

- Specify another healthy database backup.
- 300109** Failed to expand XDB archive. Cannot continue restoration of database. The original database is left as before.
- Specify another healthy database backup. See the log file <common data folder>\Agilent\EasyEXPERT\Daemon\StaDaemon.log if needed.
- 300110** Could not delete folder. The folder is left in the following location.
Path: *A*
- Delete the folder *A* manually. See the log file <common data folder>\Agilent\EasyEXPERT\Daemon\StaDaemon.log if needed.
- 300111** Failed to replace the current database with the following folder.
Source: *A*, Destination: *B*
- If Source shows the EasyEXPERT database folder name, the database remains the condition before starting restore.
- If Destination shows the EasyEXPERT database folder name, the database is broken. Restore the database by deleting the folder named “1” and renaming the temporary folder named “1.xxx”, for example 1.tmp1A, to “1”.
- See the log file <common data folder>\Agilent\EasyEXPERT\Daemon\StaDaemon.log if needed.
- 300112** Failed to update Application Library. Information: *A*
- Consult the Information *A* and solve the problem.
- 300113** The specified backup is partially deleted.
- Specify another healthy database backup.
- 300114** The specified folder is not empty. Please select an empty folder.
- 300115** Folder deletion is aborted. The folder is left in the following location.
Path: *A*
- 300116** Expansion of the specified XDB archive is aborted. Expanded files are removed.
- 300117** Copying the specified folder is aborted. Copied files are removed.
- 400001** Failed to retrieve inf.dat. Path: *A*, Description: *B*
- 400002** Cannot access EasyEXPERT Database root directory. Path: *A*,
Description: *B*

Error Message

Keysight EasyEXPERT Operation Error

- 400003** Intermingled EasyEXPERT Database root directory.
Path: *A*, Description: *B*
- 400004** Invalid EasyEXPERT root directory. Path: *A*, Description: *B*
- 400005** Failed to retrieve dir file. Path: *A*, Description: *B*
- 400006** Cannot access EasyEXPERT Database lib directory.
Path: *A*, Description: *B*
- 500011** License device not found. Connect the license device for EasyEXPERT properly. Feature: *A*, Error: *B*
- 500012** License device busy. Try again later. Feature: *A*, Error: *B*
- 500021** License for this feature is locked. Try again later. Feature: *A*, Error: *B*
- 500022** Unlicensed feature found. Feature: *A*
Get and install the license.
- 500023** Unknown license information for this feature. The software revision may be too old. Feature: *A*
Update the EasyEXPERT software.
- 500024** You need the license to use this function. Function: *A*, Required Option: *B*
Get and install the license.
- 500031** License authentication error. Feature: *A*, Reason: *B*
Contact your nearest Keysight Technologies.
- 500032** License authentication failed. Feature: *A*, Reason: *B*
Contact your nearest Keysight Technologies.
- 500041** Installation of the license file is failed. Please check the license file.
Check if the license file is effective.
- 500042** Host ID in the license file does not match the actual Host ID. Please check the license file. Actual Host ID: *A*
Check if the license file is effective.
- 500051** License for EasyEXPERT Extension is required. Please specify the license file.
- 500052** Installation will be aborted. After obtaining the license file for EasyEXPERT Extension, please retry installation.

Get and install the license.

500053 Starting of EasyEXPERT will be aborted. After obtaining the license file for EasyEXPERT Extension, please retry starting of EasyEXPERT.

Get and install the license.

Keysight FLEX Execution Error

When Keysight B1500 causes errors in Keysight FLEX command execution environment, the B1500 returns the following error code and error message.

- | | |
|------------|---|
| 100 | Undefined GPIB command.
Send the correct command. |
| 102 | Incorrect numeric data syntax.
Correct the data syntax. |
| 103 | Incorrect terminator position.
Correct the command syntax. The number of parameters will be incorrect. |
| 104 | Incorrect serial data syntax. |
| 120 | Incorrect parameter value.
Correct the parameter value. |
| 121 | Channel number must be 1 to 10.
Correct the channel number. The channel number must be 1 to 10 for Keysight B1500. |
| 122 | Number of channels must be corrected.
Check the MM, FL, CN, CL, IN, DZ, or RZ command, and correct the number of channels. |
| 123 | Compliance must be set correctly.
Incorrect compliance value was set. Set the compliance value correctly. |
| 124 | Incorrect range value for this channel.
Check the range value available for the channel, and correct the range value. |
| 125 | Search goal value must be less than compliance value. |
| 126 | Pulse base and peak must be same polarity.
The polarity of the base and peak values must be the same in the PI command. Also the polarity of the base, start, and stop values must be the same in the PWI command. |

- 130** Start and stop must be same polarity.
For a log sweep, the polarity of the start and stop values must be the same in the WV, WI, WSV, WSI, or WNX command. Also, 0 is not allowed for the start and stop values.
- 140** Invalid setup
Check the setup required for the specified function and set it properly.
- 150** Command input buffer is full.
Keysight B1500 can receive 256 characters maximum including the terminator at one time.
- 151** This command is not allowed to this channel.
- 152** Cannot use failed module.
The channel number specifying the module failed the self-test or calibration. Specify another module that passed the self-test or calibration. For the service purpose, execute the RCV command to enable the module.
- 153** No module for the specified channel.
Module is not installed in the slot specified by the channel number.
- 154** Cannot recover this module.
The specified module cannot recover from the fail status. It may be defective.
- 155** Module initialization failed.
The specified module failed the initialization. It may be defective.
- 160** Incorrect ST execution.
The internal memory programming can be started by the ST command and completed by the END command. Do not enter the ST command between the ST command and the END command.
- 161** Incorrect END execution.
The internal memory programming can be started by the ST command and completed by the END command. Do not send the END command before starting the programming.
- 162** Incorrect command for program memory.

Error Message
Keysight FLEX Execution Error

Specified command cannot be stored in the program memory. For the incorrect commands, see *Keysight B1500 Programming Guide*.

- 170** Incorrect usage of internal variable.
The internal variable must be %In for integer data, or %Rn for real data. where *n* is an integer, 0 to 99. Use %In for the integer type command parameters; and use %Rn for the real type command parameters. For the internal variables, see the VAR command of *Keysight B1500 Programming Guide*.
- 171** Internal variable is not allowed.
The internal variables %In and %Rn are not available for the ACH, VAR, and VAR? commands. Do not use the internal variables for the commands.
- 200** Channel output switch must be ON.
To enter the specified command, set the channel output switch to ON.
- 201** Compliance must be set.
To change the source output mode (voltage or current), set the compliance value.
- 202** Interlock circuit must be closed.
To set the output voltage or the voltage compliance to more than the allowable voltage for the interlock open condition (high voltage state), close the interlock circuit. If the interlock circuit is opened in the high voltage state, outputs of all units will be set to 0 V.
- 203** Cannot enable channel.
The channel output switch cannot be set to ON in the high voltage state. Set the output voltage or the voltage compliance to the allowable voltage for the interlock open condition or less to set the switch to ON.
- 204** Cannot disable channel.
The channel output switch cannot be set to OFF in the high voltage state. Set the output voltage or the voltage compliance to the allowable voltage for the interlock open condition or less to set the switch to OFF. Or send the CL command with no parameter to set switches of all channels to OFF immediately.
- 205** DZ must be sent before RZ.

- The RZ command is effective for the channels set to 0 V output by the DZ command.
- 206** Do not specify the channel recovered by RZ.
Specify the channels that have not been recovered yet by the RZ command after the DZ command. The RZ command cannot be executed if the specified channels include a channel that has already been recovered by the RZ command.
- 210** Ext trigger could not start measurement.
External trigger cannot start measurement because of busy condition.
- 211** TM1 must be sent to use GET.
Send the TM1 command to use the GPIB GET command (TRIGGER statement in HP BASIC).
- 212** Compliance must be set correctly.
Compliance was not set or an incorrect compliance value was set in the DV, DI, PV, PI, PWV, PWI, TDV, TDI, LSV, LSI, LSSV, LSSI, BSV, BSI, BSSV, or BSSI command. Set the compliance value correctly.
- 213** Cannot perform self-test or calibration.
Self-test and calibration cannot be performed in the high voltage state. Set the output voltage or the voltage compliance to the allowable voltage for the interlock open condition or less to perform the self-test or calibration.
- 214** Send MM before measurement trigger.
Before sending the measurement trigger, the MM command must be sent to set the measurement mode.
- 217** Self-test is not defined for this module.
- 218** Cannot change output range.
The specified module failed the output range change. The output is set to the initial condition 0 V and 100 μ A.
- 219** Channel output switch must be OFF.
The channel output switch must be OFF before executing the specified command.
- 220** Send WV or WI to set primary sweep source.

