Service Guide

Agilent B1500A Semiconductor Device Analyzer

Edition 2

Agilent Technologies

Agilent Part Number: B1500-90902
December 2007

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To the extent allowed by local law, the remedies in this warranty statement are customer's sole and exclusive remedies. Except as indicated above, in no event will Agilent Technologies or its suppliers be liable for loss of data or for direct, special, incidental, consequential (including lost profit or data), or other damage, whether based in contract, tort, or otherwise.

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Assistance

Product maintenance agreements and other customer assistance agreements are available for Agilent Technologies products.

For any assistance, contact your nearest Agilent Technologies Sales Office.

Certification

Agilent Technologies certifies that this product met its published specifications at the time of shipment [from the factory]. Agilent Technologies further certifies that its calibration measurements are traceable to the National Institute of Standard Technology (NIST), to the extent allowed by the Institute's calibration facility, and to the calibration facilities of other International Standards Organization members.

Printing History

New editions are complete revisions of the manual. Update packages, which are issued between editions, contain additional and replacement pages to be merged into the manual by the customer. The dates on the title page change only when a new edition is published. No information is incorporated into a reprinting unless it appears as a prior update; the edition does not change when an update is incorporated.

The software revision code printed before the date indicates the version level of the software product at the time the manual or update was issued. Many product updates and fixes do not require manual changes and, conversely, manual corrections may be done without accompanying product changes. Therefore, do not expect a one to one correspondence between product updates and manual updates.

Edition 1	September 2005
Edition 2	December 2007

Safety Summary

The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or with specific warnings elsewhere in this manual may impair the protections provided by the equipment. In addition, it violates safety standards of design, manufacture, and intended use of the instrument. Agilent Technologies, Inc. assumes no liability for customer's failure to comply with these requirements.

GROUND THE INSTRUMENT

To minimize shock hazard, the instrument chassis and cabinet must be connected to an electrical ground. The power terminal and the power cable must meet International Electrotechnical Commission (IEC) safety standards.

DO NOT OPERATE IN AN EXPLOSIVE ATMOSPHERE

Do not operate the instrument in the presence of flammable gases or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.

KEEP AWAY FROM LIVE CIRCUITS

Operation personnel must not remove instrument covers. Component replacement and internal adjustments must be made by qualified maintenance personnel. Do not replace components with power cable connected. Under certain conditions, dangerous voltages may exist even with the power cable removed. To avoid injuries, always disconnect power and discharge circuits before touching them.

DO NOT SERVICE OR ADJUST ALONE

Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.

DO NOT SUBSTITUTE PARTS OR MODIFY INSTRUMENT

Because of the danger of introducing additional hazards, do not install substitute parts or perform any unauthorized modification to the instrument. Return the instrument to a Agilent Technologies Sales and Service Office for services and repair to ensure that safety features are maintained.

DANGEROUS PROCEDURE WARNINGS

Warnings, such as in the example below, precede potentially dangerous procedures throughout this manual. Instructions contained in the warnings must be followed.

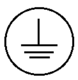
WARNING **Dangerous voltages, capable of causing death, are present in this instrument. Use extreme caution when handling, testing, and adjusting.**

Safety Symbols

The general definitions of safety symbols used on equipment or in manuals are listed below.

Instruction manual symbol: the product will be marked with this symbol when it is necessary for the user to refer to the instruction manual in order to protect against damage to the instrument.

Indicates dangerous voltage and potential for electrical shock. Do not touch terminals that have this symbol when instrument is on.



Protective conductor terminal.

It is intended for connection to an external protective conductor for protection against electric shock in case of a fault or the terminal of a protective earth electrode.

Frame or chassis terminal. A connection to the frame (chassis) of the equipment which normally includes all exposed metal structures.

~ Alternating current.

⎓ Direct current.

Electrical shock.

| ON (Supply).

○ OFF (Supply).

WARNING	The warning sign denotes a hazard. It calls attention to a procedure, practice, condition or the like, which, if not correctly performed or adhered to, could result in injury or death to personnel.
CAUTION	The caution sign denotes a hazard. It calls attention to an operating procedure, practice, condition or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the product.
NOTE	The note sign denotes important information. It calls attention to a procedure, practice, condition or the like, which is essential to highlight.

Preface

Contents

WARNING **The information in this manual is provided for use by service trained personnel only. To avoid electrical shock, do not perform any procedures in this manual, unless you are qualified to do so.**

This manual contains information relating to the calibration and repair of the Agilent B1500A Semiconductor Device Analyzer. The manual consists of the following chapters:

Chapter 1 , “Overview” provides the product overview for the B1500A mainframe, the accessories, and the calibration kit.

Chapter 2 , “Software Installation, Updates, and Hardware Upgrades” provides how to install, recover, and upgrade the B1500A software, and how to upgrade the B1500A hardware.

Chapter 3 , “Calibration” provides the information and instructions for the calibration.

Chapter 4 , “Troubleshooting” provides the B1500A troubleshooting procedures and the reference information.

Chapter 5 , “Replacement Procedure” provides the assemblies replacement procedures.

Chapter 6 , “Replaceable Parts” provides the replaceable parts information for the B1500A and its accessories.

Appendix A , “Error Codes,” contains the meaning of the error codes.

Other Manuals

See the following user's manuals for more detailed information on the above topics, user operation, and programming.

User's Guide (part number B1500-90005)

Programming Guide (part number B1500-90013)

VXIplug&play Driver User's Guide (part number B1500-90022)

The following manuals contain service information for the Agilent 16440A, Agilent 16441A, and Agilent 16442A.

Agilent 16440A SMU/Pulse Generator Selector User's Guide (part number 16440-90004)

Agilent 16441A R-Box User's Guide (part number 16441-90004)

Agilent 16442A Test Fixture User's Guide (part number 16442-90004)

Contents

Contents

Product Overview

This section provides the product overview for the mainframe, the accessories, and the calibration toolkit.

Mainframe

The Agilent B1500A Semiconductor Device Analyzer is the new generation one box solution for the semiconductor device DC/AC parametric measurement and analysis application. You can perform measurement and analysis easily and effectively on the Microsoft Windows environment with intuitive graphical user interface, touch screen LCD panel, keyboard, and mouse by using the Agilent B1500A.

The Agilent B1500A provides the DC voltage/current output capability, the DC voltage/current measurement capability, and the AC signal output and impedance measurement capability. So you can perform the current-voltage sweep measurement and the capacitance-voltage sweep measurement for example by one instrument. You can also analyze the measurement result characteristics graph by using several tools such as markers, cursors, and lines.

Also, in the GPIB remote control mode, you can control the B1500A from an external computer by using the Agilent FLEX command set that is the common language for the Agilent semiconductor DC measurement instruments. So you can reuse the measurement program created for the Agilent 4155/4156/E5260/E5270.

- Agilent B1500A Semiconductor Device Analyzer

  Mainframe that provides the ground unit (GNDU) and ten empty slots for the measurement facilities, and the Agilent EasyEXPERT software for the operating environment. The EasyEXPERT is the GUI based measurement control and analysis software runs on the Microsoft Windows XP Professional.

  The B1500A is equipped with the 15 inch LCD with touch panel, hard disk drive, DVD-ROM/CD-ROM/CD-RW drive, and USB/LAN/GP-IB interfaces. The USB keyboard, the USB mouse, and the stylus pen are available as option.

- Agilent B1510A HPSMU module

  High power source/monitor unit module for the B1500A. Occupies two slots.

- Agilent B1511A MPSMU module

  Medium power source/monitor unit module for the B1500A. Occupies one slot.

- Agilent B1517A HRSMU module

  High resolution source/monitor unit module for the B1500A. Occupies one slot. Needs Agilent E5288A ASU to perform atto level current measurement.

- Agilent B1520A MFCMU module

  Multi frequency capacitance measurement unit module for the B1500A. Occupies one slot. Needs Agilent N1301A-100 SCUU to switch the CMU/SMU connection automatically or to use the Agilent N1301A-100 GSWU.

- Agilent B1525A HV-SPGU module

  High voltage semiconductor pulse generator unit module for the B1500A. Occupies one slot.

- Agilent N1301A-100 SCUU

  SMU CMU unify unit (SCUU). Used to switch the CMU/SMU connection to the DUT interface. Attach or connect to the CMU and two SMUs, MPSMU and/or HRSMU).

- Agilent N1301A-200 GSWU

  Guard switch unit (GSWU). Used to connect the guard lines between CMU high and low near the DUT. The GSWU must be connected to the SCUU and the guard lines of the DUT interface. Effective for the accurate impedance measurements.

- Agilent E5288A ASU

  Atto sense and switch unit (ASU). Used to enable the 1 pA range for the atto level current measurement, also switch the SMU/AUX connection to the DUT interface. Available for the HRSMU.

Agilent EasyEXPERT Software

Agilent EasyEXPERT software is a specially-designed Windows XP application program for controlling the Agilent B1500A. The EasyEXPERT provides the easy and effective measurement and analysis environment with intuitive graphical user interface (GUI), touch screen LCD panel, keyboard, and mouse.

The EasyEXPERT has the following two measurement execution environments.

- Application test mode

  The EasyEXPERT contains more than one hundred test definitions as the application library for CMOS devices, BJT, TFT, diode, resistor, capacitor, varactor, memory, and so on. The test definitions are the template for making your measurement setup. And the all test definitions are just sample.

  You can perform measurements by choosing the best one for your device under test (DUT) from the application libraries, and modifying and executing it. Modification is really simple. For example, it will be completed by changing the output voltage only to DUT terminals. And the application library with your modifications can be saved and recalled as your favorite setup.

- Classic test mode

  You can perform measurements by using the user interface similar to the semiconductor parameter analyzers such as the Agilent 4156C. The setup can be made by entering values into the setup tables used for controlling the measurement modules. And the setup can be saved and recalled as your favorite one. The I-V, C-V, and sampling measurement modes are supported.

The EasyEXPERT also provides the other functions. Some of the functions are listed below.

- Data graph/list display
- Data analysis with markers, cursors, and lines; and auto analysis
- Application library development environment
- Measurement/setup data management by workspace
- Data output by CSV/XML format and graph output by EMF/BMP/GIF/PNG format
- Data import/export capability
- Maintenance; self-test and self-calibration

Accessories and Options

The Agilent B1500A is furnished with the following accessories.

- Power Cable, 1 ea.
- Manual CD-ROM, 1 ea.

Table 1-1 lists the options and the available accessories for the Agilent B1500A.

Table 1-1 Options and accessories

Model Number	Option Item	Description
B1500A		Semiconductor Device Analyzer
	B1500A-050	50 Hz power line frequency
	B1500A-060	60 Hz power line frequency
	B1500A-A6J	ANSI Z540 compliant calibration
	B1500A-UK6	Commercial cal. certificate w/ test data
	B1500A-ABA	Paper manual set, English
	B1500A-ABJ	Paper manual set, Japanese
B1510A		High Power Source/Monitor Unit module (HPSMU)
B1511A		Medium Power Source/Monitor Unit module (MPSMU)
B1517A		High Resolution Source/Monitor Unit module (HRSMU)
B1520A		Multi Frequency Capacitance Measurement Unit module (MFCMU)
B1525A		High Voltage Semiconductor Pulse Generator Unit module (HV-SPGU)

Table 1-1 Options and accessories

Model Number	Option Item	Description
B1540A		Agilent EasyEXPERT software with application libraries
	B1540A-001	EasyEXPERT software with general application libraries
E5288A		Atto Sense and Switch Unit (ASU)
	E5288A-001	Add triaxial and D-sub cables, 1.5 m
	E5288A-002	Add triaxial and D-sub cables, 3 m
N1253A		Digital I/O accessories
	N1253A-100	Digital I/O T-cable
	N1253A-200	Digital I/O BNC Box
N1254A		Accessories
	N1254A-100	GNDU to Kelvin Adapter
	N1254A-107	Triax(m)-Triax(f) Adapter
	N1254A-108	ASU Magnetic Stand
N1300A		CMU cable
	N1300A-001	1.5 m length
	N1300A-002	3 m length
N1301A		CMU accessories
	N1301A-100	SMU CMU Unify Unit (SCUU)
	N1301A-102	SCUU cable, 3 m
	N1301A-110	SCUU magnetic stand
	N1301A-200	Guard Switch Unit (GSWU)
	N1301A-201	GSWU cable, 1.5 m
	N1301A-202	GSWU cable, 3 m
16435A		Interlock cable adapter (B1500 type to BNC)

Table 1-1 Options and accessories

Model Number	Option Item	Description
16442B		Test fixture
	16442B-010	Add triaxial cables, 1.5 m, 4 ea.
	16442B-011	Add triaxial cables, 3 m, 4 ea.
	16442B-800	Extra blank teflon board
	16442B-801	Universal socket module, 0.1 inch pitch, with 10 pins
	16442B-802	Universal socket module, 0.075 inch pitch, with 10 pins
	16442B-803	Universal socket module, 0.05 inch pitch, with 10 pins
	16442B-810	Extra pin set (for universal socket module, 10 pins.)
	16442B-811	Extra wire set (mini banana to pin plug, 6 ea.)
	16442B-812	Extra wire set (pin plug to pin plug, 6 ea.)
	16442B-813	Extra wire set (mini banana to mini clip, 6 ea.)
	16442B-814	Extra wire set (mini banana to mini banana, 6 ea.)
	16442B-821	Socket module, 4-pin TO package
	16442B-822	Socket module, 18-pin DIP package
	16442B-823	Extra socket module, 28-pin DIP package
	16442B-890	Extra accessory case
16444A		B1500 accessories
	16444A-001	USB keyboard
	16444A-002	USB mouse
	16444A-003	Stylus pen
16445A		SMU/PGU Selector Connection Adapter
	16445A-001	Control Cable for B1500A to 16440A (1.5 m)
	16445A-002	Control Cable for B1500A to 16440A (3.0 m)
16493G		Digital I/O connection cable
	16493G-001	1.5 m length
	16493G-002	3 m length

Table 1-1 Options and accessories

Model Number	Option Item	Description
16493J		Interlock cable
	16493J-001	1.5 m length
	16493J-002	3 m length
	16493J-003	5 m length
16493K		Kelvin triaxial cable (B1500 to B1500)
	16493K-001	1.5 m length
	16493K-002	3 m length
16493L		GNDU cable
	16493L-001	1.5 m length
	16493L-002	3 m length
	16493L-003	5 m length
16493M		Triaxial and D-sub cables for ASU
	16493M-001	1.5 m length
	16493M-002	3 m length
16493N		GNDU cable for B2200 Kelvin input
	16493N-001	2 m length
16493P		SPGU cable (SMA-BNC)
	16493P-001	1.5 m length
	16493P-002	3 m length
16493Q		SPGU synchronous cable
	16493Q-001	8 cm length
16494A		Triaxial cable
	16494A-001	1.5 m length
	16494A-002	3 m length
	16494A-003	80 cm length
	16494A-004	40 cm length
	16494A-005	4 m length

Table 1-1 Options and accessories

Model Number	Option Item	Description
16494B		Kelvin triaxial cable (B1500 to E5250)
	16494B-001	1.5 m length
	16494B-002	3 m length
	16494B-003	80 cm length
16495F		Connector plate w/ 12× triax., Interlock, GNDU
	16495F-001	Bulkhead feedthrough connectors (female to female)
	16495F-002	Connectors to contacts for soldering
16495G		Connector plate w/ 24× triax., Interlock, GNDU
	16495G-001	Bulkhead feedthrough connectors (female to female)
	16495G-002	Connectors to contacts for soldering
16495H		Connector plate w/ 6× triax., 6× coax., Interlock, GNDU
	16495H-001	Bulkhead feedthrough connectors (female to female)
	16495H-002	Connectors to contacts for soldering
16495J		Connector plate w/ 8× triax., 4× coax., Interlock, GNDU
	16495J-001	Bulkhead feedthrough connectors (female to female)
	16495J-002	Connectors to contacts for soldering
16495K		Connector plate with universal cable holder
	16495K-001	Connector plate with rubber holder

Calibration tool kit

The Agilent B1549A is a calibration tool kit for the B1500A, and consists of calibration software, cables, adapters, and operation guide. The contents are listed in Table 1-2. Table 1-3 shows the required equipment and Table 1-4 shows the required tools.

Table 1-2 B1549A contents

Product number/ part number	Description	Quantity
04142-61641	Triaxial cable, 1 m	1
04155-60007	Module extractor	1
04155-61614	Interlock cable	1
04155-61648	Mini pin plug to banana plug cable	1
04155-65041	Calibration adapter	1
04155-65042	Shorting box for calibration adapter	1
04155-65043	Interlock test adapter	1
1250-0929	BNC shorting cap	1
11058A	Banana plug to banana plug cable[a]	1
E5299-65001	Low current calibration adapter	1
04294-61001	100 ohm Resistor	1
04294-61002	4TP to BNC Interface Box	1
8120-1839	BNC(m)-BNC(m) Cable, 61cm	1
1251-2277	Dual Banana-BNC(f) Adaptor	1
1251-0077	N(m)-BNC(m) Adaptor	1
1250-0080	BNC(f)-BNC(f) Adaptor	4
B1500-65001	Capacitor Holder	1
B1549-16004	B1500A PV software	1

a. The 11058A consists of red and black banana plug to banana plug cables.

Table 1-3 Required equipment for calibration

Product number/ part number	Description	Quantity
53131A	Frequency Counter	1
3458A	Digital multimeter	1
E4418A/B or E4419A/B	Power meter	1
8482A	Power sensor	1
16380A	Standard capacitor	1
16380C	Standard capacitor	1
42030A	Standard resistor	1
42090A	4TP open termination	1
42091A	4TP short termination	1
N1300A-001	Test leads 1.5-meter	1
N1300A-002	Test leads 3.0-meter	1
16353A	Standard resistor set	1
16353H	100 Gohm standard resistor	1
86100C[a]	Infinium DCA oscilloscope mainframe	1
86112A	Dual 20 GHz electrical channel plug-in	1
8493C	Coaxial fixed attenuator, dc to 26.5 GHz	1
option 020	20 dB attenuator	1
option 030	30 dB attenuator	1
E3190-61611	BNC-to-SMA cable assembly, 2m	1
N9158-61604	SMA-SMA cable assembly, 2 m	2
04192-61002	50 Ω Feedthru	1
8710-1582	5 lb-in torque wrench	1
B1549A	Calibration tool set for B1500A series	1

Table 1-3 Required equipment for calibration

Product number/ part number	Description	Quantity
–	PC as a controller: CPU: Intel® Pentium® or compatible processor 300 MHz or higher clock speed Memory: 128 Mbyte Hard disk: 20 Mbyte free space OS: Microsoft® Windows® NT 4.0, 2000, or XP GPIB card: Agilent 82350A PCI GPIB interface card, Agilent 82357A USB-GPIB interface card, National Instruments® PCI-GPIB interface card, or other GPIB interface cards that are supported by VISA.	1

a. You can also use the 86100A or 86100B instead of the 86100C.

NOTE The Agilent 53131A, Agilent 3458A, Agilent 4418A/4418B/4419A/4419B, Agilent 8482A, Agilent 16380A, Agilent 16380C, Agilent 42030A, Agilent 16353A, Agilent 16353H, and Agilent 86100C with 86112A should be calibrated by an instrument traceable to the National Institute of Standards and Technologies (NIST) or an equivalent standard; or calibrated directly by an authorized calibration organization such as NIST. The calibration cycle should be in accordance with the stability specifications of each component.

Table 1-4 Required equipment for troubleshooting and repair

Part number	Description	Quantity
N/A	Torx® screwdriver (No. 25)	1
N/A	Hex wrenches	1
N/A	Nut drivers or spanners	1
N/A	Flat-tip screwdrivers	1
N/A	Pozidrive screwdrivers	1
N/A	Torque driver (8kgf.cm)	1
N/A	Torque driver (9kgf.cm)	1
04155-60007	Module extractor	1
8710-1582	5 lb-in torque wrench	1

NOTE Calibration equipment is also needed for troubleshooting.

Service Overview

This section provides the service overview information.

Repair Policy

The B1500A will be repaired and calibrated in a local Agilent Service Center.

Most B1500A repairs are handled by an assembly-level replacement basis. Mechanical parts and cables are handled on a part-level replacement basis.

To repair and calibrate, whole B1500A unit must be returned to Agilent Service Centers because they can only be performed as a whole instrument and the performance is specified as a whole unit.

Retrofit Policy

The plug-in modules such as B1510A, B1511A, B1517A, B1520A, and B1525A can be installed by customers and they will work functionally. However, to satisfy the published specification, the whole B1500A unit must be returned to Agilent Service Center as the calibration and PV can only be performed at Agilent Service Center.

NOTE To install the B1525A HV-SPGU module, the new versions of the Power PC board and Frame Power Supply module have to be installed inside the B1500A. If not, customers cannot install the HV-SPGU module. In this case, the B1500A must be returned with the B1525A HV-SPGU module to Agilent Service Center. Then, you need to upgrade the Power PC board and Frame Power Supply module before installing the HV-SPGU module. For details, see “Installing First HV-SPGU module” on page 39.

2 Software Installation, Updates, and Hardware Upgrades

This chapter provides how to check the software and hardware revision and how to upgrade.

Software Installation and Recovery

This section describes how to install and recover B1500A software.

NOTE It is strongly recommended for the users to make the data backup before shipping the unit to the service centers. It is informed to the users that all the data may be lost when a repair is done as the HDD may be replaced or the whole software may be recovered to the condition of the factory shipment. So, the customers should understand if the data is gone after the repair. And this section also describes the backup procedure in the "Data backup and recovery" section in case it is needed.

Software installation

When replacing the harddisk drive, the whole software installation is necessary. In this case, please visit below URL for the installation instruction.

http://hpyidmk.jpn.agilent.com/hstd_web/bt_portal.html

This URL is the portal page for HSTD box instrument products and it contains the information to support HSTD box instruments. In there, look for "B1500A" information. In the B1500A area, you should be able to find the software and hardware revision information, the instructions, and the software that can be downloaded.

NOTE The software download site is secured and you need the account name and the password. Contact svc-support_hstd@agilent.com to get them.

Software recovery

If you find problems in the B1500A system or internal hard disk drive (HDD), perform system recovery as shown in the following procedure. After the recovery is performed successfully, the HDD will recover to the condition of shipment.

1. Set the B1500A Standby switch to the OFF position.
2. Disconnect all USB devices from the B1500A.
3. Connect the USB keyboard to a USB port of the B1500A.
4. Set the B1500A Standby switch to the ON position.
5. On the boot system selection menu, select Agilent Recovery System, and press Enter key. To select the system, use arrow keys.

   The Command Prompt window is opened, and displays the following message.

```
Agilent Technologies System Utilities
Recovery Options

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

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