Error Message
Keysight FLEX Execution Error

- Before triggering the staircase sweep measurement, triggering the staircase sweep with pulsed bias measurement, or sending the WSV, WSI, or WNX command to set the synchronous sweep source, send the WV or WI command to set the primary sweep source.
- 221** Send PWV or PWI to set pulse sweep source.
Before triggering the pulsed sweep measurement, or sending the WSV or WSI command to set the synchronous sweep source, send the PWV or PWI command to set the pulse sweep source.
- 222** Send PV or PI to set pulse source.
Before triggering the staircase sweep with pulsed bias measurement, send the PV or PI command to set the pulse source.
- 223** Compliance must be set correctly.
Compliance was not set or an incorrect compliance value was set in the WV, WI, WSV, WSI, WNX, or BDV command. Set the compliance value correctly.
- 224** Sweep and sync output modes must be the same.
The primary sweep channel and the synchronous sweep channel must be different, and they must be set to the same output mode (voltage or current).
- 225** Send WSV, WSI, or WNX to get sync sweep data.
If you enable data output of the synchronous sweep source, do not forget to set the synchronous sweep source by the WSV, WSI, or WNX command. For data output, see the FMT command of *Keysight B1500 Programming Guide*.
- 226** Set linear sweep for MM4 or MM5.
Only the linear sweep is available for the PWV or PWI command for the pulsed sweep measurement (MM4) or the WV or WI command for the staircase sweep with pulsed bias measurement (MM5).
- 227** Sweep measurement was aborted.
Sweep measurement was aborted by the automatic abort function or the power compliance.
- 228** Pulse period is not set for pulse measurements.
- 230** Pulse source must be set.

- To perform the pulsed spot measurement (MM3), send the PV or PI command to set the pulse source.
- 231** Compliance must be set correctly.
Compliance was not set or an incorrect compliance value was set in the PV, PI, PWV, or PWI command. Set the correct compliance value effective for the pulse output.
- 232** Invalid pulse output setup
Check the pulse output setup and set the correct value.
- 233** Invalid pulse timing setup
Check the pulse timing parameters and set the correct values.
- 238** Too large pulse width (max. 2 s).
The maximum value of the pulse width is 2 s. And the available value depends on the pulse period value. See the PT command of *Keysight B1500 Programming Guide*.
- 239** Pulse width must be 0.01 ms or more.
Set the pulse width to 0.01 ms or more. See the PT command of *Keysight B1500 Programming Guide*.
- 240** Enter QSV to set QSCV sweep source.
The QSV command must be entered to set the sweep source of the quasi-static CV measurement.
- 241** QSR range value must be -9 to -14.
The *range* values available for the QSR command are -9 to -14. Set one of the available values.
- 242** QSCV measurement was aborted.
Quasi-static CV measurement was aborted by the automatic abort function.
- 243** Enter MM13 before QSZ.
Before the QSZ command, the MM13 command must be entered to set the measurement mode.
- 244** Set a longer integration time to QST.
The integration time is too short to perform the offset measurement. Set a longer value to the integration time parameter of the QST command.

Error Message
Keysight FLEX Execution Error

- 245** Specify a higher measurement range to QSR.
Too large offset current was measured. Specify the next higher measurement range to the QSR command.
- 246** QSV mode value must be 1 or 3.
The *mode* values available for the QSV command are 1 (single linear) and 3 (double linear). Set one of the available values.
- 247** Dedicated channel must be specified by QSO.
Specify the dedicated channel to the QSO command. It must be the channel other than the measurement channel set by the MM13 command or the sweep output channel set by the QSV command.
- 253** Program memory is full.
Maximum of 2000 programs or 40000 commands can be stored in the program memory. See the ST command of *Keysight B1500 Programming Guide*.
- 254** Invalid input for a memory program.
The GPIB GET command (TRIGGER statement in HP BASIC) and an external trigger input are not allowed in a memory program (between the ST and END commands).
- 255** Maximum nesting level is eight.
Nesting (one program calling another) of a memory program must be eight levels or less.
- 260** Data output buffer is full.
Maximum 34034 measurement data items can be stored in the data output buffer.
- 270** Search source channel must be set.
Before triggering the search measurement or sending the LSSV, LSSI, BSSV, or BSSI command to set the synchronous search source, send the LSV, LSI, BSV, or BSI command to set the primary search source.
- 271** Search monitor channel must be set.
Before triggering the search measurement, send the LGV, LGI, BGV, or BGI command to set the search monitor channel.
- 273** Search and sync output modes must be the same.

- The primary search source channel and the synchronous source channel must be different, and they must be set to the same output mode (voltage or current).
- 274** Search sync source is overflow.
Set the search sources so that the same output range is set to both primary and synchronous search sources.
- 275** Search target must be compliance value or less.
The search target value must be less than or equal to the compliance value of the search monitor channel. Correct the search target value or the compliance value.
- 276** Start and stop must be different.
Set different values for the search start and stop values.
- 277** Step must be output resolution or more.
Set the search step value to the output resolution or more.
- 278** Search and sync channels must be different.
Set the search source and the synchronous source to different channels.
- 279** Search monitor mode must be compliance side.
Send the LGI/BGI command to set the voltage source search monitor channel, or send the LGV/BGV command to set the current source search monitor channel.
- 280** Send WDCV to set CV sweep source.
Before triggering the multi frequency CV measurement, send the WDCV command to set the DC voltage sweep source.
- 281** Send PDCV to set CV pulse source.
Before triggering the pulsed spot C measurement, send the PDCV command to set the pulsed voltage source.
- 282** Send PWDCV to set CV pulse sweep source.
Before triggering the pulsed CV measurement, send the PWDCV command to set the pulsed voltage sweep source.
- 283** Set linear sweep for MM20.
Only the linear sweep is available for the PWDCV command for the pulsed CV measurement (MM20).

Error Message
Keysight FLEX Execution Error

- 284** Improper setting of CMU frequency and pulse width.
Pulse width value is out of the range for the CMU output frequency. Set both frequency value and pulse width value properly.
- 290** Send WFC to set Cf sweep source.
Before triggering the Cf sweep measurement, send the WFC command to set the frequency sweep source (oscillator).
- 301** Line power failure.
- 303** Excess voltage in MPSMU.
Voltage that exceeds maximum voltage at the present current range was detected by a MPSMU. All output switches were set to OFF.
- 304** Ground unit abuse is detected.
- 305** Excess current in HPSMU.
Current that exceeds maximum current at the present voltage range was detected by a HPSMU. All output switches were set to OFF.
- 307** Unsupported module.
This module is not supported by this firmware revision. Until you update the firmware, use Keysight B1500 with this module removed.
- 309** Unknown emergency occurred.
All modules stopped their output and opened their output relay.
- 310** Interlock open operation error. Initialized.
Initialization was automatically performed because the B1500 failed to set its output to 0 V when the interlock circuit was opened in the high voltage condition. Any module may be defective. Perform self-test.
- 311** ASU control cable was connected/disconnected.
The B1500 must be turned off when the Atto Sense and Switch Unit (ASU) is connected/disconnected.
- 312** SCUU control cable was connected/disconnected.
The B1500 must be turned off when the SMU CMU Unify Unit (SCUU) is connected/disconnected.
- 320** Excess current in CMU.
Current that exceeds maximum current at the present voltage range was detected by the CMU. The output switch was set to OFF.

- 321** This command is not available for CMU.
CMU was specified for the SMU dedicated command. Specify SMU.
- 322** This command is not available for SMU.
SMU was specified for the CMU dedicated command. Specify CMU.
- 323** Use SSP instead of CN for SCUU modules.
It is not necessary to specify the modules connected to the SMU CMU Unify Unit (SCUU) in the CN command. The output switches will be controlled by the SSP command.
- 330** Turn on again to detect source channel.
SCUU might be disconnected/connected on the power on condition.
Restart the B1500 to detect and enable the channel.
- 331** Turn on again to detect synchronous channel.
SCUU might be disconnected/connected on the power on condition.
Restart the B1500 to detect and enable the channel.
- 332** Turn on again to detect measurement channel.
SCUU might be disconnected/connected on the power on condition.
Restart the B1500 to detect and enable the channel.
- 333** Turn on again to detect search source.
SCUU might be disconnected/connected on the power on condition.
Restart the B1500 to detect and enable the channel.
- 334** Turn on again to detect search sync source.
SCUU might be disconnected/connected on the power on condition.
Restart the B1500 to detect and enable the channel.
- 335** Turn on again to detect search monitor channel.
SCUU might be disconnected/connected on the power on condition.
Restart the B1500 to detect and enable the channel.
- 603** Sweep and pulse channels must be different.
Set the sweep source and the pulse source to different channels for the staircase sweep with pulsed bias measurement (MM5).
- 610** Quasi-pulse source channel must be set.
Before triggering the quasi-pulsed spot measurement, send the BDV command to set the quasi-pulse source.