```
----------------------------------------------------------

Enter a Choice:
```

Where, 2 is not valid now. 3 should be entered for rebooting the B1500A without performing system recovery.

6. For the message “Enter a Choice:”, enter 1 and press the Enter key. Message will be displayed for asking if you continue or not.
7. For the message, enter 1 and press the Enter key. System recovery starts. After the recovery completes successfully, system boot starts automatically.

When replacing the harddisk drive, the whole software installation is necessary. In this case, please visit below URL for the installation instruction.

Data backup and recovery

To perform data backup/recovery, use the Backup program of Windows. For the operation steps, follow the wizard of the program. Prepare a blank CD-ROM or CD-RW as the backup media.

Perform the following procedure before performing data backup/recovery.

1. If the EasyEXPERT software is running, terminate it as shown below:
   a. Select the menu function *File* > *Exit* on the EasyEXPERT main window.
   b. Click [x] at the upper right corner of the Start EasyEXPERT button.
2. Select *All Programs* > *Accessories* > *System Tools* > *Backup* from the Start menu. The Backup program is activated.
3. Insert backup media (CD-ROM or CD-RW) into the DVD-ROM/CD-ROM/CD-RW drive.
4. Follow the wizard of the Backup program to perform data backup/recovery.

Folders to Backup

Make backup of the following folders.

- Folder used by EasyEXPERT:
  — D:\Agilent\EasyEXPERT
- Other folders (optional):
  — Folders that store the data to be saved
  — Personal folders (C:\Documents and Settings)

NOTE After performing B1500A system recovery, the C drive will be returned to the condition when you received the B1500A or it left the factory. The D drive is not changed.

Software and Hardware Updates

Microsoft Windows update and PC hardware update

B1500A adopts Microsoft XP Professional operating system. For any software update and PC hardware update, HSTD provides the necessary information in HSTD website below. Confirm the latest information and update the software and hardware accordingly.

http://hpyidmk.jpn.agilent.com/hstd_web/bt_portal.html

The above URL is the portal page for the box instrument products and it contains all the necessary information on supporting HSTD box instruments. In there, look for “B1500A” information. In the B1500A area, you will find the software and hardware revision information and you will be able to download the latest software.

NOTE The software download site is secured and you need the account name and the password. Contact svc-support_hstd@agilent.com and obtain them.

Firmware Update Procedure

This section describes how to update the B1500A firmware.

NOTE You can access the latest firmware and the revision information in the HSTD website as described in the introduction section of this chapter.

1. Click **Start > Program > Accessories > Command Prompt** to get MS-windows' command prompt.
2. Download the firmware update execution file; `flash_prog.exe` and the firmware image file (for example; `appl_A_01_xx.bin`) to B1500A's following folder;

   `c:\Program files\Agilent\B1500\Firmware`
3. Move to the above folder.
   `cd c:\Program files\Agilent\B1500\Firmware`
4. Type in as follows. (In this example, the firmware image file name is; `appl_A_01_02.bin`)

   `$ flash_prog.exe -g agb1500a appl_A_01_02.bin`

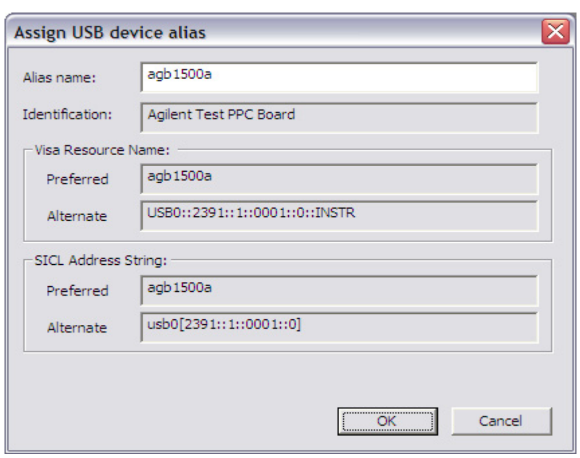
NOTE If you do not specify the device_name by '`-g`' option, `flash_prog` will select the firmware image file whose name is '`UsbDevice1`'.

If you omit the firmware file name, `flash_prog` will select the firmware image file whose name is '`appl.bin`'.

Then, you should get the following dialogue window, click **OK**. This switches to the firmware BOOTROM mode.

NOTE The below dialogue window may not disappear, depending on the firmware revision.

Figure 2-1 Dialogue window to switch to firmware bootrom mode



5. Repeat the above Step 3 once again. This will update the firmware.

   ```
   $ flash_prog.exe -g agb1500a appl_A_01_02.bin
   ```

   Then the update starts.

6. When the firmware update is complete, you may get the above dialogue window again. Then click **OK**.

Hardware Upgrades

B1500A employs the modular architecture and the customer can purchase additional modules after their initial B1500A purchase. In this case, it is recommended that the customers send their B1500A and a newly purchased modules to Agilent service centers for installation. The upgradeable module is sold with its own product model numbers and it does not contain the installation cost, so the service center should charge the necessary cost for the installation.

This section provides the module upgrade installation procedure, and consists of the following.

- “SMU/CMU/SPGU module upgrades”
- “Installing First HV-SPGU module”
- “Upgrading Frame Power Supply”
- “Upgrading Power PC Board”

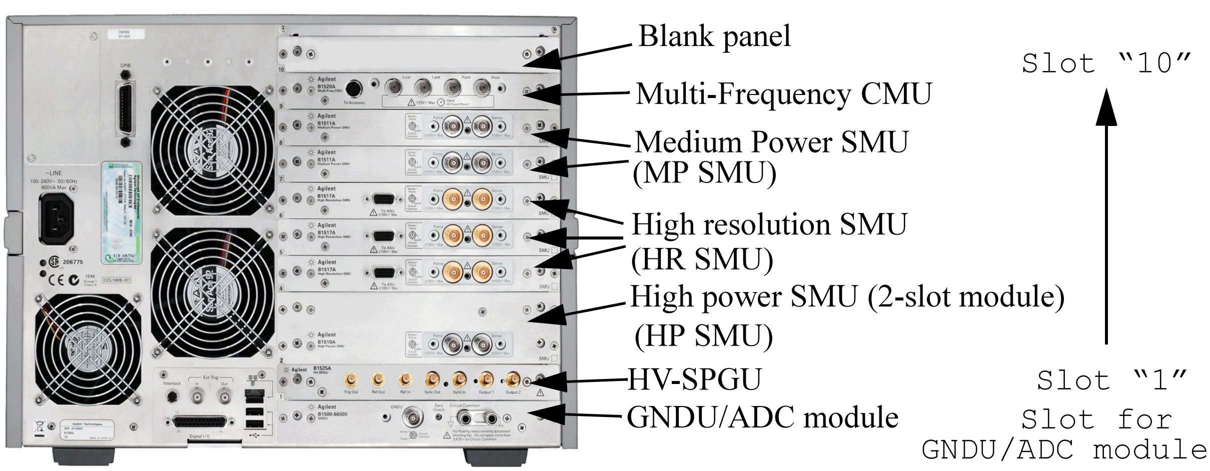
NOTE To install the first HV-SPGU module, see “Installing First HV-SPGU module” on page 39.

SMU/CMU/SPGU module upgrades

Module location rule

B1500A has 10 slots for SMU, CMU, and SPGU modules. And there is a rule on the module location so that all the B1500A have the same kind of module at the same location if the configuration is the same. And by following this rule when performing the upgrade, the above can be achieved whatever it is a newly purchased one or an upgraded one. So, understand the module location rule and strictly follow it when installing the additional SMU, CMU, and SPGU modules.

Figure 2-2 Example B1500A module location



NOTE B1500A has a dummy board installed in the lowest vacant slot and also has an air-hole-covering-plate on the right side of each vacant slot. These are to enable the enough air flow for cooling and they must be installed correctly for the proper instrument operation. Strictly follow the below procedure and make sure that those plates are removed and installed properly.

- The module location rule is as follows:

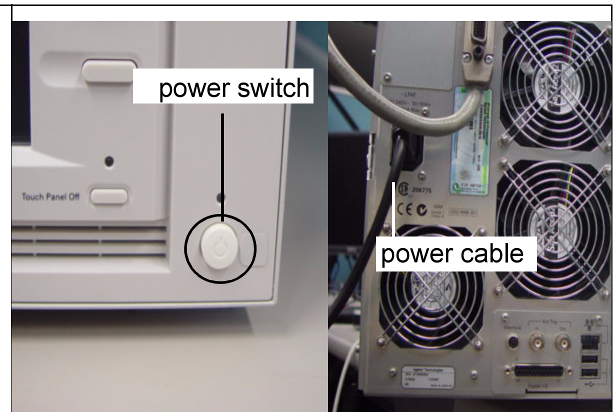
GNDU/ADC module (B1500-61001)	Always at the bottom slot (dedicated to GNDU/ADC module)
High Power SMU (HP SMU) (B1510A)	Right above the GNDU/ADC module
High Resolution SMU (HR SMU) (B1517A)	Right above the HP SMU
Medium Power SMU (MP SMU) (B1511A)	Right above the HR SMU
Mulit-frequency CMU (B1520A)	Right above the MP SMU