Error Message
Keysight FLEX Execution Error

- 620** TGP specified incorrect I/O port.
Specify trigger input for the Ext Trig In port, or trigger output for the Ext Trig Out port by the TGP command. See the TGP command of Programming Guide.
- 621** Specify trigger input port for PAX/WSX.
No trigger input port was specified for the PAX or WSX command. Specify the trigger input port, or set the port as the trigger input port. See the TGP command of *Keysight B1500 Programming Guide* to set trigger port.
- 622** Specify trigger output port for OSX.
No trigger output port was specified for the OSX command. Specify the trigger output port, or set the port as the trigger output port. See the TGP command of *Keysight B1500 Programming Guide* to set trigger port.
- 626** DIO control mode must be HV/HC/HP SMU selector control mode (ERMOD 2).
Set the digital IO control mode to the N1258A/N1259A control mode by using the ERMOD 2 command.
- 627** Mismatch HV/HC/HP SMU selector ID
Module selector is not connected to the Digital IO connector. Connect the N1258A or the module selector of the N1259A.
- 628** HV/HC/HP SMU selector control cable was disconnected.
Connection cable was removed. Turn the instrument off and connect the cable. And then turn the instrument on again.
- 629** HV/HC/HP SMU selector is not active.
Module selector does not respond. The power code may be removed.
- 630** Incorrect polarity of search step value.
For the linear search measurement. The step value must be positive if start<stop, or negative if start>stop.
- 631** Number of search steps must be 1001 or less.
For the linear search measurement. The number of search steps between start and stop must be 1001 or less. This means the |step| value must be |stop-start|/1001 or more.

- 632** Search measurement was aborted.
Search measurement was aborted by the automatic abort function.
- 640** Search limits must be range/20000 or more.
For the binary search measurement. The limit value for the search target must be *range*/20000 or more. where *range* means the measurement range actually used for the measurement.
- 650** Data format must be ASCII to get time data.
The time stamp function is not available for the binary data output format. To use the time stamp function, set the data output format to ASCII.
- 655** Cannot connect/disconnect series resistor.
The series resistor status cannot be changed in the high voltage state. Set the output voltage or the voltage compliance to the allowable voltage for the interlock open condition or less to connect or disconnect the series resistor.
- 656** Series resistor must be OFF for 1 A range.
The series resistor cannot be set to ON for the measurement channels or the output channels that use 1 A range.
- 657** Series resistor cannot be used with ASU.
The series resistor is not available for the channel connected to the Atto Sense and Switch Unit (ASU).
- 660** Sampling measurement was aborted.
Sampling measurement was aborted by the automatic abort function.
- 661** Negative hold time is only valid for I/V-t linear sampling with interval < 2 ms.
- 662** Sampling interval for I/V-t log sampling must be 2 ms or longer.
- 663** Number of samples does not have to exceed 100001.
- 664** Base and bias must be same polarity for I mode.
The *base* and *bias* values of the MI command must be the same polarity.
- 670** Specified channel does not have ASU.
Specify the module that can be used with the ASU.

Error Message
Keysight FLEX Execution Error

- 671** SSP is not available for this channel.
SSP command is available only for the CMU. Specify the slot number that the CMU has been installed.
- 680** CMU correction mode must be manual.
To perform the CMU correction by using the ADJ? command, set the CMU correction mode to manual by using the ADJ command.
- 681** CMU correction mode must be off.
- 682** Invalid standard is specified as CMU correction.
- 683** Frequency index is not available for CMU correction.
- 684** AC Voltage is 0 mV.
- 685** CMU correction is not complete.
- 690** DIO control mode must be Ultra High Current Expander / Fixture control mode (ERMOD 4).
Set the digital IO control mode to N1265A control mode by using the ERMOD 4 command.
- 691** Mismatch Ultra High Current Expander / Fixture ID.
Ultra high current expander/fixture is not connected to the Digital IO connector. Connect the N1265A.
- 692** Ultra High Current Expander / Fixture control cable was disconnected.
Connection cable was removed. Turn the instrument off and connect the cable. And then turn the instrument on again.
- 693** Ultra High Current Expander / Fixture is not active.
Ultra high current expander/fixture does not respond. The power switch may be off or the power code may be removed.
- 694** DIO control mode must be HVSMU Current Expander control mode (ERMOD 8).
Set the digital IO control mode to N1266A control mode by using the ERMOD 8 command.
- 695** Mismatch HVSMU Current Expander ID.
HVSMU current expander is not connected to the Digital IO connector. Connect the N1266A.
- 696** HVSMU Current Expander control cable was disconnected.

- Connection cable was removed. Turn the instrument off and connect the cable. And then turn the instrument on again.
- 697** HVSMU Current Expander is not active.
HVSMU current expander does not respond. The power switch may be off or the power code may be removed.
- 940** DIO control mode must be Ultra High Voltage Expander control mode (ERMOD 16).
Set the digital IO control mode to N1268A control mode by using the ERMOD 16 command.
- 941** Mismatch Ultra High Voltage Expander ID.
Ultra high voltage expander is not connected to the Digital IO connector. Connect the N1268A.
- 942** Ultra High Voltage Expander control cable was disconnected.
Connection cable was removed. Turn the instrument off and connect the cable. And then turn the instrument on again.
- 943** Ultra High Voltage Expander is not active.
Ultra high voltage expander does not respond. The power cord may be removed.
- 950** DIO control mode must be Device Capacitance Selector control mode (ERMOD 32).
Set the digital IO control mode to N1272A control mode by using the ERMOD 32 command.
- 951** Mismatch Device Capacitance Selector ID.
N1272A/B1506A/B1507A is not connected to the Digital IO connector. Connect the N1272A, B1506A, or B1507A.
- 952** Device Capacitance Selector control cable was disconnected.
Connection cable was removed. Turn the instrument off and connect the cable. And then turn the instrument on again.
- 953** Device Capacitance Selector is not active.
N1272A/B1506A/B1507A does not respond. The power cord may be removed.
- 999** Error not supported by the ERR? command occurs. Execute the ERRX? command to read the error code and the error message.

Error Message
Keysight FLEX Execution Error

- 1000** The specified module doesn't support power compliance.
The power compliance is not available for the specified module.
- 1001** Illegal pulse duty
Set the pulse period and the pulse width so that the pulse duty ratio is within the acceptable range.
- 1002** Illegal pulse width
Check the pulse width and set the correct value.
- 1003** Illegal pulse base/peak limit
Check the pulse base and peak values, and set the correct values.
- 1004** Illegal pulse base/peak polarity
Check the pulse base and peak values, and set the polarity properly.
- 1005** Illegal sweep polarity
Check the sweep start and stop values, and set the polarity properly.
- 1006** Application measurement setup is not sufficient.
Check the setup required for the specified measurement and set it properly.
- 1007** Source channel must be set.
Set the source output channel properly.
- 1008** Pulse output channel is required.
Specify the pulse output channel. Or set the pulse output channel properly.
- 1009** The specified value is out of range defined by output limit function.
Specify the voltage/current output value within the range limited by the LIM command. Or change the limit value by using the LIM command.
- 1010** This B1500A does not support PCH.
PCH is not supported by this B1500A. The B1500A must be upgraded to use the dual HCSMU operation.
- 1011** SMU is not installed in the slot set to PCH.
Empty slot or non SMU module was specified by PCH. The HCSMU modules must be specified.

- 1012** Execute CL to the modules set to PCH.
Output switch of the modules set to PCH must be OFF previously.
- 1013** Execute ERHPA 0,0,0 before PCH.
Modules set to ERHPA cannot be specified in PCH.
Execute ERHPA 0,0,0, then execute PCH. After that execute ERHPA to set the module selector input connection.
- 1014** Modules set to PCH must be HCSMU.
Only the HCSMU module can be specified in PCH.
- 1015** Modules set to PCH must be different.
Same module was specified by PCH for both primary and secondary HCSMU modules. They must be the different modules.
- 1016** Do not execute CN/CNX to the secondary module set to PCH.
Specify the primary module in CN/CNX to enable the dual HCSMU channel.
- 1017** Specified module is already used for dual HCSMU.
Specify a free HCSMU.
- 1018** Total setting current exceeds the capacity of main frame power supply.
Reduce setting current.
Set the current lower than the specified value.
- 1019** A voltage setting other than 0 V or a current setting above +4 mA or below -4 mA can be applied to only one HVSMU channel in case of single channel HVSMU operation. Change HVSMU operation mode by HVSMUOP command.
- 1020** Cannot change HVSMU operation mode in high voltage status.
Execute HVSMUOP command after solving the high voltage status.
- 1021** Cannot change N1274A path in high voltage status.
Execute ERHPQG command after solving the high voltage status.
- 1022** Execute ERHPE 1 before ERHPQG.
Enable the external relay control function of the N1258A module selector using ERHPE command, and then execute ERHPQG command.
- 2000** SPGU module does not exist.