HV-SPGU (B1525A)	Right above the GNDU/ADC module, but except the slot 10
Blank panel	Remaining vacant slots

NOTE Here are some additional notes on the module location rule.

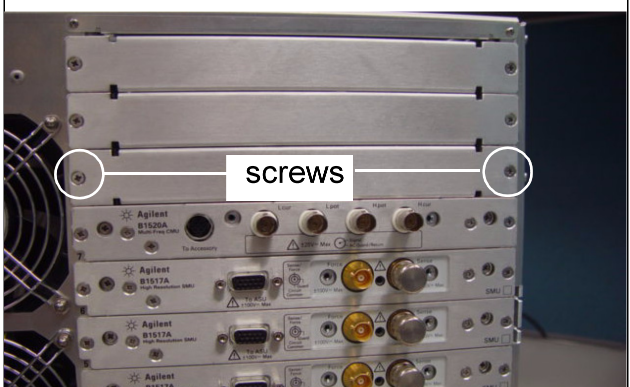
- The GNDU/ADC module must be always installed at the bottom slot and the slot is dedicated for the unit. The slot numbers start from right above the GNDU/ADC slot with the slot number “0”.
- All the above modules may not be configured. In this case, just ignore the non-configured ones and install the next one without making empty slots between modules.
- Multiple SPGU modules have to be installed in the continuous slots.

Installation procedure

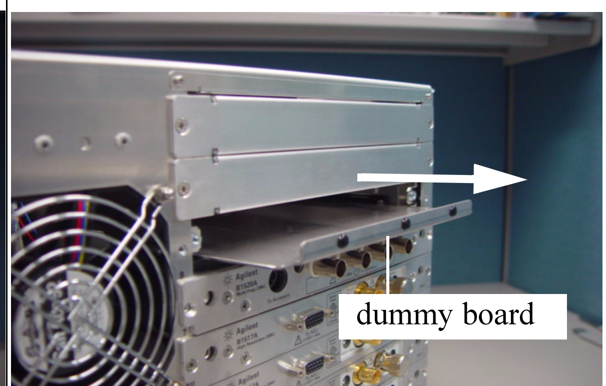
1. Confirm which modules and how many are added.
2. Confirm the module location rule above.
3. Confirm the position of all the modules after the upgrade is done. Note that some existing module may need to be removed and relocated.



4. Turn off power, then disconnect the power cable on the rear side.



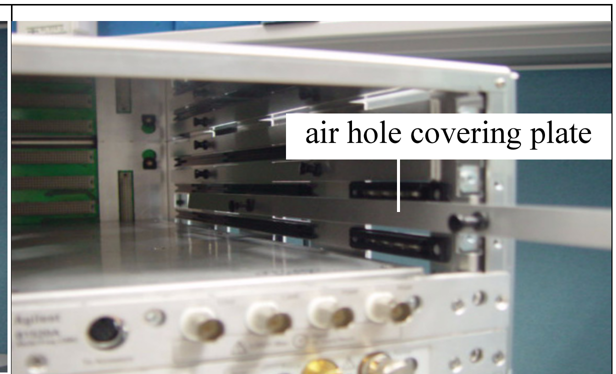
5. Loosen two screws and remove the blank panel for the necessary number of slots.



6. Remove the dummy board.

NOTE The dummy board is installed only at the lowest vacant slot.

7. Remove the air hole covering plate by pulling two plastic rivet.



8. Take out the air hole covering plate.

NOTE Perform the steps 7-8 for all the slots that will be used.

9. Install the modules from the lower slots, following the module location rule.

CAUTION When installing the module, the precise position alignment is needed or some screws may not be fixed properly and maybe damaged. So, insert all the screws to the holes and loosely fix. And then fix the screws little by little in diagonal sequence to firmly fix.

10. When all the modules are installed, install the dummy board at the lowest vacant slot.

11. Install the blank panels for the vacant slots.

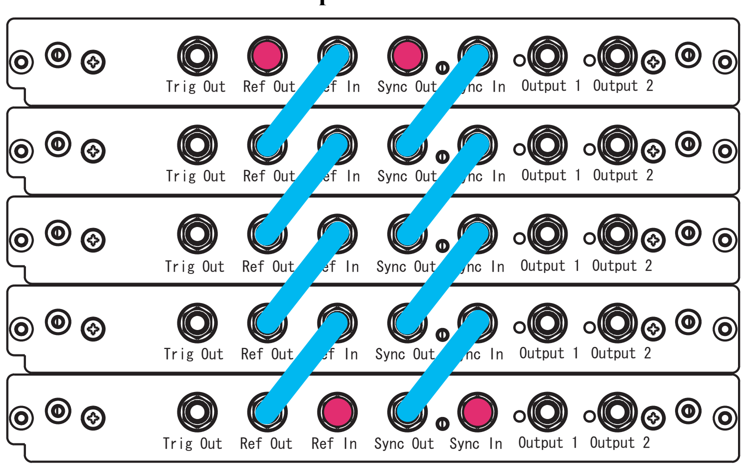
12. When multiple HV-SPGU modules are installed, the cable connections are required between the modules for synchronization. See Figure 2-3.

    - Connect the Ref Out connector on an SPGU module to the Ref In connector on the "right above" SPGU module with an SMA-SMA cable assembly (part number N9158-61601). Use 5 lb-in torque wrench (part number 8710-1582) to connect (coupling torque: 56 N-cm).
    - Connect the Sync Out connector on an SPGU module to the Sync In connector on the "right above" SPGU module with an SMA-SMA cable assembly (part number N9158-61601). Use 5 lb-in torque wrench (part number 8710-1582) to connect (coupling torque: 56 N-cm).
    - Put the SMA open caps (part number 1253-7431) on the opened Ref Out and Sync Out connectors of the youngest slot SPGU module, and on the Ref In and Sync In connectors of the oldest slot SPGU module. For single SPGU module, put them on the Ref Out/In and Sync Out/In connectors of the module.

NOTE For multiple SPGU modules, you must execute the SPGU skew calibration.

13. Connect the power cable and turn on the power.
14. Perform necessary calibration and PV test for the upgraded modules. Refer to Chapter 5 , “Replacement Procedure,” for which PV and calibration must be performed.

Figure 2-3 Cable connections for multiple SPGU modules



Installing First HV-SPGU module

To install the B1525A HV-SPGU module to the B1500A mainframe, there are unique requirements described below, in addition to the standard procedures such as calibration and performance verification after the installation.

- The revisions of the EasyEXPERT software and B1500A firmware installed on the B1500A are both A.03.10 or later
- Frame Power Supply 2 module is installed.
- Power PC Board 2 is installed.

If they are not satisfied, you need to get the following in advance:
(See the following step 3 to check which item is really needed.)

To install the software and firmware

- Software update package A.03.10 or later

To install the Frame Power Supply 2 module

- Frame Power Supply 2 (P/N: B1500-64110 or Exchange P/N: B1500-69110)
- Frame Power Supply Cable 2 (P/N: B1500-65218)
- Cable clamp (P/N: 5188-4540), 4 each

To install the Power PC Board 2

- Power PC Board 2 (P/N: B1500-65111)
- Power PC Board Bracket 2 (P/N: B1500-65320)
- Cable clamp (P/N: 1400-1334), 4 each
- Remote On/Off Cable (P/N: B1500-65219)

To install the first HV-SPGU module, do as follows:

1. Confirm with the customer to which slot the SPGU module should be installed in advance.
2. Confirm that the revisions of the EasyEXPERT software and B1500A firmware installed on the B1500A are both A.03.10 or later. You can check them using the Configuration window on the EasyEXPERT. If not, do as follows:

   a. Download the latest software update package from the software download site in the following HSTD bench technician portal site.

      http://hpyidmk.jpn.agilent.com/hstd_web/bt_portal.html

NOTE The software download site is secured and you need the account name and the password. Contact svc-support_hstd@agilent.com to get them.

   b. Extract the downloaded software update package file.

   c. Execute `Setup.Exe` to update the EasyEXPERT software and B1500A firmware. It takes about 20 minutes.

3. Check the serial number of the B1500A mainframe:

   - It is JP40Nxxxxx.

     B1500A has both the Frame Power Supply 2 and the Power PC Board 2 at the shipment from the factory. Hence, there is no need to check the two modules' revisions. Just installing SPGU is enough.

- It is JP30N00478 or later.

  B1500A has the Frame Power Supply 2 at the shipment from the factory. Hence, it is required to check only if the Power PC Board 2 has been installed at the previous repair by checking if the "Power PC Bd 2" label is put on the B1500A rear panel.

  If the label is not put on the rear panel, upgrade the Power PC board with referring to “Upgrading Power PC Board” on page 43.

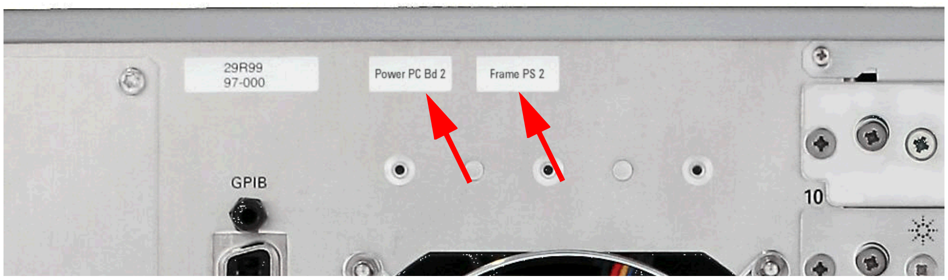
- It is JP30N00477 or earlier.

  B1500A has the Frame Power Supply (previous version) and the Power PC Board (old version) at the shipment from the factory. Hence, it is required to check if the Frame Power Supply 2 or/and Power PC Board 2 have been installed at the previous repair by checking if the "Frame PS 2" and "Power PC Bd 2" labels are put on the B1500A rear panel.

  If the "Frame PS 2" label is not put on the rear panel, upgrade the Frame Power Supply module with referring to “Upgrading Frame Power Supply” on page 41.

  If the "Power PC Bd 2" label is not put on the rear panel, upgrade the Power PC board with referring to “Upgrading Power PC Board” on page 43.

Figure 2-4 Labels on the rear panel



4. Install the HV-SPGU module with referring to “SMU/CMU/SPGU module upgrades” on page 34.

5. Perform the following items in the calibration and performance verification for the installed HV-SPGU modules. See Chapter 3 , “Calibration,”.

   - SPGU 50 ohm calibration
   - SPGU ADC calibration
   - SPGU skew calibration (if multiple HV-SPGU modules are installed)
   - SPGU pulse level test
   - SPGU pulse shape test

Upgrading Frame Power Supply

Frame Power Supply 2 module (P/N: B1500-64110 or its exchange P/N: B1500-69110) is the replacement to the Frame Power Supply (P/N: B1500-61010). Hence, when B1500A with the Frame Power Supply becomes defective and if the Frame Power Supply module is defective, replace it with Frame Power Supply 2. In this case, order the following parts:

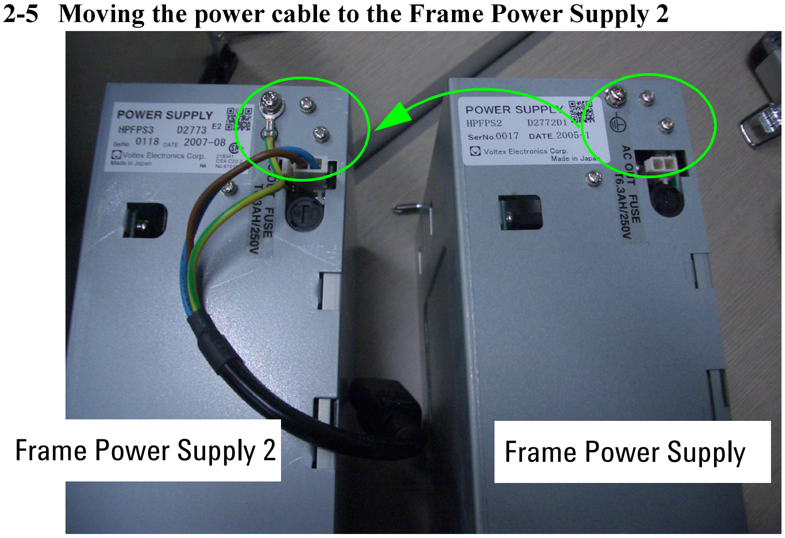
- Frame Power Supply 2 (P/N: B1500-64110 or Exchange P/N: B1500-69110)
- Frame Power Supply Cable 2 (P/N: B1500-65218)
- Cable clamp (P/N: 5188-4540), 4 each

NOTE B1500A with the serial number JP30N00478 or later has the Frame Power Supply 2 at the shipment from the factory. And, B1500A with the serial number JP40Nxxxxx has both the Frame Power Supply 2 and the Power PC Board 2 at the shipment from the factory.

To replace the Frame Power Supply with the Frame Power Supply 2, do as follows:

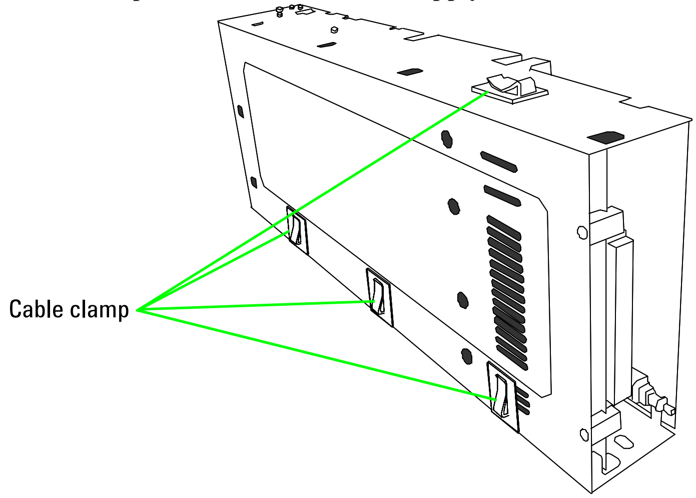
1. Confirm that the "Frame PS 2" label is contained in the box of the Frame Power Supply 2 module.
2. Remove the Frame Power Supply module with referring to “Removing Frame Power Supply Module” on page 165.
3. Disconnect the power cable from the Frame Power Supply module, then connect it to the Frame Power Supply 2 module.

Figure 2-5 Moving the power cable to the Frame Power Supply 2



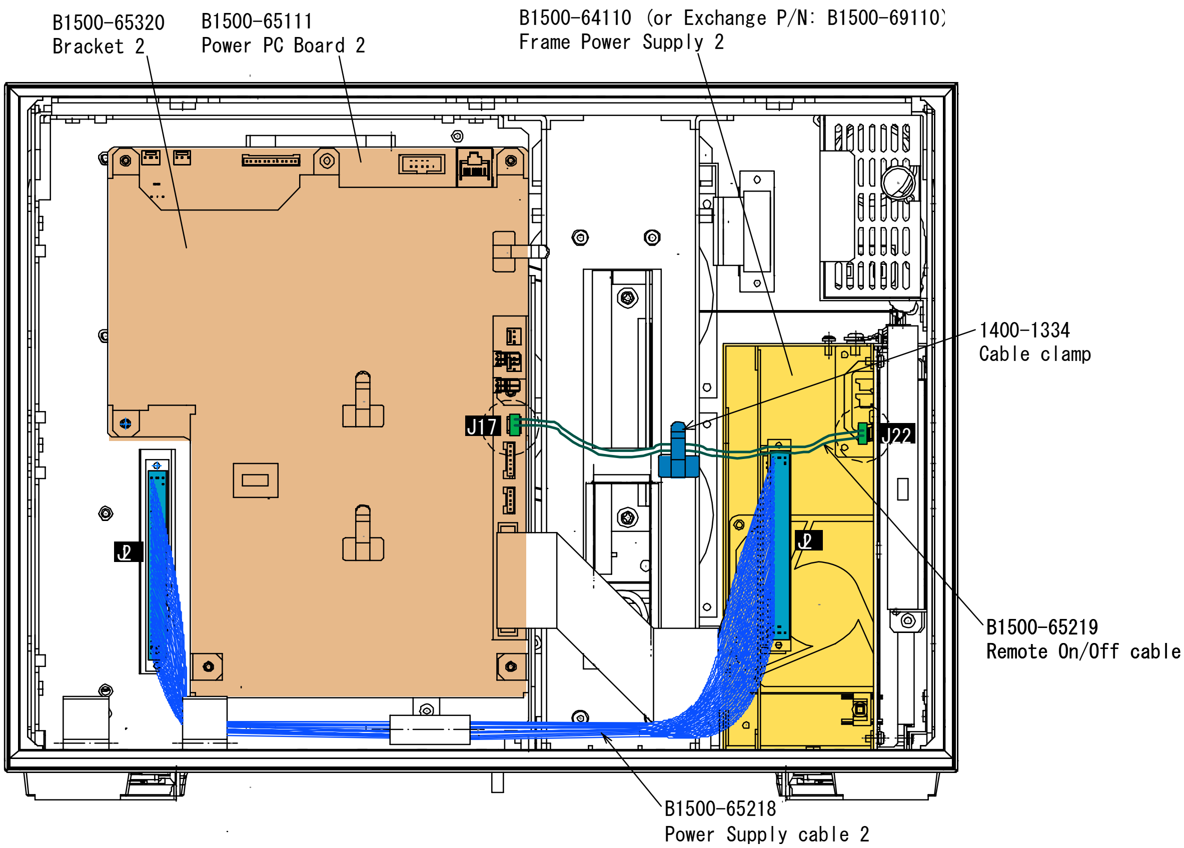
4. Put four cable clamps (P/N: 5188-4540) on the chassis of the Frame Power Supply 2 module with referring to the removed Frame Power Supply module and Figure 2-6.

Figure 2-6 Cable clamps on the Frame Power Supply 2



5. Install the Frame Power Supply 2 (P/N: B1500-64110 or Exchange P/N: B1500-69110).
6. Connect the Power Supply cable 2 (P/N: B1500-65218) between the J2 terminal on the analog mother board and the J2 terminal on the Frame Power Supply 2 module, instead of the Power Supply cable removed in step 2. See Figure 2-7.
7. If the Power PC board 2 is installed in the B1500A at the previous repair, an end of the Remote On/Off cable (P/N: B1500-65219) should be connected to the J17 terminal on the Power PC board 2, and the other end should open. Connect it to the J22 terminal on the Frame Power Supply 2 module. See Figure 2-7.
8. Put the B1500A mainframe back together.
9. Put the "Frame PS 2" label on the B1500A rear panel to indicate that the Frame Power Supply 2 has been installed. See Figure 2-4.

Figure 2-7 Cabling on Frame Power Supply 2 and Power PC Board 2 (front view)



Upgrading Power PC Board

Power PC Board 2 (P/N: B1500-65111) is the replacement to Power PC Board (P/N: B1500-66502). Hence, when B1500A with the Power PC Board becomes defective and if the Power PC Board is defective, replace it with Power PC Board 2. In this case, order the following parts:

- Power PC Board 2 (P/N: B1500-65111)
- Power PC Board Bracket 2 (P/N: B1500-65320)
- Cable clamp (P/N: 1400-1334), 4 each
- Remote On/Off Cable (P/N: B1500-65219)

NOTE B1500A with the serial number JP40Nxxxxx has both the Frame Power Supply 2 and the Power PC Board 2 at the shipment from the factory.

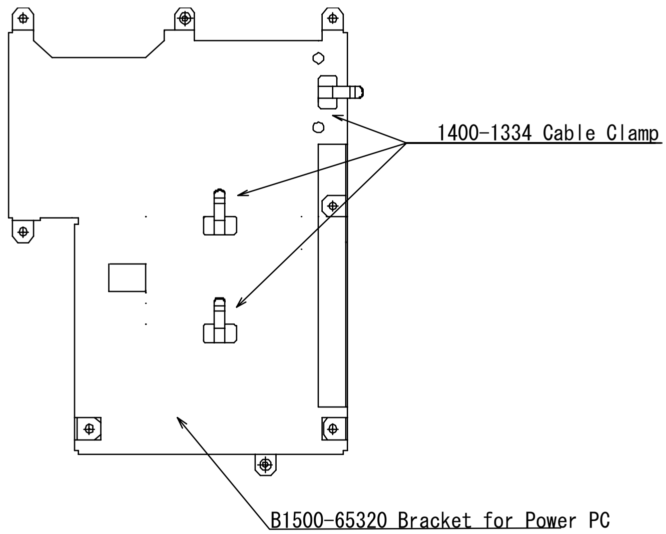
The Power PC Board 2 (P/N: B1500-65111) can be replaced with the Power PC Board (P/N: B1500-66502) regardless of the installed software revision.

To replace the Power PC Board with the Power PC Board 2, do as follows:

1. Confirm that the "Power PC Bd 2" label is contained in the box of the Power PC Board 2 module.
2. Remove the Power PC board with referring to “Removing Power PC Board” on page 163.
3. Remove the bracket from the Power PC board by loosing two screws. These screws are used in the step 4.

4. Put three cable clamps (P/N: 1400-1334) on the Power PC board bracket 2 (P/N: B1500-65320) with referring to the removed original bracket and Figure 2-8.

Figure 2-8 Cable clamps on the bracket



5. Attach the Power PC board bracket 2 (P/N: B1500-65320) with the Power PC board 2 (P/N: B1500-65111) using two screws that are removed in the step 3.
6. Install the Power PC board 2 with the bracket 2, then re-connect the cables removed in the step 2.
7. Put a cable clamp (P/N: 1400-1334) on the front bracket for fixing the PC unit. For the location of the cable clamp, see Figure 2-7.
8. Connect the Remote On/Off cable (P/N: B1500-65219) between the J17 terminal on the Power PC board 2 and the J22 terminal on the Frame Power Supply board 2 (P/N: B1500-64110 or Exchange P/N: B1500-69110). See Figure 2-7. If the B1500A has the Frame Power Supply module (P/N: B1500-61010), connect an end of the Remote On/Off cable to the J17 terminal on the Power PC board 2, then fix the Remote On/Off cable using the cable clamp with leaving the other end open.
9. Put the B1500A mainframe back together.
10. Put the "Power PC Bd 2" label on the B1500A rear panel to indicate that the Power PC Board 2 has been installed. See Figure 2-4.

3 Calibration

This chapter gives the information about the Agilent B1500A calibration, and consists of the following sections:

- “Calibration Overview”
- “Getting Started”
- “Performance Verification Procedure for B1500A”
- “Calibration and Adjustment Procedure”
- “Printing Test Result”

Calibration Overview

This section describes definition of calibration, calibration flow, requirements, operating conditions, and so on.

Definition of calibration

Calibration is defined as the action that confirms the equipment performance, compares it with commercial specifications, and adjusts the reference resistors and voltages values that affect the measurement and output values. The calibration consists of the performance verification, ADC/SMU/SPGU calibration, and CMU adjustment.

Calibration structure

Figure 3-1 shows the calibration structure, and Figure 3-2 shows the performance verification structure.

Figure 3-1 Calibration structure

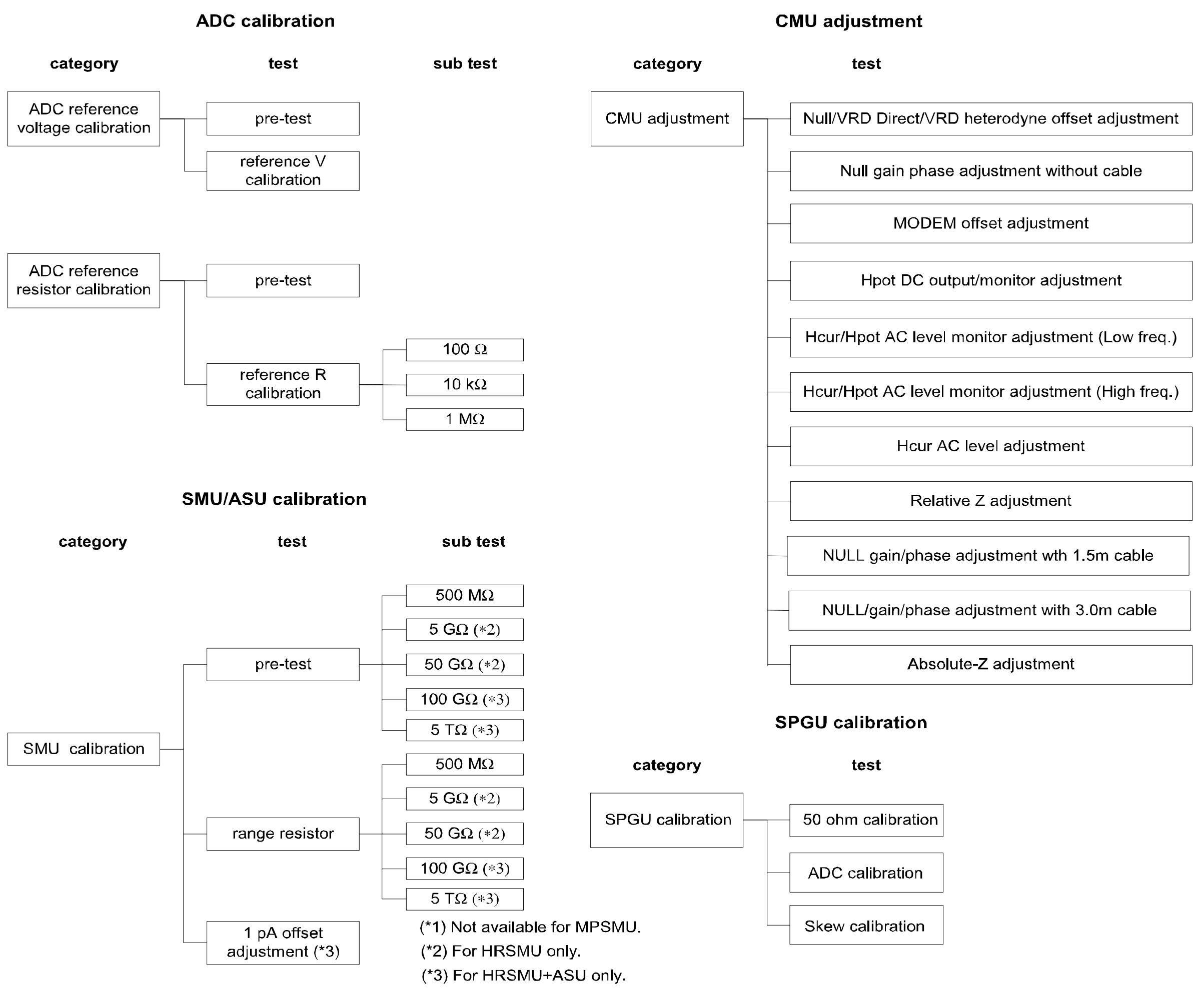
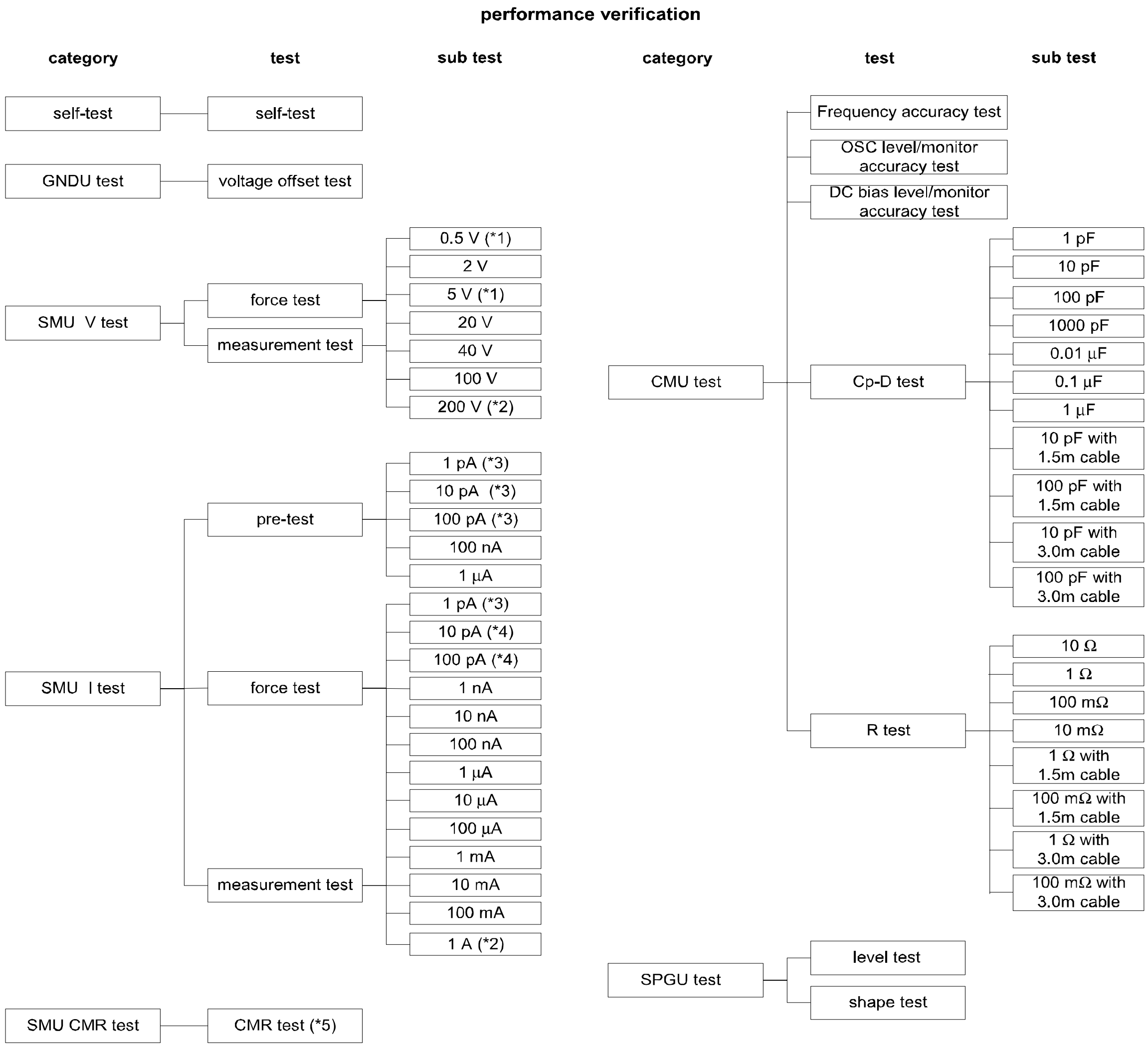