Error Message
Keysight FLEX Execution Error

- The SPGU channel number must be specified correctly.
- 2001** SPGU channel does not exist.
- The SPGU channel number must be specified correctly.
- 2002** SPGU signal source does not exist.
- The SPGU signal source number must be specified correctly.
- 2003** SPGU operation mode must be PG. (SIM 0).
- 2004** SPGU operation mode must be ALWG (SIM 1).
- 2051** Over voltage emergency occurred.
- All modules stopped their output and opened their output relay.
- 2052** Over current emergency occurred.
- All modules stopped their output and opened their output relay.
- 2053** High temperature emergency occurred.
- All modules stopped their output and opened their output relay.
- 2054** Over voltage H/W SRQ detected.
- Specified module stopped the output and opened the output relay.
- 2055** Over current H/W SRQ detected.
- Specified module stopped the output and opened the output relay.
- 2056** High temperature H/W SRQ detected.
- Specified module stopped the output and opened the output relay.
- 2101** Specified load impedance is out of absolute limits.
- Set the appropriate impedance value to SER.
- 2103** Specified period is out of absolute limits.
- Set the appropriate pulse period value to SPPER.
- 2104** Specified trigger count is out of absolute limits.
- Set the appropriate count value to SPRM.
- 2105** Specified load voltage is out of range.
- Set the appropriate voltage to SPV or ALW.
- 2106** Specified load voltage of added amplitude is out of range.

- Set the appropriate voltage to SPV for setting the 3-level pulse output.
- 2107** Specified voltage is out of absolute limits (can't achieve amplitude).
Set the appropriate voltage to SPV. It must be the voltage which can be applied under the present load impedance condition.
- 2108** Specified transition time is out of absolute limits.
Set the appropriate value of leading time or trailing time to SPT.
- 2111** Leading/0.8 must be within Width value.
Set the appropriate value to SPT. The pulse width value must be more than *leading time*/0.8 value.
- 2112** Delay + Width + Trail/0.8 must be within Period value.
Set the appropriate value to SPT. The pulse period value must be more than *delay time+pulse width+trailing time*/0.8 value.
- 2113** Specified pulse delay is out of absolute limits.
Set the appropriate delay time value to SPT.
- 2114** Specified pulse width is out of absolute limits.
Set the appropriate pulse width value to SPT.
- 2115** Specified duration is out of absolute limits.
Set the appropriate duration value to SPRM.
- 2121** Delay + Width must be within Period value (ODSW Timing).
Set the appropriate value to ODSW. The period value must be more than *delay+width* value.
- 2122** Specified ODSW delay timing parameter out of absolute limits.
Set the appropriate *delay* value to ODSW.
- 2123** Specified ODSW width timing parameter out of absolute limits.
Set the appropriate *width* value to ODSW.
- 2131** Delay + Interval * N must be within Period value (ADC Timing).
Set the appropriate value to CORRSER?. The period value must be more than *delay+interval×count* value.
- 2132** Specified delay for DUT impedance measurement out of absolute limits.

Error Message
Keysight FLEX Execution Error

- Set the appropriate *delay* time value to CORRSER?.
- 2133** Specified interval for DUT impedance measurement out of absolute limits.
Set the appropriate *interval* value to CORRSER?.
- 2134** Specified count for DUT impedance measurement out of absolute limits.
Set the appropriate *count* value to CORRSER?.
- 2151** ALWG Sequence Data is not ready.
Sequence data must be set by using ALS before starting the output.
- 2152** Specified ALWG Sequence Data size is out of absolute limits.
Set the appropriate sequence data to ALS. Too large data was specified.
- 2153** Specified pattern index of ALWG Sequence Data is out of absolute limits.
Set the appropriate sequence data to ALS. The pattern index in the sequence data must be the index of a pattern defined in the pattern data.
- 2154** Specified repeat count of ALWG Sequence Data is out of absolute limits.
Set the appropriate sequence data to ALS. The repeat count in the sequence data must be 1 to 1048576.
- 2155** ALWG Pattern Data is not ready.
Pattern data must be set by using ALW before starting the output.
- 2156** Specified ALWG Pattern Data size is out of absolute limits.
Set the appropriate pattern data to ALW. Too large data was specified.
- 2157** Specified interval time of ALWG Pattern is out of absolute limits.
Set the appropriate pattern data to ALW. The incremental time value in the pattern data must be 10 ns to 671.088630 ms in 10 ns resolution.
- 2158** Specified output voltage of ALWG Pattern Data is out of absolute limits.
Set the appropriate pattern data to ALW. The output level value in the pattern data must be 0 to ± 40 V in 1 mV resolution.
- 2204** Load voltage is too small for DUT impedance measurement.

- Failed to perform the terminal voltage measurement and the load impedance calculation by the CORRSER? command. Set the SPGU output voltage more than 1 V. Set high voltage for high impedance.
- 2206** Auto correction of load impedance failed.
- Cannot perform the SPGU automatic level adjustment. Load impedance exceeds the acceptable range. Change the SPGU output voltage or the DUT.
- 3000** WGF MU module does not exist.
- Check the channel number of the WGF MU module and set the correct value.
- 3001** RSU is not connected.
- Check the channel number of the WGF MU module connected to the RSU and set the correct value.
- 3015** Measurement data corrupted.
- Cannot get the measurement data. Correct measurement result is not stored in the memory.
- 3050** Measurement data memory overflow error.
- ALWG sequencer run time error. WGF MU module memory overflow occurred. Data exceeds memory size could not be stored.
- 3051** Measurement data FIFO overflow error.
- ALWG sequencer run time error. WGF MU module FIFO overflow occurred because the averaging count was frequently changed.
- 3052** Measurement range change request error.
- ALWG sequencer run time error. Measurement range cannot be changed because the range change interval is too short.
- 3201** ALWG Sequence Data is not ready.
- Sequence data must be set to the specified WGF MU channel.
- 3202** ALWG Waveform Data is not ready.
- Waveform data must be set to the specified WGF MU channel.
- 3301** Specified output voltage is out of absolute limits.

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Keysight FLEX Execution Error

- Check the output voltage and set the correct value. The value must be -3 V to +3 V for the 3 V range, -5 V to +5 V for the 5 V range, -10 V to 0 V for the -10 V range, or 0 V to +10 V for the +10 V range.
- 3302** Specified voltage output range is invalid.
Check the voltage output range and set the correct value.
- 3303** Invalid measurement mode for current operation mode.
Operation mode must be Fast IV or DC to perform current measurement.
- 3304** Specified ALWG Vector Data size is out of absolute limits.
ALWG data cannot be read because of too large data size.
- 3305** Specified ALWG Sequence Data size is out of absolute limits.
ALWG data cannot be read because of too large sequence data size.
- 3306** ALWG Waveform Data is empty.
ALWG data must not be empty.
- 3307** Specified ALWG Waveform Data size is out of absolute limits.
ALWG data cannot be read because of too large waveform data size.
- 3308** Specified waveform index of ALWG Sequence Data is out of absolute limits.
Check the index value of the sequence data and set the correct value.
- 3309** Specified loop number of ALWG Sequence Data is out of absolute limits.
Check the loop value of the sequence data and set the correct value.
- 3310** Specified output voltage of ALWG Waveform Data is out of absolute limits.
Check the output voltage and set the correct value. The value must be -3 V to +3 V for the 3 V range, -5 V to +5 V for the 5 V range, -10 V to 0 V for the -10 V range, or 0 V to +10 V for the +10 V range.
- 3311** Specified interval time of ALWG Waveform is out of absolute limits.
Check the incremental time (interval time) and set the correct value. The value must be 10 ns to 10995.11627775 s, in 10 ns resolution.
- 3312** Specified ALWG measurement interval time is out of absolute limits.

- Check the measurement interval time and set the correct value. The value must be 10 ns to 1.34217728 s, in 10 ns resolution.
- 3313** Specified ALWG measurement instruction code is invalid.
Check the measurement event setting and set the correct values.
- 3314** Specified ALWG range change instruction code is invalid.
Check the range event setting and set the correct values.
- 3315** Specified ALWG measurement count is out of absolute limits.
Check the measurement averaging time and set the correct value. The value must be 0, or 10 ns to 0.020971512 s, in 10 ns resolution.
- 3316** Specified ALWG measurement count is greater than measurement interval.
Check the measurement averaging time and set the correct value. The value must less than or equal to the measurement interval time.
- 3317** Specified slot is invalid.
Check the slot number and set the correct value. The slot number must be 1 to 10.
- 3318** Specified module channel is invalid.
Check the channel number and set the correct value.
- 3319** Output delay is out of absolute limits.
Check the output delay and set the correct value. The value must be -50 ns to 50 ns, in 625 ps resolution.
- 3320** Measurement delay is out of absolute limits.
Check the measurement delay and set the correct value. The value must be -50 ns to 50 ns, in 625 ps resolution.
- 3321** VM/IM measurement mode is invalid.
Check the measurement mode and set the correct value.
- 3322** Voltage measurement range is invalid.
Check the voltage measurement range and set the correct value.
- 3323** Current measurement range is invalid.
Check the current measurement range and set the correct value.
- 3324** WGMA?,WGMB? command query size is out of absolute limits.