Figure 3-2 Performance verification structure



(*1) Not available for HPSMU.
(*2) For HPSMU only.
(*3) For HRSMU+ASU only.
(*4) For HRSMU and HRSMU+ASU only.
(*5) Not available for HRSMU+ASU.

Required equipment

Table 1-3 lists the required equipment for the calibration.

Operating conditions

Perform all calibration in the following conditions:

- Ambient temperature is 23 °C ± 3°C, operating humidify is 20% ≤70% RH.
- B1500A is warmed up at least 40 minutes.
- At least one SMU is installed in the mainframe for the ADC calibration.
- Agilent 3458A:
  - ❑ Agilent 3458A is periodically calibrated and is warmed up for four hours. Also, **ACAL** is performed after the warm-up time.
  - ❑ Temperature change is within 1 °C after the 3458A **ACAL** and B1500A self calibration.
- Agilent 86100C with 86112A:
  - ❑ Agilent 86100C with 86112A is periodically calibrated and is warmed up and stabilized at least one hour.
  - ❑ Temperature change is within 5 °C after the last horizontal calibration for the mainframe.
  - ❑ The horizontal calibration for the mainframe is performed within a year.
  - ❑ Temperature change is within 5 °C after the last vertical calibration for the plug-in.
  - ❑ The vertical calibration for the plug-in is performed within 10 hours.
  - ❑ Agilent 86112A is installed in the slot 1-2 of the Agilent 86100C.

Calibration cycle

The B1500A requires the periodic calibration. The frequency of the calibration depends on the operating and environmental conditions under which the instrument is used. Agilent Technologies recommends that the calibration is performed at least once a year.

Also, a part of calibration should be performed to guarantee the instrument specification when you repair a part of the B1500A that is related to the specification.

Getting Started

This section describes how to install, set up, and run the performance verification and calibration software. Perform steps 1 through 6 in this section.

NOTE Before you perform steps 1 through 6, check if the GPIB interface card and I/O library are properly installed.

You can't use B1500A itself as controller of performance verification test.

Step 1. Software and hardware setup for controller PC

The following is the hardware and software (calibration software for Agilent B1500A) installation and set up procedure.

1. Confirm that the GPIB interface and I/O library are installed in the controller PC and are working.
2. Install the B1500A calibration software as follows:
   a. Insert the software CD-ROM into your CD-ROM drive.
   b. Close all running applications.
   c. Click **Start > Run**.
   d. Enter the setup file name with the path (ex. `D:\setup`), and then click **OK**.
   e. Follow the instructions displayed on the screen to install the calibration software.

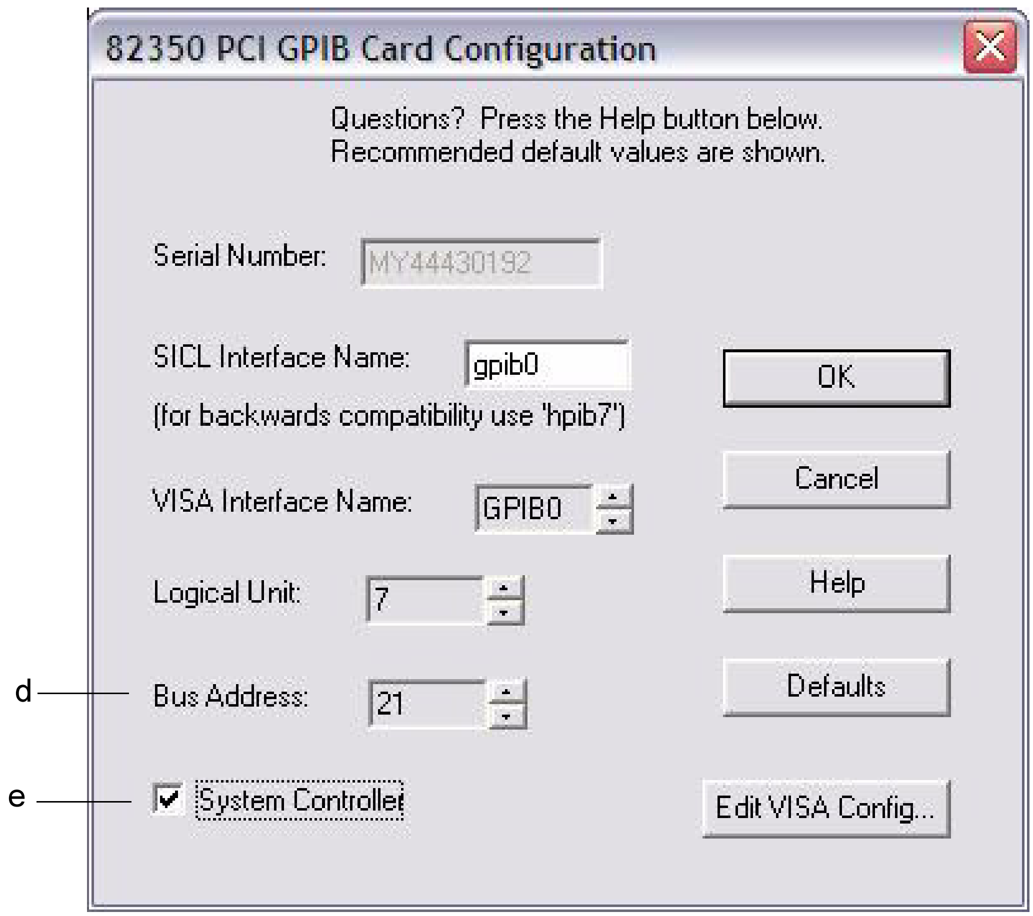
   When the installation is complete, a program group is added on the **Start** menu labeled **Calibration SW for Agilent B1500A > Calibration SW for Agilent B1500A**.

Step 2. Software and hardware setup for B1500A

The following is the hardware and software installation and set up procedure for B1500A.

1. Connect the GPIB cable between a PC and the B1500A.
2. Turn on the PC and B1500A.
3. If StaDaemon.exe invoked (you can see “Start EasyEXPERT” dialog) or EasyExpert is invoked, terminate it.
4. Confirm that the GPIB interface and I/O library are configured as remote controllable.
   a. Click **Start > Agilent IO Libraries > IO Config**.
   b. Select the VISA name **GPIB0** and click **Edit** button.
   c. Figure 3-3, “Configuration for B1500A GPIB0,” shows default configuration.
   d. Change the ’Bus address’ from 21 to what you want (ex. 20).
   e. Uncheck the check box as ’System Controller’.
   f. Click **OK**.

Figure 3-3 Configuration for B1500A GPIB0



5. Invoke StaDaemon.exe again. (Not click “Start EasyEXPERT”. You need to stay to show this dialog window.)

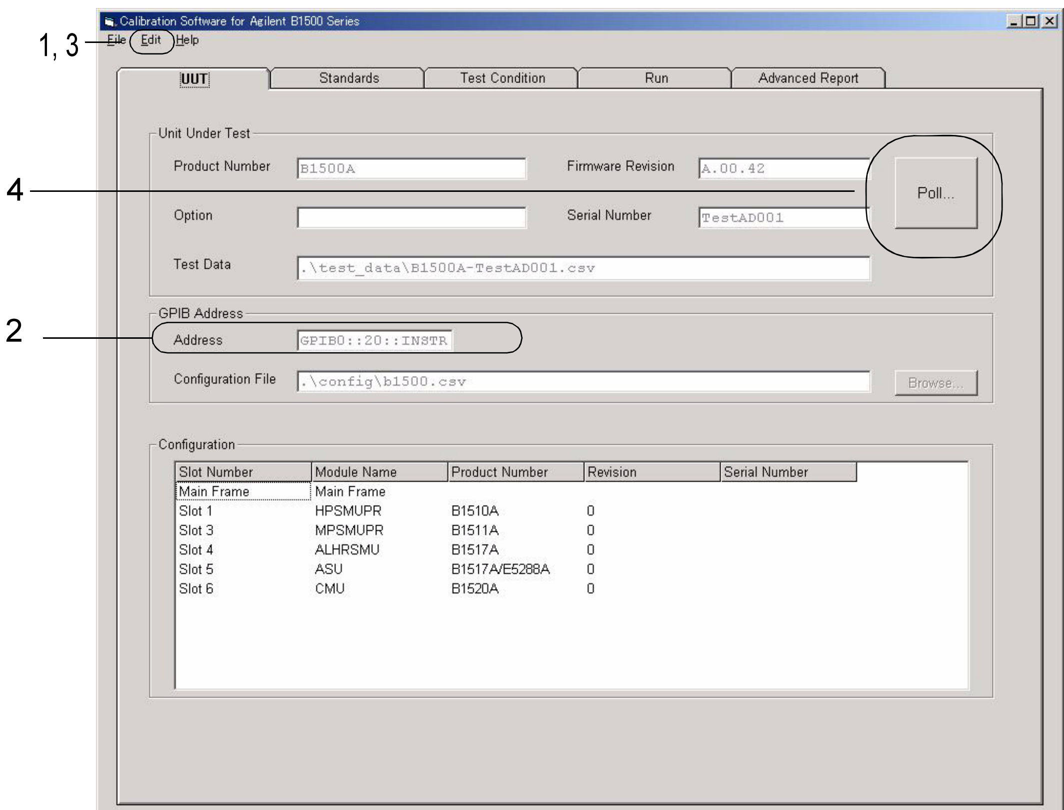
Step 3. Configuring UUT information

Run the calibration software by selecting **Start > Calibration SW for Agilent B1500A > Calibration SW for Agilent B1500A**. This opens the calibration software graphical user interface (GUI) as shown in Figure 3-4. The calibration software is grouped into five tabs: `UUT`, `Standards`, `Test Condition`, Run, and Advanced Report. The unit under test (UUT) configuration is done on the `UUT` tab.

Follow these steps to configure the UUT information.

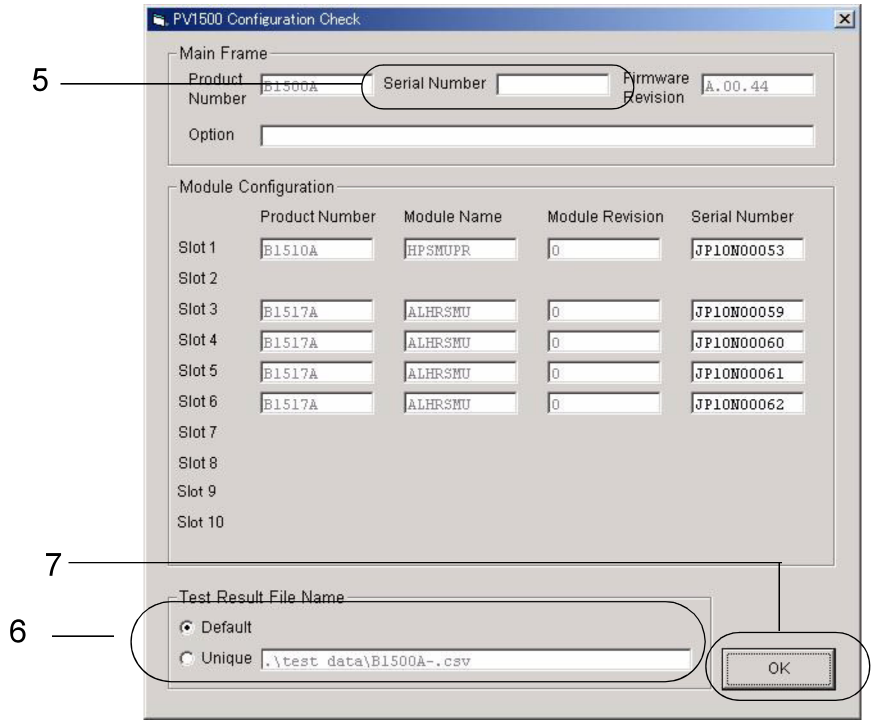
1. Click **Edit > Edit Data**. The check mark is displayed beside the **Edit Data**.
2. Enter the GPIB address in the blank of the `GPIB Address` area. For example, if the GPIB interface name is GPIB0 and the B1500 GPIB address is 20, type `GPIB0::20::INSTR`.. This information is confirmable by using the VISA Assistant. Note that you can configure B1500 GPIB address as configured on Step 2. 3-d Bus Address.
3. Click **Edit > Edit Data**, and then save the configuration into the file specified in `Configuration File`.

Figure 3-4 UUT tab



4. Click **Poll**. The calibration software retrieves the UUT configuration (model number, firmware revision, and module configuration), and displays this on the PV1500 Configuration Check window as shown in Figure 3-5.

Figure 3-5 PV1500 Configuration Check window



5. Enter the B1500A serial number.
6. Enter the test result file name. The default setting of the test result file name is made by the serial number. If you want to change the test result file name, select `Unique`, then enter the file name.

NOTE When you execute the performance verification after the calibration, Agilent Technologies recommends that you change the test result file name for easy test data administration. For details, see “Printing Test Result”.

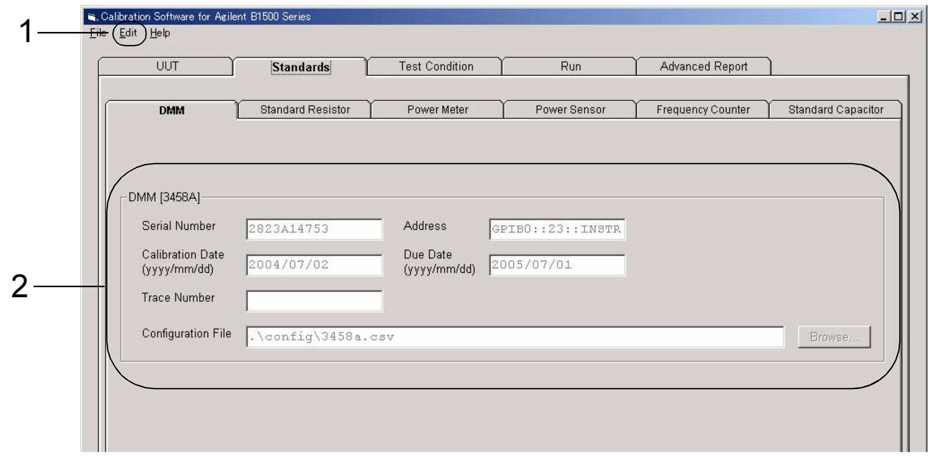
7. Click **OK**.

Step 4. Setting calibration standards

Open the `Standards` tab by clicking the tab, and then follow these steps to set up the calibration standards (Agilent 3458A, Agilent 16353A/16353H, Agilent 441xA/B, Agilent 8482A, Agilent 531xxA, Agilent 16380A, and Agilent 86100A/B/C with 86112A).

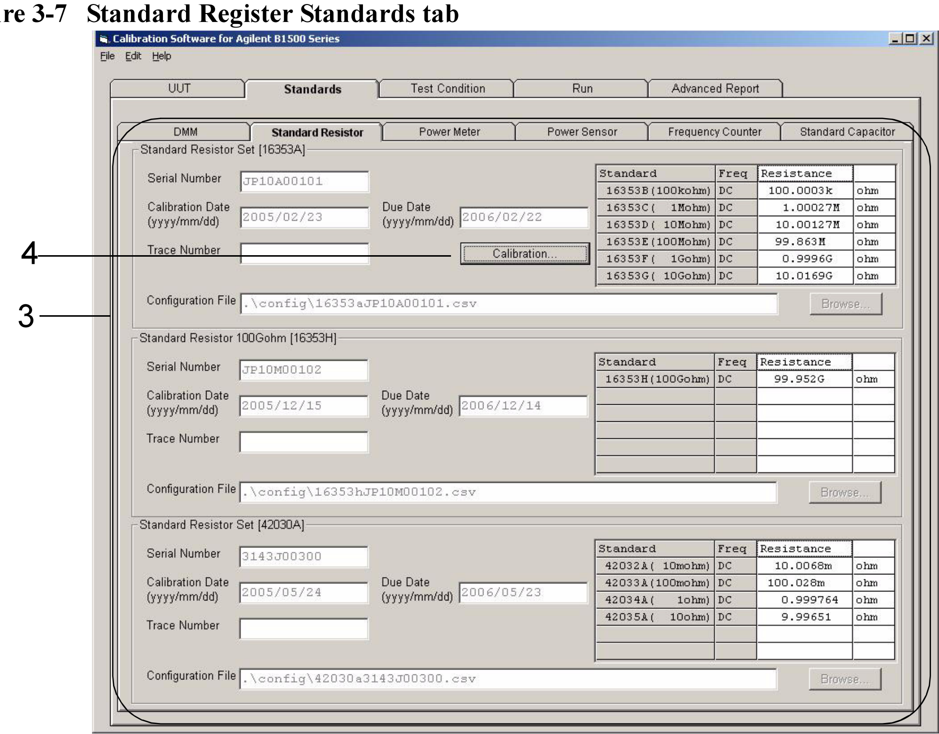
1. Click **Edit > Edit Data**. The check mark is displayed beside **Edit Data**. See Figure 3-6.
2. Click DMM tab on Standards tab, and enter the serial number, GPIB address, calibrated date, due date, and trace number of Agilent 3458A (DMM).

Figure 3-6 DMM Standards tab



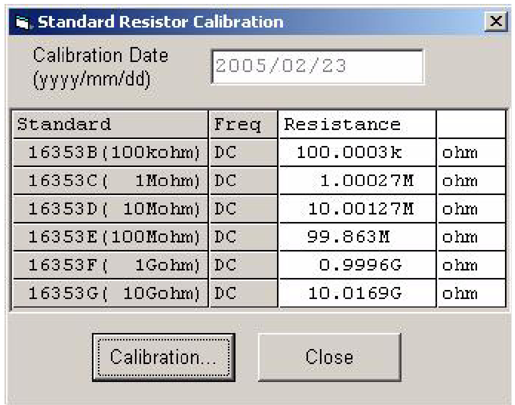
3. Click Standard Register tab, and enter the serial number, calibrated date, due date, trace number, and resistance values of Agilent 16353A standard resistor set and 16353H. See Figure 3-7.

Figure 3-7 Standard Register Standards tab



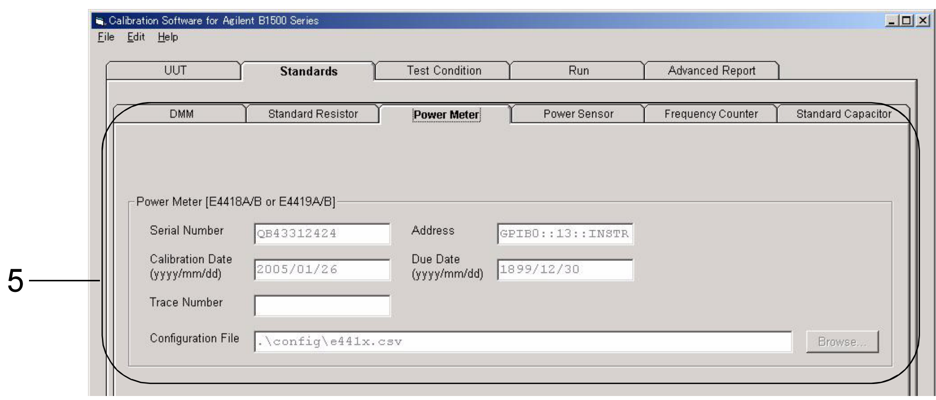
4. After input the 16353A data, you need to compensate the 16353A by click **Calibration** button. When you input 16353A, or you have one month to use the same 16353A, you need to perform Standard Register Calibration. For the detail about how to calibrate, see “16353A Standard R Calibration procedure”.

Figure 3-8 Standard register calibration



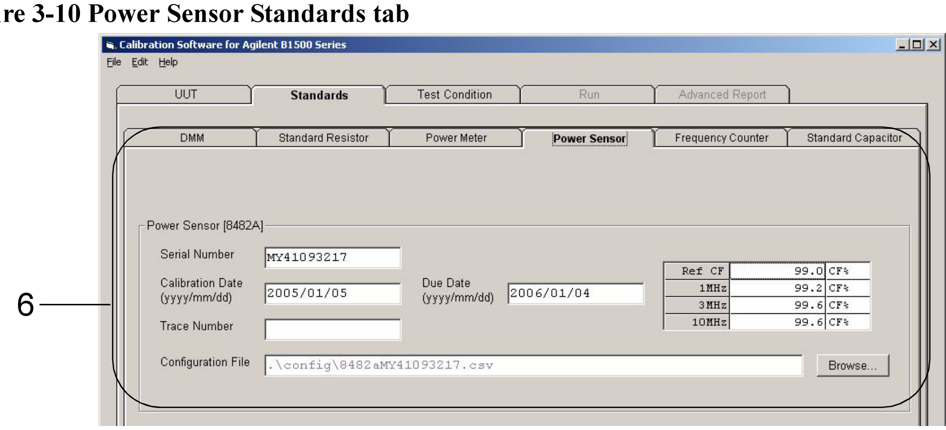
5. Click Power Meter tab, and enter the serial number, GPIB address, calibrated date, due date, and trace number of Agilent E4418A/B or E4419A/B. See Figure 3-9.

Figure 3-9 Power Meter Standards tab



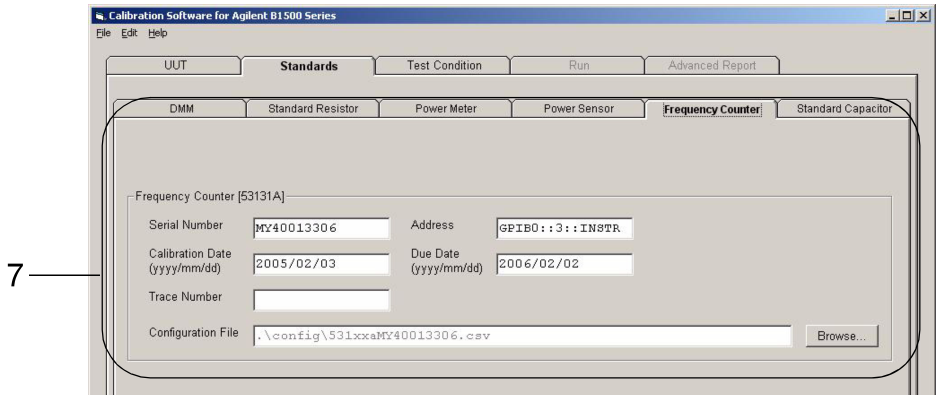
6. Click Power Sensor tab, and enter the serial number, GPIB address, calibration factor, calibrated date, due date, and trace number of Agilent 8482A. See Figure 3-10.

Figure 3-10 Power Sensor Standards tab



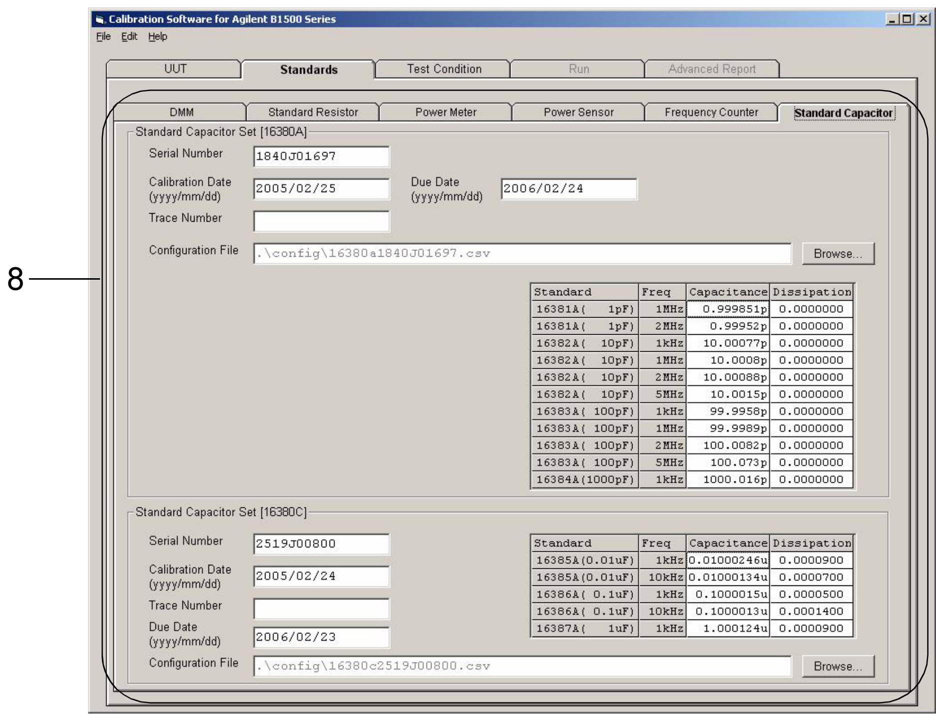
7. Click Frequency Counter tab, and enter the serial number, GPIB address, calibrated date, due date, and trace number of Agilent 53131A. See Figure 3-11.

Figure 3-11 Frequency Counter Standards tab



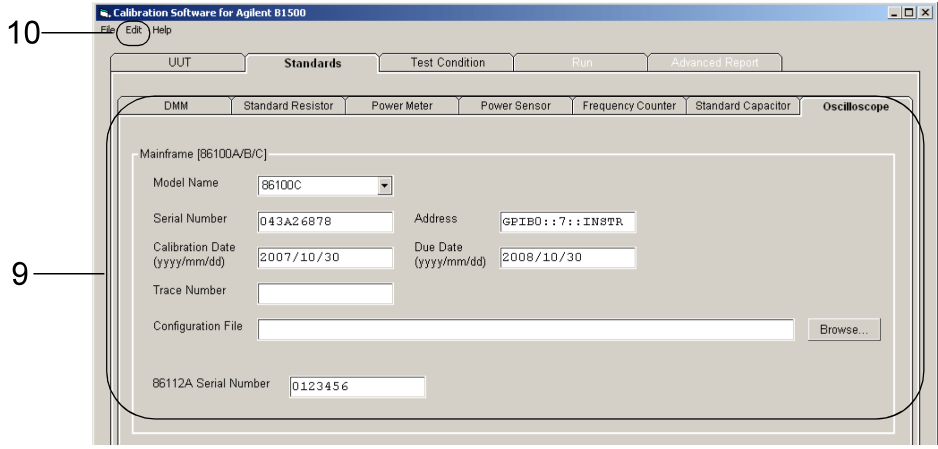
8. Click Standard Capacitor tab, and enter the serial number, calibrated date, due date, trace number, and capacitance values of Agilent 16380A standard capacitor set. See Figure 3-12.

Figure 3-12 Standard Capacitor Standards tab



9. Click Oscilloscope tab, and enter the model number, serial number, GPIB address, calibrated date, due date, trace number of Agilent 86100A/B/C oscilloscope, and the serial number of Agilent 86112A plug-in. See Figure 3-13.

Figure 3-13 Oscilloscope Standards tab



10. Click **Edit > Edit Data**, and then save the data into the files specified in the `Configuration File`.

NOTE Once you enter the information and save it into the files, you can load the information by clicking **Load or Create File**. In default setting, the standard setting files are made in the `C:\Program Files\Agilent Technologies\E1549A\config` folder, but you can put the setting files in another folder and share them with other networked PCs.

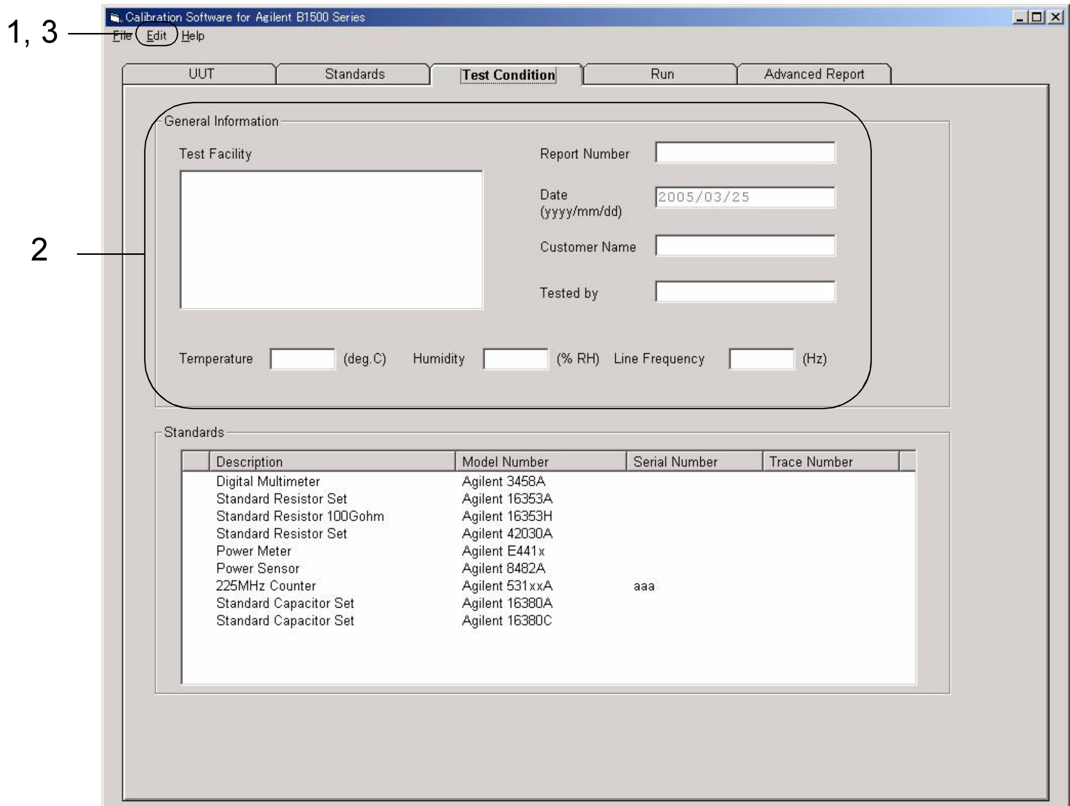
And, it is strongly recommended to copy the setting files into another folder as back-up. This would be useful when you update this calibration software to new version, because installing the new version software overwrites the standard setting files in the `C:\Program Files\Agilent Technologies\E1549A\config` folder with the default files and you will need to enter all the calibration standard data again. If you have the back-up setting files, it would be easily to recover.

Step 5. Entering test conditions

Open the `Test Condition` tab by clicking the tab, and then follow these steps to enter test conditions.

1. Click **Edit > Edit Data**. The check mark is displayed beside **Edit Data**.
2. Enter the test facility name, report number, calibration date, customer name, tested by, temperature, humidity, and line frequency. These data are used for the first page of calibration report.
3. Click **Edit > Edit Data**, and then save the data into result file specified in the Test Condition tab.

Figure 3-14 Test Condition tab



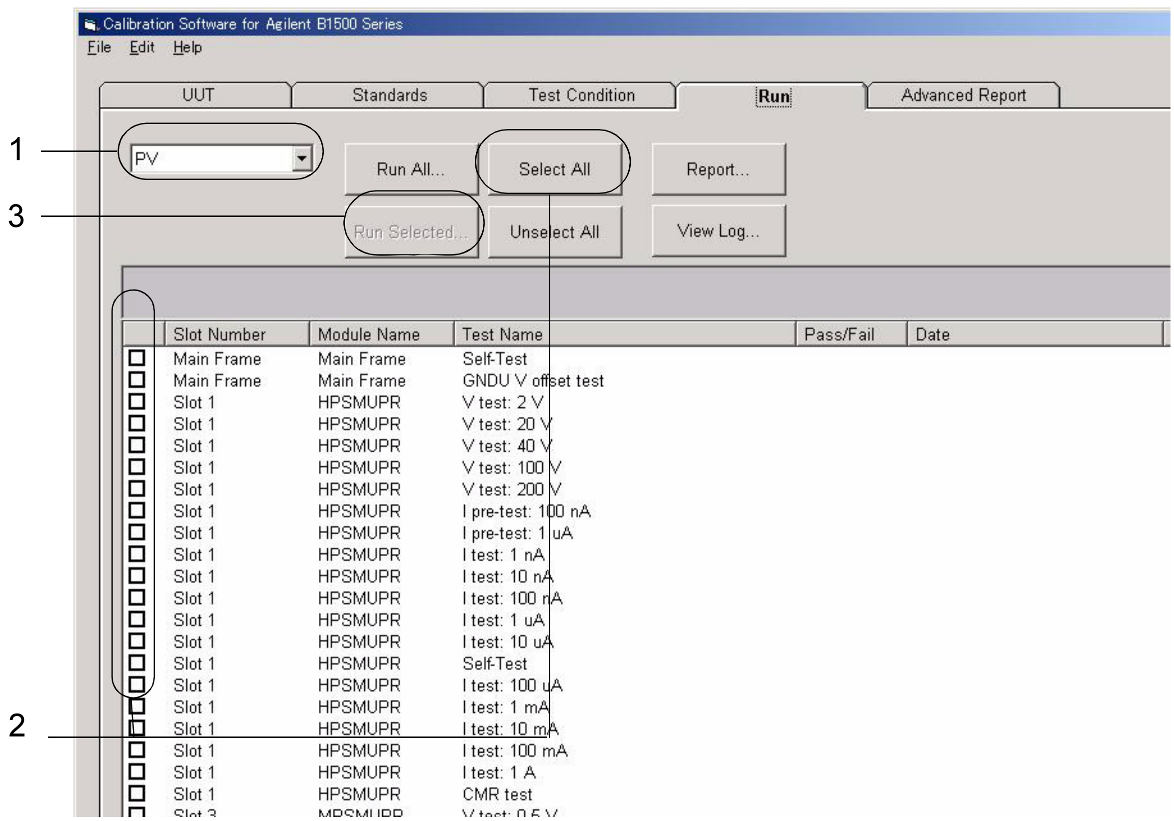
Step 6. Selecting tests

Open the `Run` tab by clicking the tab, and then follow these steps to execute the performance verification or calibration.

1. If you want to execute the performance verification, select `PV`. If you want to execute the calibration, select `Calibration`. The executable tests are displayed in the window.
2. Select tests or calibrations that you want to execute by clicking the check box or **Select All**.
3. Click **Run Selected**.

NOTE If you are executing the performance verification after the calibration. Agilent Technologies recommends that you change the result file name in step 2-4 for easy test data administration. See also "Printing Test Result".

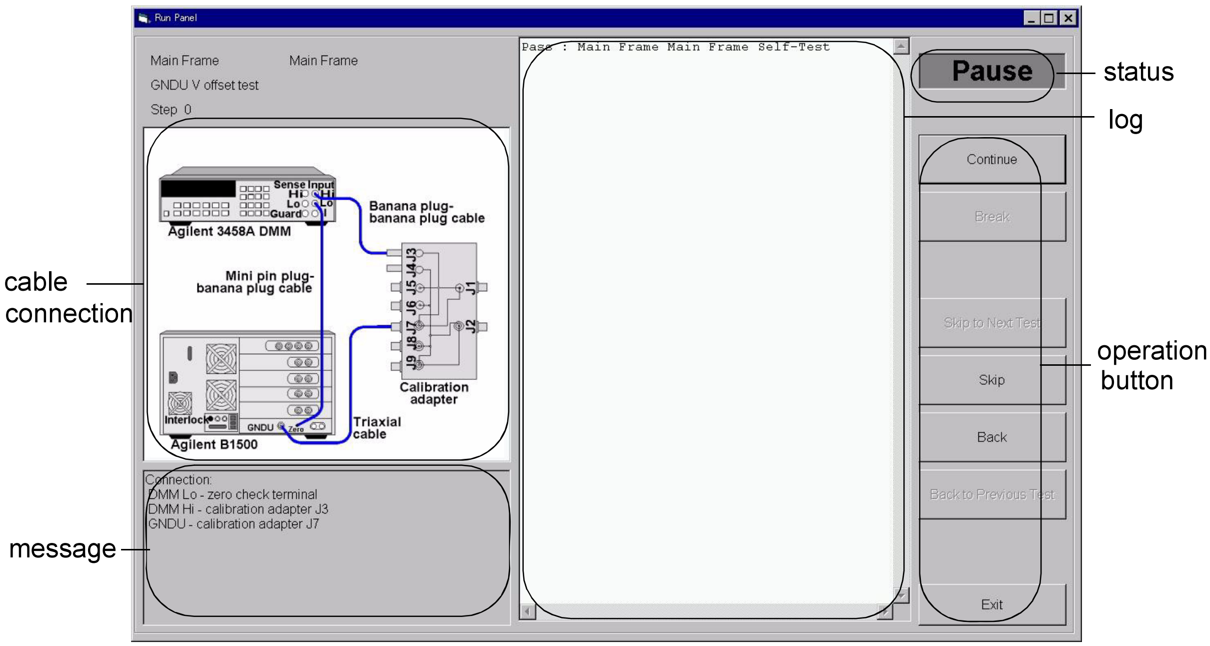
Figure 3-15 Run tab



Step 7. Executing tests or calibrations

Run the selected tests or calibrations by clicking Run Selected. This opens the run panel and test introduction window as shown in figure 3-16.

Figure 3-16 Run panel



The following lists the functions of the Run Panel.

Continue Goes to next step.

Break Stops executing tests or calibrations.

Skip to Next Test Skips the current test or calibration, then goes to the next test.

Skip Skips the current step, then goes to the next step.

Back Returns to the previous step.

Back to Previous Test Returns to the previous test or calibration.

Exit Quits the performance verification or calibration, then closes the Run Panel.

Cable connection Displays the cable connection.

Message Displays the connection or test name.

Log Displays logs for performance verification and calibration. This information is also stored in the result file that you specified in the `Configuration` tab.

Status Displays the test and calibration status.

16353A Standard R Calibration procedure

B1500A SMU module provide ultra low current measurement ranges such as 10 nA or lower. Also, the specification of 16353A 10 GΩ and 100 MΩ does not adequate for B1500A SMU PV. You need to compensate 10 GΩ register by measure 10 GΩ and 1 GΩ, 100 MΩ register by 100 MΩ and 10 MΩ. If you don't have HRSMU or ASU, you can skip 10 GΩ and 1 GΩ in step 9.

It is recommended to perform 16353A standard R calibration every one month.

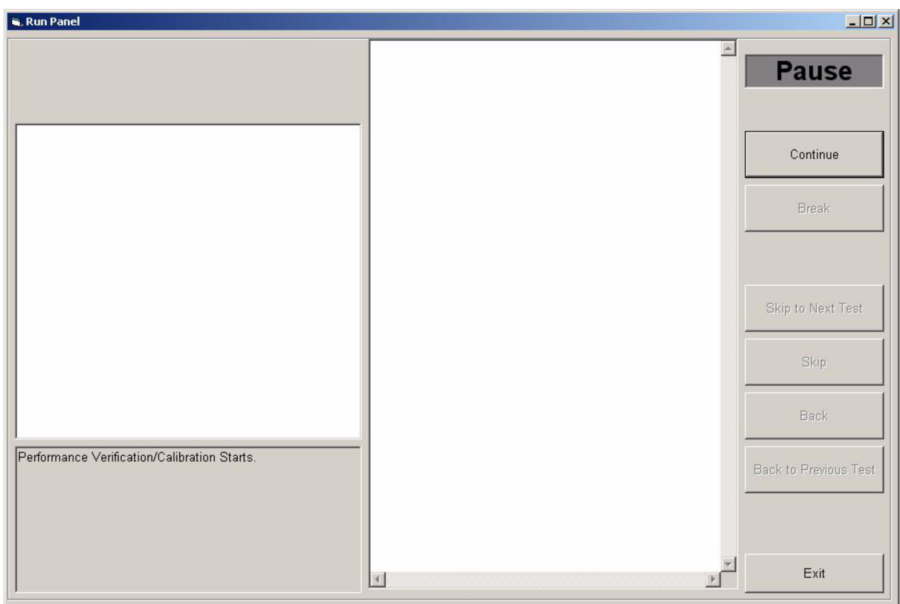
Required equipment

Low current calibration adapter (E5299-65001)
Shorting box (04155-65042)
Standard register set (16353A)
100 Gohm standard resister (16353H: Only for HRSMU or ASU)
Banana plug to banana plug cable (Agilent 11058A)
Digital multimeter (Agilent 3458A)

Procedure

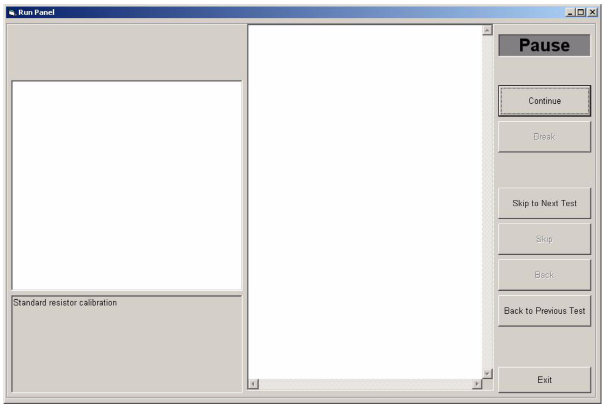
1. Invoke 'Calibration SW for Agilent B1500A', select 'Standards' tab, then select Standard Resistor tab. You need to input calibration data for 16353A and 16353H. See Figure 3-7 on page 54.
2. Click **Calibration** button. See Figure 3-7 on page 54.
3. Standard Resister Calibration window appears. Click **Calibration** button. See Figure 3-8 on page 55.