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Keysight FLEX Execution Error

- Check the data size for WGMA? or WGMB? and set the correct value.
- 3325** Specified count for spot measurement is out of absolute limits.
Check the count value for WGMS? and set the correct value.
- 3326** Specified interval for spot measurement is out of absolute limits.
Check the interval value for WGMS? and set the correct value.
- 3327** Specified operation mode is invalid for spot measurement.
Operation mode must be DC to perform spot measurement.
- 4304** HV/HC/HP SMU selector must be open state.
Set the module selector input-output path to the open status to execute the specified command.
- 4305** External relay control is not active.
Enable the external relay control function by using the ERHPE command to enter the specified command. Also, check the cable connection and the relay operation.

NOTE

If one of the errors 4401 to 4408 occurs, the all module output is changed to 0 V and the all output switch is disconnected.

- 4401** HVSMU over voltage emergency occurred.
- 4402** HVSMU over current or guard abuse emergency occurred.
- 4403** HVSMU guard abuse emergency occurred.
- 4404** HVSMU HVPS cannot power-off emergency occurred.
- 4405** HVSMU V ADC lost emergency occurred.
- 4406** HVSMU I ADC lost emergency occurred.
- 4407** HVSMU Float lost emergency occurred.
- 4408** HVSMU HVPS cannot power-on emergency occurred.
- 5301** Specified module is already assigned to voltage control, current control or gate control.
Specify a free MCSMU/HCSMU.
- 5302** Voltage control module and current control module must be different.
Specify a free MCSMU/HCSMU.

- 5303** Do not execute CN/CNX to the current control module set to ERPFUHCA.
Execute the CN/CNX command to the module that is set to voltage control by the ERPFUHCA command.
- 5304** Ultra High Current Expander / Fixture drain path must be open state.
Open the selector connection path before switch the HVSMU series resistor.
- 5305** Execute CL to the module set to ERPFUHCA.
Execute the CL command to the modules that will be specified by the ERPFUHCA command.
- 5306** Ultra High Current Expander / Fixture gate path must be open state.
Open the gate connection path before switching the series resistor for the path.
- 5307** CRC for N1265A/B1506A EEPROM Vs correction segment failed.
N1265A/B1506A might be defective. Contact your nearest Keysight Technologies service center.
- 5308** CRC for N1265A/B1506A EEPROM Is correction segment failed.
N1265A/B1506A might be defective. Contact your nearest Keysight Technologies service center.
- 5309** CRC for N1265A/B1506A EEPROM Vm correction segment failed.
N1265A/B1506A might be defective. Contact your nearest Keysight Technologies service center.
- 5310** CRC for N1265A/B1506A EEPROM Im correction segment failed.
N1265A/B1506A might be defective. Contact your nearest Keysight Technologies service center.
- 5311** Specified module is already assigned to voltage control or current control of HVMCU.
Specify a free MCSMU/HCSMU.
- 5312** Different module must be assigned to voltage control and current control of HVMCU.
Specify a free MCSMU/HCSMU.

Error Message
Keysight FLEX Execution Error

- 5313** Do not execute CN/CNX to the current control module set to ERHVCA.
Execute the CN/CNX command to the module that is set to voltage control by the ERHVCA command.
- 5314** HVSMU Current Expander output must be open state.
Open the input-output path before switching the HVSMU series resistor.
- 5315** Execute CL to the module set to ERHVCA.
Execute the CL command to the modules that will be specified by the ERHVCA command.
- 5316** CRC for N1266A EEPROM Vm correction segment failed.
N1266A might be defective. Contact your nearest Keysight Technologies service center.
- 5317** CRC for N1266A EEPROM Im correction segment failed.
N1266A might be defective. Contact your nearest Keysight Technologies service center.
- 5318** Over voltage is detected in Selector Output High Force, Low Force, or Low Sense terminal of N1265A/B1506A.
Remove the causes of overvoltage.
- 5319** Over voltage is detected in Selector Output High Sense terminal of N1265A/B1506A.
Remove the causes of overvoltage.
- 5320** Pulse width overrun is detected in N1265A/B1506A.
Check the assignment of control modules.
- 5321** Specified module is already assigned to voltage control or current control of UHVU.
Specify a free MCSMU/HCSMU.
- 5322** Different module must be assigned to voltage control and current control of UHVU.
Specify a free MCSMU/HCSMU.
- 5323** Do not execute CN/CNX to the current control module set to ERUHVA.

- Execute the CN/CNX command to the module that is set to voltage control by the ERUHVA command.
- 5324** Execute CL to the module set to ERUHVA.
Execute the CL command to the modules that will be specified by the ERUHVA command.
- 5325** Specified module is already used for UHCU, Selector, or Gate of N1265A/B1506A.
Specify a free module.
- 5326** Specified module is already used for HVMCU.
Specify a free module.
- 5327** Specified module is already used for UHVU.
Specify a free module.
- 5330** N1265A/B1506A: Cooling fan is not operating.
Check the operation of cooling fan and the condition around the fan.
- 5331** Execute CL to the module set to ERCMAA.
- 5332** Execute ERCMAIO to clear measurement path of Device Capacitance Selector before executing ERCMAGR.
- 5333** Invalid parameters for ERCMAIO.
- 5334** N1272A/B1506A/B1507A: Input modules are not assigned. Execute ERCMAA to assign input modules.
- 5340** N1265A/B1506A: Control modules are not assigned. Execute ERPFUHCA to assign control modules.
- 5341** N1265A/B1506A: Status test failed.
- 5342** N1265A/B1506A: Voltage pulse test failed.
- 5343** N1265A/B1506A: Current pulse test failed.
- 5344** N1265A/B1506A: Current measurement CMR test failed.
- 5345** N1265A/B1506A: Offset voltage test failed.
- 5346** N1265A/B1506A: Voltage measurement offset test failed.
- 5347** N1265A/B1506A: Current measurement offset test failed.
- 5350** N1266A: Control modules are not assigned. Execute ERHVCA to assign control modules.

Error Message
Keysight FLEX Execution Error

- 5351** N1265A/B1506A: Voltage measurement offset calibration failed.
- 5352** N1265A/B1506A: Current measurement offset calibration failed.
- 5355** N1266A: Cannot use N1258A's series resistor for HVSMU.
- 5356** N1266A: Cannot use N1265A's series resistor for HVSMU.
- 5360** N1268A: Control modules are not assigned. Execute ERUHVA to assign control modules.
- 5361** N1266A: Voltage pulse test failed.
- 5371** Specified module cannot be used in the present measurement mode.
- 5381** N1265A/B1506A diagnosis failed.
- 5385** N1268A diagnosis failed.
- 5395** N1272A/B1506A/B1507A diagnosis failed.

NOTE

If one of the errors 5401 to 5413 occurs, the all module output is changed to 0 V and the all output switch is disconnected.

- 5401** HCSMU high force over voltage emergency occurred.
- 5402** HCSMU high sense over voltage emergency occurred.
- 5403** HCSMU low force over voltage emergency occurred.
- 5404** HCSMU low sense over voltage emergency occurred.
- 5405** HCSMU low sense chassis over voltage emergency occurred.
- 5406** HCSMU power supply shortage voltage emergency occurred.
- 5407** HCSMU sense open error detected.
- 5408** HCSMU pulse peak over current emergency occurred.
- 5409** HCSMU DC over current emergency occurred.
- 5410** HCSMU pulse width over current emergency occurred.
- 5411** HCSMU float lost emergency occurred.
- 5413** HCSMU should not apply low current to high impedance device.

NOTE

If one of the errors 6401 to 6413 occurs, the all module output is changed to 0 V and the all output switch is disconnected.

- 6401** MCSMU high force over voltage emergency occurred.

- 6402** MCSMU high sense over voltage emergency occurred.
- 6403** MCSMU low force over voltage emergency occurred.
- 6404** MCSMU low sense over voltage emergency occurred.
- 6410** MCSMU pulse width over current emergency occurred.
- 6411** MCSMU float lost emergency occurred.
- 6412** MCSMU calculation overflow emergency occurred.
- 6413** MCSMU should not apply low current to high impedance device.

Keysight B1500 Self-test/Calibration Error

When Keysight B1500 fails the self-test or self-calibration, the B1500 returns the following error code and error message.

In the error code, N indicates the slot number. If the module is installed in slot 1, and it fails the function test, the error code will be 1760.

700	CPU failed NVRAM read/write test.
701	CPU failed FPGA read/write test.
702	CPU failed H-RESOLN ADC end signal test.
703	CPU failed H-RESOLN ADC start signal test.
704	CPU failed emergency status signal test.
705	CPU failed SRQ status signal test.
706	CPU failed high voltage status signal test.
707	CPU failed low voltage status signal test.
708	CPU failed DAC settling status signal test.
709	CPU failed measure ready status signal test.
710	CPU failed set ready status signal test.
711	CPU failed measure end status signal test.
712	CPU failed measure trigger signal test.
713	CPU failed pulse trigger signal test.
714	CPU failed abort trigger signal test.
715	CPU failed DAC set trigger signal test.
720	H-RESOLN ADC is not installed.
721	H-RESOLN ADC failed ROM/RAM test.
722	H-RESOLN ADC failed B-COM offset DAC test.
723	H-RESOLN ADC failed sampling ADC test.
724	H-RESOLN ADC failed integrating ADC test.
725	H-RESOLN ADC failed bus function test.

740	GNDU failed calibration.
935	CMU FPGA version mismatch.
2400	SPGU module is in TEST FAIL state.
2401	Digital H/W function test failed.
2402	CPLD access function test failed.
2403	CPLD version check test failed.
2404	CPLD revision check test failed.
2405	FPGA configuration test failed.
2406	FPGA access function test failed.
2407	FPGA version check test failed.
2408	FPGA revision check test failed.
2409	DCM function test failed.
2410	CONVEND interrupt function test failed.
2411	EMG interrupt function test failed.
2412	10 MHz clock test failed.
2413	FPGA SYNC SEL pin control function test failed.
2414	FPGA SYNC FB pin control function test failed.
2415	FPGA SYNC IN pin control function test failed.
2416	IDELAY function test failed.
2417	NVRAM access function test failed.
2418	ADC function test failed.
2419	SDRAM access function test failed.
2430	Module EEPROM CRC data is invalid.
2431	Module EEPROM CRC data of module data ID is invalid.
2432	Module EEPROM CRC data of format revision data is invalid.
2433	Module EEPROM CRC data of analog reference data is invalid.
2434	Module EEPROM CRC data of timing calibration data is invalid.
2435	Module EEPROM CRC data is skew calibration data invalid.

Error Message

Keysight B1500 Self-test/Calibration Error

2450	Internal ADC function test failed.
2451	0.5 Vref Internal ADC function test failed.
2452	4.5 Vref Internal ADC function test failed.
2453	Power Amp initial test failed.
2454	Filter & Amp test failed.
2455	Internal temperature test failed.
2456	Internal output resistance test failed.
2481	Invalid frame configuration.
2482	Frame has no modules.
2483	PLL not locked in secondary module.
2484	Reference line is not connected.
2485	Sync line is not connected.
2486	Interrupt line is not available.
2487	Module service request assertion test failed.
2488	Module service request detection test failed.
2489	Emergency interrupt is not available.
2500	SPGU calibration failed.
2501	Power Amp idling calibration failed.
2502	DAC output level calibration failed.
3002	WGFMU initialization failure.
3003	WGFMU FPGA is not configured.
3004	EEPROM CRC data of system timing data is invalid.
3005	EEPROM CRC data of DAC DCM PS data is invalid.
3006	EEPROM CRC data of ADC DCM PS data is invalid.
3007	EEPROM CRC data of DAC clock edge data is invalid.
3008	EEPROM CRC data of ADC clock edge data is invalid.
3009	EEPROM CRC data of DAC level calibration data is invalid.
3010	EEPROM CRC data of ADC level calibration data is invalid.

- 3011** EEPROM CRC data of DAC skew calibration data is invalid.
- 3012** EEPROM CRC data of ADC skew calibration data is invalid.
- 3013** EEPROM CRC data of RSU calibration data is invalid.
- 3014** Invalid EEPROM type.
- 3400** WGF MU module is in TEST FAIL state.
- 3401** Digital H/W function test failed.
- 3402** CPLD access function test failed.
- 3403** FPGA configuration test failed.
- 3404** FPGA1 access function test failed.
- 3405** FPGA2 access function test failed.
- 3406** FPGA1 System Clock DCM function test failed.
- 3407** FPGA1 DAC Clock DCM function test failed.
- 3408** FPGA1 ADC Clock DCM function test failed.
- 3409** FPGA1 Memory Clock DCM function test failed.
- 3410** FPGA2 System Clock DCM function test failed.
- 3411** FPGA2 DAC Clock DCM function test failed.
- 3412** FPGA2 ADC Clock DCM function test failed.
- 3413** FPGA2 Memory Clock DCM function test failed.
- 3414** FPGA1, 2 communication I/F test failed.
- 3415** CONVEND interrupt function test failed.
- 3416** 10 MHz clock test failed.
- 3417** FPGA SYNC SEL pin control function test failed.
- 3418** FPGA SYNC FB pin control function test failed.
- 3419** FPGA SYNC IN pin control function test failed.
- 3420** IDELAY function test failed.
- 3421** Channel 1 SDRAM access function test failed.
- 3422** Channel 2 SDRAM access function test failed.
- 3423** WGF MU EEPROM access function test failed.

Error Message

Keysight B1500 Self-test/Calibration Error

- 3424** Channel 1 RSU EEPROM access function test failed.
- 3425** Channel 2 RSU EEPROM access function test failed.
- 3426** WGF MU EEPROM CRC data is invalid.
- 3427** WGF MU EEPROM CRC data of format revision data is invalid.
- 3428** WGF MU EEPROM CRC data of serial number data is invalid.
- 3429** WGF MU EEPROM CRC data of system timing data is invalid.
- 3430** WGF MU EEPROM CRC data of DAC DCM PS data is invalid.
- 3431** WGF MU EEPROM CRC data of ADC DCM PS data is invalid.
- 3432** WGF MU EEPROM CRC data of DAC clock edge data is invalid.
- 3433** WGF MU EEPROM CRC data of ADC clock edge data is invalid.
- 3434** WGF MU EEPROM CRC data of DAC level calibration data is invalid.
- 3435** WGF MU EEPROM CRC data of ADC level calibration data is invalid.
- 3436** WGF MU EEPROM CRC data of DAC skew calibration data is invalid.
- 3437** WGF MU EEPROM CRC data of ADC skew calibration data is invalid.
- 3438** RSU EEPROM CRC data of format revision data is invalid.
- 3439** RSU EEPROM CRC data of serial number data is invalid.
- 3440** RSU EEPROM CRC data of type id data is invalid.
- 3441** RSU EEPROM CRC data of calibration data is invalid.
- 3450** WGF MU EEPROM data is invalid.
- 3451** WGF MU EEPROM data of RSU type is invalid.
- 3452** WGF MU EEPROM data of RSU cable type is invalid.
- 3460** Main DAC, Main ADC test failed.
- 3461** Bias DAC, Main ADC test failed.
- 3462** Main DAC, Reference ADC test failed.
- 3463** VM function test failed.
- 3464** IM offset test failed.
- 3465** IM short test failed.
- 3480** Invalid frame configuration.

3481	Invalid frame configuration.
3482	Frame has no modules.
3483	PLL not locked in secondary module.
3484	Reference line is not connected.
3485	Sync line is not connected.
3486	Sync Reserve line is not connected.
3487	Interrupt line is not available.
3488	Module service request assertion test failed.
3489	Module service request detection test failed.
3490	Emergency interrupt is not available.
3500	WGFMU calibration failed.
3501	ADC gain calibration failed.
3502	CMR calibration failed.
3503	IM offset calibration failed.
3504	VM offset calibration failed.
3505	VF gain calibration failed.
3506	VF offset calibration failed.
3507	Reference ADC does not exist. Cannot perform WGFMU calibration.
3508	WGFMU, RSU cable length calibration failed.

NOTE

Error codes 4501 to 4701 are for HVSMU.

4501	Digital H/W function test failed.
4502	CPLC access function test failed.
4503	FPGA access function test failed.
4504	SERDES access function test failed.
4505	Bus FPGA JTAG function test failed.
4506	Float FPGA JTAG function test failed.
4507	OPT I/F access function test failed.
4508	Internal temperature test failed.

Error Message

Keysight B1500 Self-test/Calibration Error

4509	ADC access test failed.
4510	EEPROM access function test failed.
4511	Float lost detection test failed.
4512	ADC lost detection test failed.
4513	HVPS control test failed.
4514	ADC control test failed.
4515	DAC switch test failed.
4516	DAC control test failed.
4517	CALBUS control test failed.
4520	V divider gain test failed.
4521	V loop control test failed.
4522	Voltage detector test failed.
4523	Oscillation detector test failed.
4524	I ADC gain test failed.
4525	I loop control test failed.
4526	I range change test failed.
4527	HVPS force test failed.
4528	Over current detector test failed.
4529	Guard abuse detector test failed.
4601	VFVM calibration failed.
4602	EEPROM CRC data of VFVM adjust is invalid.
4603	Non-feedback mode offset calibration failed.
4604	Calculation of VM correction data failed.
4605	Calculation of VF correction data failed.
4611	IFIM calibration failed.
4612	EEPROM CRC data of IFIM adjust is invalid.
4613	IFIM offset measurement failed.
4614	IFIM gain measurement by Ref ADC failed.

- 4615** IFIM gain measurement by I ADC failed.
- 4616** Calculation of IM correction data failed.
- 4617** Calculation of IF correction data failed.
- 4701** Non-feedback offset adjustment is failed.

NOTE

Error codes 5501 to 5701 are for HCSMU.

- 5501** Digital H/W function test failed.
- 5502** CPLC access function test failed.
- 5503** FPGA access function test failed.
- 5505** Bus FPGA JTAG function test failed.
- 5506** Float FPGA JTAG function test failed.
- 5507** OPT I/F access function test failed.
- 5509** ADC access test failed.
- 5510** EEPROM access function test failed.
- 5513** Power AMP bias test is failed.
- 5551** V offset self-test is failed.
- 5552** V sense self-test is failed.
- 5553** HS VADC self-test is failed.
- 5554** V CMR DAC self-test is failed.
- 5555** I offset self-test is failed.
- 5556** V loop self-test is failed.
- 5557** I sense low self-test is failed.
- 5558** HS IADC self-test is failed.
- 5559** I CMR DAC self-test is failed.
- 5560** I sense high self-test is failed.
- 5561** Power supply test is failed.
- 5562** V switch test is failed.
- 5563** High force output relay test is failed.
- 5564** High sense output relay test is failed.

Error Message
Keysight B1500 Self-test/Calibration Error

- 5601** VM offset calibration is failed.
- 5602** V CMR DAC calibration is failed.
- 5603** VM gain calibration is failed.
- 5604** IM offset calibration is failed.
- 5605** I CMR DAC calibration is failed.
- 5606** Iad gain calibration is failed.
- 5701** Power AMP bias adjustment is failed.

NOTE

Error codes 6501 to 6606 are for MCSMU.

- 6501** Digital H/W function test failed.
- 6502** CPLC access function test failed.
- 6503** FPGA access function test failed.
- 6505** Bus FPGA JTAG function test failed.
- 6506** Float FPGA JTAG function test failed.
- 6507** OPT I/F access function test failed.
- 6509** ADC access test failed.
- 6510** EEPROM access function test failed.
- 6551** V offset self-test is failed.
- 6552** V sense self-test is failed.
- 6553** HS VADC self-test is failed.
- 6554** V CMR DAC self-test is failed.
- 6555** I offset self-test is failed.
- 6556** V loop self-test is failed.
- 6557** I sense low self-test is failed.
- 6558** HS IADC self-test is failed.
- 6559** I CMR DAC self-test is failed.
- 6560** I sense high self-test is failed.
- 6562** V switch test is failed.
- 6563** High force output relay test is failed.

6564	High sense output relay test is failed.
6601	VM offset calibration is failed.
6602	V CMR DAC calibration is failed.
6603	VM gain calibration is failed.
6604	IM offset calibration is failed.
6605	I CMR DAC calibration is failed.
6606	Iad gain calibration is failed.
N760	SMU failed function test.
N761	SMU failed VF/VM function test.
N762	SMU failed IF/IM function test.
N763	SMU failed loop status test.
N764	SMU failed temperature sensor test.
N765	SMU failed CMR amplifier calibration.
N766	SMU failed CMR amplifier adjustment.
N767	SMU failed CMR 100 V range full output test.
N768	SMU failed VF/VM calibration.
N769	SMU failed VM offset calibration.
N770	SMU failed VM gain calibration.
N771	SMU failed VF offset calibration.
N772	SMU failed VF gain calibration.
N773	SMU failed VF gain calibration at 20 V range.
N774	SMU failed VF filter offset calibration.
N775	SMU failed H-SPEED ADC self-calibration.
N776	SMU failed H-SPEED ADC VM offset calibration.
N777	SMU failed H-SPEED ADC VM gain calibration.
N778	SMU failed IF/IM calibration.
N779	SMU failed calibration bus test.
N780	SMU failed IM offset calibration.

Error Message
Keysight B1500 Self-test/Calibration Error

N781	SMU failed IM gain calibration.
N782	SMU failed IF offset calibration.
N783	SMU failed IF gain calibration.
N784	SMU failed IDAC filter offset calibration.
N785	SMU failed oscillation detector test.
N786	SMU failed I bias test.
N787	SMU failed common mode rejection test.
N789	SMU failed high voltage detector test.
N790	SMU failed zero voltage detector test.
N791	SMU failed V hold test.
N792	SMU failed V switch test.
N800	CMU failed NULL DC offset adjustment.
N801	CMU failed NULL DC offset measurement.
N802	CMU failed VRD DC offset adjustment.
N803	CMU failed VRD heterodyne offset adjustment.
N804	CMU failed NULL gain/phase adjustment.
N805	CMU failed MODEM offset adjustment.
N806	CMU failed relative Z adjustment.
N807	CMU failed Vch full scale measurement.
N808	CMU failed nominal gain measurement
N809	CMU failed extent range X3 adjustment.
N810	CMU failed range resistor 50ohm adjustment.
N811	CMU failed range resistor 1kohm adjustment.
N812	CMU failed range resistor 10kohm adjustment.
N813	CMU failed range resistor 100kohm adjustment.
N814	CMU failed relative Z calculation.
N820	CMU failed correction.
N830	CMU failed configuration test.

- N831** SCUU failed SCUU configuration test.
- N832** SCUU failed SMU configuration test.
- N833** SCUU failed CMU configuration test.
- N834** CMU failed digital function test.
- N835** CMU failed CPLD test.
- N836** CMU failed FPGA test.
- N837** CMU failed EEPROM test.
- N838** CMU failed PLL1/PLL2 test.
- N839** CMU failed PLL DET low state test.
- N840** CMU failed PLL DET high state test.
- N841** CMU failed PLL1 lock test
- N842** CMU failed PLL2 lock test.
- N843** CMU failed PLL2 lock test.
- N844** CMU failed Hcur DC and VRD ADC test.
- N845** CMU failed DC offset test.
- N846** CMU failed DC bias 0V test.
- N847** CMU failed DC bias -25V test.
- N848** CMU failed DC bias +25V test.
- N849** CMU failed PLL0 test.
- N850** CMU failed PLL0 lock test.
- N851** CMU failed PLL0 lock test.
- N852** CMU failed DDS test.
- N853** CMU failed DDS1 test.
- N854** CMU failed DDS2 test.
- N855** CMU failed VRD normalizer test.
- N856** CMU failed RA1 test.
- N857** CMU failed RA2 test.
- N858** CMU failed ExR test.

Error Message

Keysight B1500 Self-test/Calibration Error

N859	CMU failed R_LPF2 f1 test.
N860	CMU failed MODEM DAC test.
N861	CMU failed N_II_DAC test.
N862	CMU failed N_QI_DAC test.
N863	CMU failed N_IQ_DAC test.
N864	CMU failed N_QQ_DAC test.
N865	CMU failed TRD normalizer test.
N866	CMU failed NA1 test.
N867	CMU failed NA2 test.
N868	CMU failed NA3 test.
N869	CMU failed N_LPF1 f2 test.
N870	CMU failed N_LPF1 f3 test.
N871	CMU failed N_LPF1 f4 test.
N872	CMU failed N_LPF1 f5 test.
N873	SCUU failed EEPROM test.
N874	SCUU failed output relay test.
N875	SCUU failed control test.
N876	SCUU failed CG2 test.
N877	SCUU failed LRL test.
N880	CMU failed Hcur AC and VRD Fm test.
N881	CMU failed SA/RA 32mV test.
N882	CMU failed SA/RA 64mV test.
N883	CMU failed SA/RA 125mV test.
N884	CMU failed SA/RA 250mV test.
N885	CMU failed ExR test.
N886	CMU failed Bias_chg test.
N887	CMU failed R_LPF2/R_HPFB_vs test.
N888	CMU failed VRD IF test.

- N889** CMU failed IRM local 0deg test.
- N890** CMU failed IRM local 90deg test.
- N891** CMU failed S_LPF1 f1 120kHz test.
- N892** CMU failed S_LPF1 f2 500kHz test.
- N893** CMU failed S_LPF1 f3 2MHz test.
- N894** CMU failed S_LPF1 f4 5MHz test.
- N895** CMU failed TRD MODEM test.
- N896** CMU failed VG local 90deg test.
- N897** CMU failed VG local 0deg test.
- N898** CMU failed NA4 test.
- N899** CMU failed NA5 X1/4 test.
- N900** CMU failed NA5 X1/8 test.
- N901** CMU failed N_LPF2 f2 500kHz test.
- N902** CMU failed N_LPF2 f3 5MHz test.
- N903** CMU failed MODEM PSD test.
- N904** CMU failed PSD 0deg test.
- N905** CMU failed PSD 90deg test.
- N906** CMU failed Rr/Rf 100ohm test.
- N907** CMU failed Rr/Rf 1kohm test.
- N908** CMU failed Rr/Rf 10kohm test.
- N909** CMU failed Rr/Rf 100kohm test.
- N910** CMU failed TRD IVamp test.
- N911** CMU failed N_HPF1/N_LPF1 10kHz test.
- N912** CMU failed N_HPF1/N_LPF1 200kHz test.
- N913** CMU failed N_HPF1/N_LPF1 1MHz test.
- N914** CMU failed N_HPF1/N_LPF1 2MHz test.
- N915** CMU failed N_HPF1/N_LPF1 5MHz test.
- N916** CMU failed NA1 test.

Error Message

Keysight B1500 Self-test/Calibration Error

N917	CMU failed NA2 test.
N918	CMU failed NA3 test.
N919	CMU failed IV saturation detector test.
N920	CMU failed normal status test.
N921	CMU failed normal status test.
N922	CMU failed IV saturation status test.
N923	CMU failed IV saturation status test.
N924	CMU failed unbalance detector test.
N925	CMU failed normal status test.
N926	CMU failed normal status test.
N927	CMU failed unbalance status test.
N928	CMU failed unbalance status test.
N929	CMU failed over current detector test.
N930	CMU failed normal status test.
N931	CMU failed normal status test.
N932	CMU failed over current status test.
N933	CMU failed over current status test.

Setup File Converter Execution Error

- #01** Maximum length for the file path is 256 characters.
- #02** fopen failure. Could not open source file.
- #03** Specify a proper source file. The specified file is unsupported.
- #04** Specify a proper source file. The specified file is corrupt.
- #05** fopen failure. Could not open destination file.

MDM File Converter Execution Error

Error message:

- 10001** Reading XTR file was aborted.
Conversion was aborted because of XTR file read error.
- 10002** Reading ZTR file was aborted.
Conversion was aborted because of ZTR file read error.
- 10003** Writing MDM file was aborted.
Conversion was aborted because of MDM file write error.
- 10004** Writing log file was aborted.
Conversion was aborted because of log file write error.
- 10005** Invalid command option: *A*.
Specify the effective option. The option *A* is not valid.
- 10006** Invalid XTR or ZTR file: *A*.
Specify a proper XTR/ZTR file. The file *A* may be defective.

Warning message:

- 20001** Invalid element: *A*. Could not complete the conversion.
Cannot convert the data of the improper element *A*.
- 20002** Unsupported classic test: *A*.
Cannot convert the data of the classic test *A* other than I/V Sweep, Multi Channel I/V Sweep, or C-V Sweep.
- 20003** Application test result data is not supported: *A*.
Cannot convert the application test result data.
- 20004** Could not convert test setup using different V/I mode for VAR1 channels.
Cannot convert the test result data including the setup using different V/I mode for VAR1 channels in Multi Channel I/V Sweep classic test.
- 20005** Unsupported impedance model: *A*.
Cannot convert the data of the impedance model *A*.

- 20006** Invalid value for the element: *A*. Maximum limit is *B*.
The value of the element *A* must not exceed *B*.
- 20007** Could not calculate the number of data for log sweep. Start: *A*, Stop: *B*.
Cannot calculate the number of data for log sweep. Start and stop values must be a non-zero value. Start value: *A*. Stop value: *B*.
- 20008** Unknown parameter: *A*, Value: *B*.
Data contains the unknown parameter *A*. The value is *B*.
- 20009** The element: *A* is not found in the search target: *B*.
- 20010** Invalid character: *A*. Could not convert to integer.
Data contains the character *A* which cannot be converted to integer.
- 20011** Invalid character: *A*. Could not convert to double.
Data contains the character *A* which cannot be converted to double.
- 20012** Invalid Unit: *A*. IC-CAP does not support this Unit.
- 20013** Log sweep stop value *A* was adjusted automatically.
- 20014** Could not convert test setup using multiple log sweep sources.
Cannot convert the test result data including the setup using multiple log sweep sources.

Error Message
MDM File Converter Execution Error

This appendix shows useful reference information for the use of the EasyEXPERT.

- “EasyEXPERT Measurement Capabilities v.s. Instruments”
- “EasyEXPERT File Summary”

EasyEXPERT Measurement Capabilities v.s. Instruments

Table A-1 shows the EasyEXPERT measurement capabilities supported by the instruments. The revision number in this table shows the first revision supporting the function.

Table A-1 EasyEXPERT Measurement Capabilities Supported by Instruments

		Advance Device Analyzer		Precision IV Analyzer		Economic IV Analyzer	Dis-continued
		B1500A	B1505A	E5270B	E5260A E5262A E5263A	B2900 Series SMU	4155B/C 4156B/C
Classic Test	I/V Sweep	Rev. 1.0	Rev. 4.0	Rev. 6.0	Rev. 6.0	Rev. 6.1	Rev. 3.0 ^a
	Multi-ch I/V Sweep	Rev. 3.0	Rev. 4.0	Rev. 6.0	Rev. 6.0	Rev. 6.1	-
	I/V List Sweep	Rev. 3.0	Rev. 4.0	Rev. 6.0	Rev. 6.0	Rev. 6.1	-
	I/V-t Sampling	Rev. 1.0	Rev. 4.0	-	-	Rev. 6.1	Rev. 3.1
	C-V Sweep	Rev. 1.0	Rev. 4.0	-	-	-	-
	SPGU Control	Rev. 3.1	-	-	-	-	-
	GUI based switching matrix control ^b	Rev. 2.0	-	Rev. 6.0	Rev. 6.0	Rev. 6.1	Rev. 3.0
	Direct Control	Rev. 3.0	Rev. 4.0	-	-	-	-
Application Test		Rev. 1.0	Rev. 4.0	Rev. 6.0	Rev. 6.0	Rev. 6.1	Rev. 3.0
Tracer Test		Rev. 4.0 (DC/Pulse)	Rev. 4.0 (DC/Pulse)	Rev. 6.1 (DC)	Rev. 6.1 (DC)	Rev. 6.1 (DC/Pulse)	-
Quick Test		Rev. 2.0	Rev. 4.0	Rev. 6.0	Rev. 6.0	Rev. 6.1	Rev. 3.0

EasyEXPERT Measurement Capabilities v.s. Instruments

		Advance Device Analyzer		Precision IV Analyzer		Economic IV Analyzer	Dis-continued
		B1500A	B1505A	E5270B	E5260A E5262A E5263A	B2900 Series SMU	4155B/C 4156B/C
Oscilloscope View ^c		Rev. 5.5	Rev. 5.0	-	-	-	-
External Instrument Driver Support	LCR Meter ^d	Rev. 3.1	Rev. 4.0	Rev. 6.0	Rev. 6.0	Rev. 6.1	Rev. 3.0
	Pulse Generator ^e	Rev. 1.0	Rev. 4.0	Rev. 6.0	Rev. 6.0	Rev. 6.1	Rev. 3.0
	DVM ^f	Rev. 1.0	Rev. 4.0	Rev. 6.0	Rev. 6.0	Rev. 6.1	Rev. 3.0
Prober Control in Quick Test Mode ^g		Rev. 2.0	Rev. 4.0	Rev. 6.0	Rev. 6.0	Rev. 6.1	Rev. 3.0
Firmware Requirement		A.04.00 ^h	A.04.00 ^h	B.01.10	B.01.10	1.0	HOSTC: 03.08 SMUC: 04.08

- a. PGU and VSU/VMU are supported. Differential voltage measurement of VMU is not supported.
- b. Keysight B2200/01A and E5250A/E5252A are supported.
- c. Only available for supported modules.
- d. Keysight 4284A/E4980A
- e. Keysight 8110A/81110A/81150A/81160A
- f. Keysight 3458A
- g. Cascade Microtech Summit 12000/S300 (Nucleus), Cascade Microtech (Suss MicroTec) PA200/PA300, and Vector Semiconductor VX-2000/VX-3000
- h. The latest FW revision is strongly recommended to take full advantage of measurement capabilities.

EasyEXPERT File Summary

Table A-2 shows the summary of files regarding the EasyEXPERT software.

Table A-2 EasyEXPERT Files

Suffix	Attribute	Description	To make it	To read it
.gtr	EasyEXPERT Compressed Trace Record	Includes the measurement traces recorded by the automatic trace record function in the tracer test mode.	Click the Save button in the Replay traces dialog box that is opened by clicking the Replay traces button.	Click the Open button in the Replay traces dialog box that is opened by clicking the Replay traces button.
.xdb	EasyEXPERT Database	Includes the EasyEXPERT database (backup).	Click Options > EasyEXPERT Database > Backup EasyEXPERT Database in the Start EasyEXPERT window.	Click Options > EasyEXPERT Database > Restore EasyEXPERT Database in the Start EasyEXPERT window.
.xpg	EasyEXPERT My Favorite Setup Group	Includes the My Favorite Setup (Preset) Group and setup data as its elements.	Click My Favorite > Export.	Click My Favorite > Import.
.xtd	EasyEXPERT Test Definition	Includes the test definition of the application test.	Click Library > New (or Export) in the application test mode.	Click Library > Open (or Import) in the application test mode.
.xtr	EasyEXPERT Test Results	Includes sets of setup data and test result data.	Click Result > Export > As Test Result.	Click Result > Import.

EasyEXPERT File Summary

Suffix	Attribute	Description	To make it	To read it
.xts	EasyEXPERT Test Setup	Includes setup data for Application Test/Classic Test/Tracer Test.	Click File > Export > Test Setup.	Click File > Import > Test Setup.
.xws	EasyEXPERT Workspace	Includes the EasyEXPERT workspace (backup).	Specify a new workspace in the workspace configurator during EasyEXPERT starting up.	Select the workspace in the workspace configurator during EasyEXPERT starting up.
.ztr	EasyEXPERT Compressed Test Results	Includes sets of compressed setup data and test result data.	Click Results > Export > As Compressed Test Result.	Click Results > Import.

This information is subject to change without notice.

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