4. Run Panel window appears. Click **Continue** button to start standard R calibration.

Figure 3-17 16353A standard R calibration Run Panel (1 of 8)



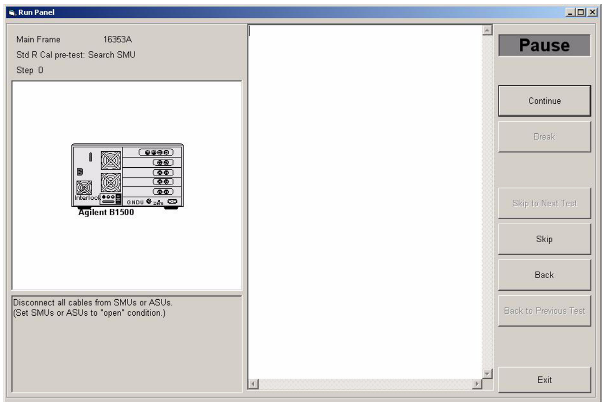
5. Click **Continue** button.

Figure 3-18 16353A standard R calibration Run Panel (2 of 8)



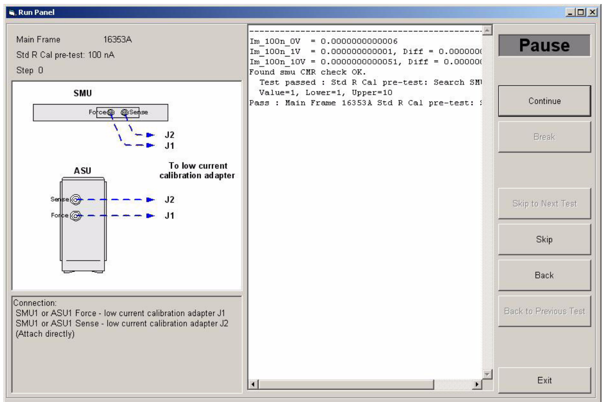
6. Disconnect all cables from SMU or ASU, and them click **Continue** button.

Figure 3-19 16353A standard R calibration Run Panel (3 of 8)



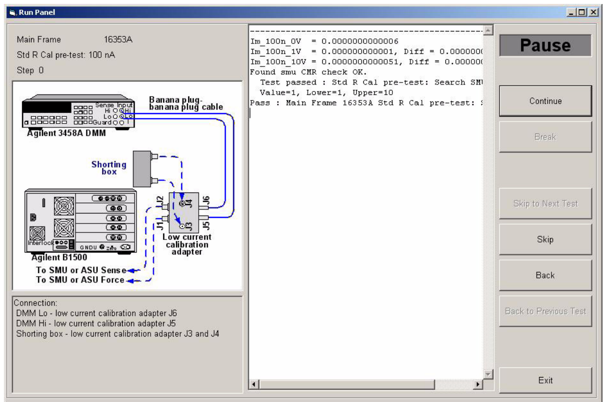
7. Connect SMU force to J1 on low current calibration adapter, SMU sense to J2 on low current calibration adapter. Click **Continue** button.

Figure 3-20 16353A standard R calibration Run Panel (4 of 8)



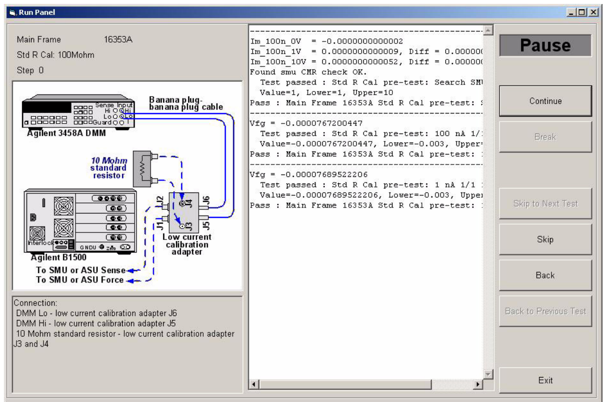
8. Connect DVM (high, low) to low current calibration adapter (J5, J6), shorting box to J3 and J4. Click **Continue** button.

Figure 3-21 16353A standard R calibration Run Panel (5 of 8)



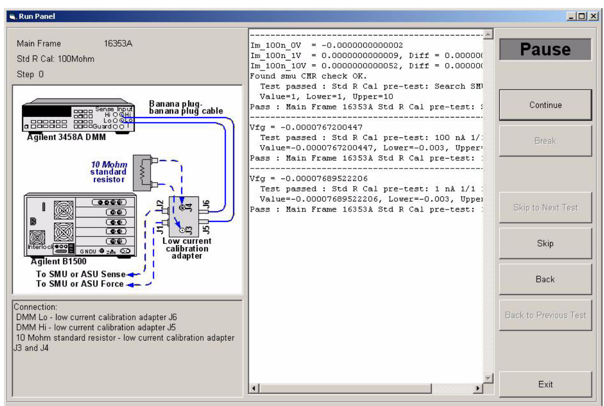
9. Disconnect shorting box, and connect standard register to J3 and J4. Click **Continue** button.

Figure 3-22 16353A standard R calibration Run Panel (6 of 8)



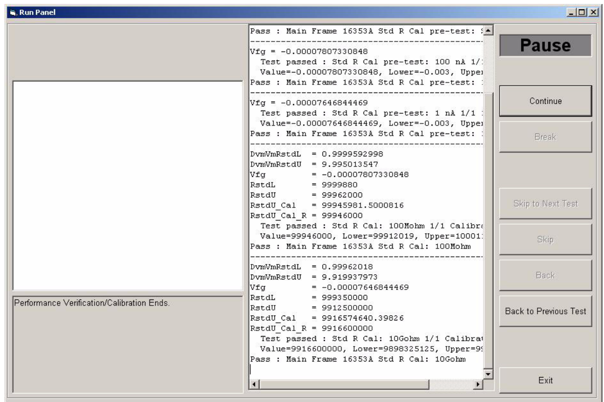
10. Step 9 is repeated until all of necessary standard register.

Figure 3-23 16353A standard R calibration Run Panel (7 of 8)



11. Standard R calibration end. Click **Continue** to return.

Figure 3-24 16353A standard R calibration Run Panel (8 of 8)



Performance Verification Procedure for B1500A

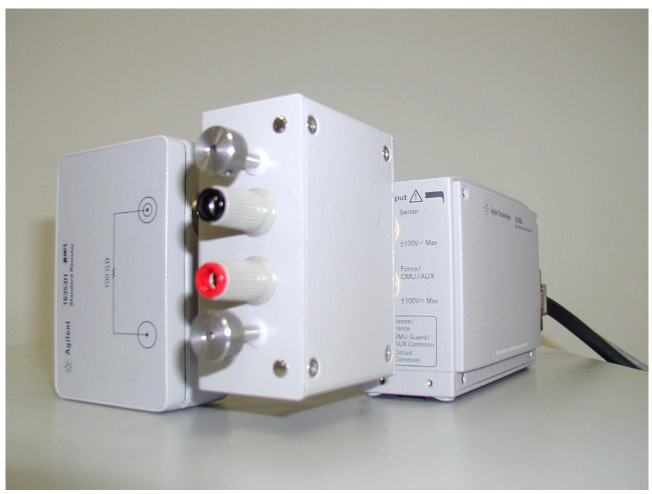
This section describes the performance verification procedure, required equipment, and cable connections for each tests.

NOTE When you execute the performance verification for B1500A, you need to disconnect ASU (Atto Sense Unit) before power on B1500A. After finish the performance verification without ASU, then you need to execute the performance verification with ASU connected. Power off the B1500A, connect ASU to HRSMU, and power on B1500A and continue the performance verification from Self-test for the HRSMU channels with ASUs only.

Please see B1500A User Guide about how to connect ASU with HRSMU.

Figure 3-25 shows example of connection between ASU, low current calibration adapter, and calibration standard.

Figure 3-25 ASU connection for low current calibration adapter and calibration standard



Self-test

Required equipment

None

Procedure

1. Disconnect all cables and plugs from the SMU. (Set the SMU to “open” condition. If you test HRSMU with ASU, don’t disconnect it.)
2. Click **Continue**. The mainframe and SMU self-test is executed. If CMU is installed, CMU self-test will be executed in the next. See “CMU self-test” for more detail.

GNDU voltage offset test

This test verifies the ground unit (GNDU) voltage offset accuracy.

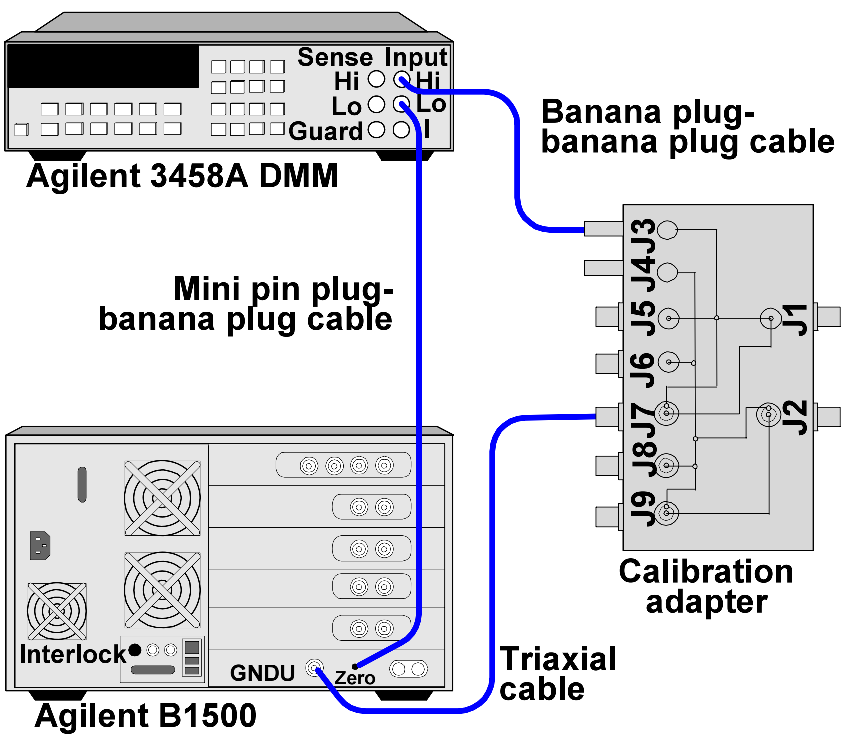
Required equipment

Triaxial cable (04142-61641)
Mini pin plug to banana plug cable (04155-61648)
Calibration adapter (04155-65041)
Banana plug to banana plug cable (Agilent 11058A)
Digital multimeter (Agilent 3458A)

Procedure

1. Connect DMM-Lo to the zero check terminal on the mainframe front panel.
2. Connect DMM-Hi to the calibration adapter J3.
3. Connect the GNDU to the calibration adapter J7.
4. Click **Continue**. The GNDU voltage offset test is executed.

Figure 3-26 Connection for GNDU voltage offset test



SMU voltage test

This test consists of the voltage setting test and voltage measurement test; it verifies the SMU voltage setting and measurement accuracy.

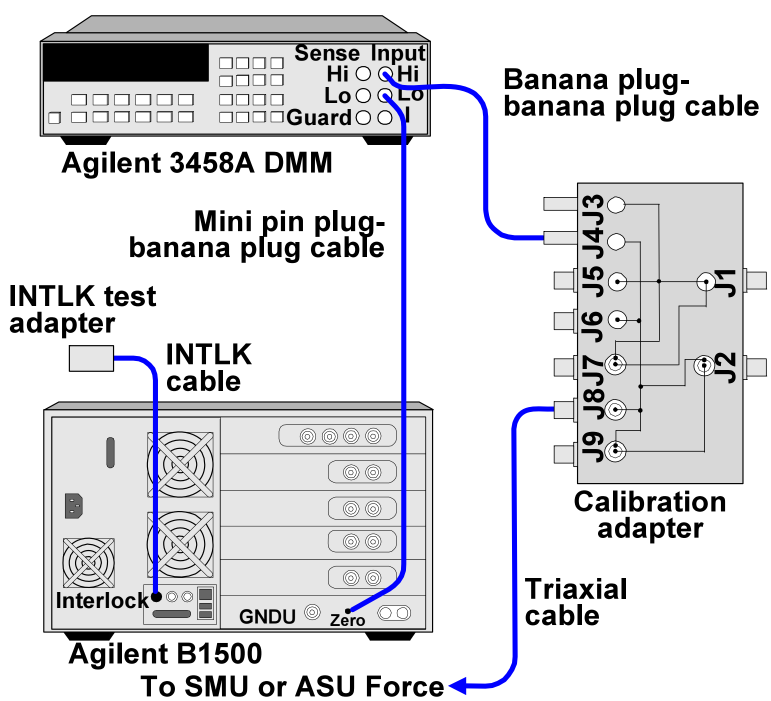
Required equipment

Triaxial cable (04142-61641)
INTLK cable (04155-61614)
Mini pin plug to banana plug cable (04155-61648)
Calibration adapter (04155-65041)
INTLK test adapter (04155-65043)
Banana plug to banana plug cable (Agilent 11058A)
Digital multimeter (Agilent 3458A)

Procedure

1. Connect DMM-Lo to the zero check terminal on the B1500A front panel.
2. Connect DMM-Hi to the calibration adapter J4.
3. Connect the INTLK test adapter to the Interlock terminal on the E527xA front panel with the INTLK cable.
4. Set the INTLK test adapter switch to 1 (ON).
5. Click **Continue**.
6. Connect the SMU Force or ASU Force to the calibration adapter J8 according to the displayed instruction.
7. Click **Continue**. The voltage setting test and voltage measurement test are executed.
8. Steps 6 and 7 are repeated until all of the selected SMUs are tested.

Figure 3-27 Connection for SMU voltage test



SMU current pre-test

This test is the pre-measurement for the SMU current test, and verifies the guard potential offset voltage.

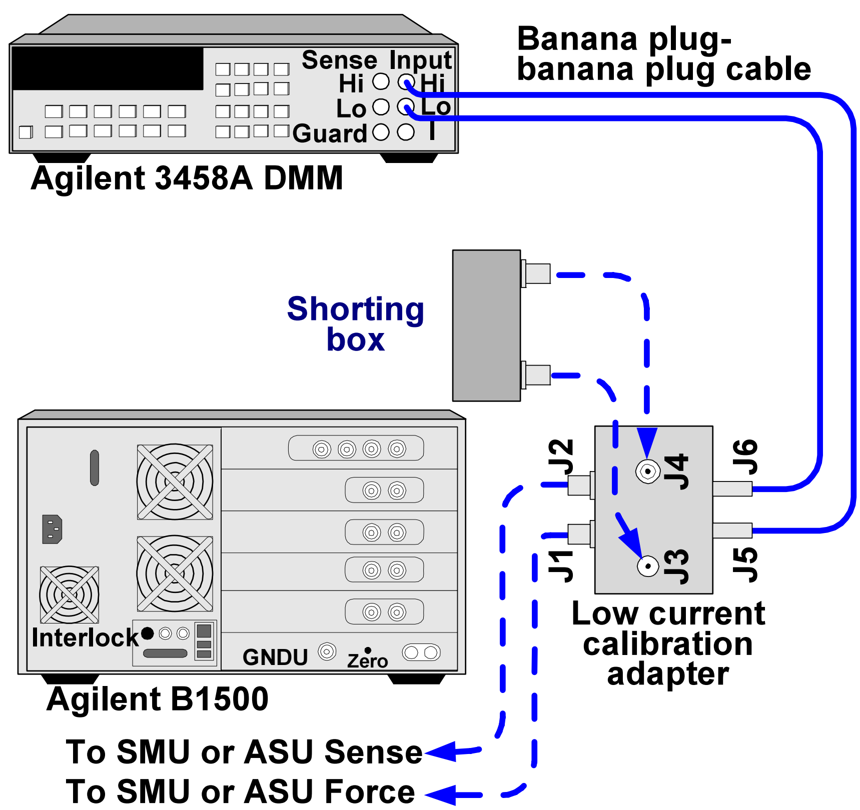
Required equipment

Triaxial cable (04142-61641)
Low current calibration adapter (E5299-65001)
Shorting box (04155-65042)
Banana plug to banana plug cable (Agilent 11058A)
Digital multimeter (Agilent 3458A)

Procedure

1. Connect DMM-Lo to the low current calibration adapter J6.
2. Connect DMM-Hi to the low current calibration adapter J5.
3. Connect the shorting box to the calibration adapter J3 and J4.
4. Click **Continue**.
5. Connect the SMU Force or ASU Force to the calibration adapter J1, SMU Sense or ASU Sense to the J2 according to the displayed instruction.
6. Click **Continue**. The SMU current pre-test is executed.
7. Steps 6 and 7 are repeated until all SMUs are tested.

Figure 3-28 Connection for SMU current pre-test



SMU current test (Lower than 10 µA ranges)

This test consists of the current setting test and current measurement test; it verifies the current setting and measurement accuracy. Note that the SMU current pre-test must pass before this test.

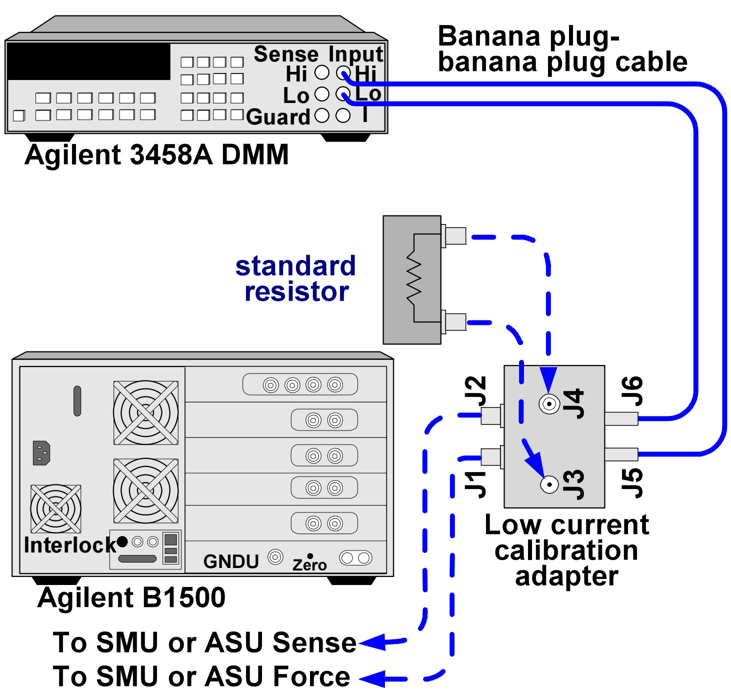
Required equipment

Triaxial cable (04142-61641)
Low current calibration adapter (E5299-65001)
Banana plug to banana plug cable (Agilent 11058A)
Standard resistor set (Agilent 16353A)
100 Gohm standard resistor (Agilent 16353H: Only for HRSMU or ASU)
Digital multimeter (Agilent 3458A)

Procedure

1. Connect DMM-Lo to the calibration adapter J6.
2. Connect DMM-Hi to the calibration adapter J5.
3. Connect the standard resistor to the calibration adapter J3 and J4 according to the displayed instruction.
4. Click **Continue**.
5. Connect the SMU Force or ASU Force to the calibration adapter J1, SMU Sense or ASU Sense to J2.
6. Click **Continue**. The current setting test and current measurement test are executed.
7. Steps 3 and 4 are repeated until all of the selected current ranges are tested.
8. Steps 1 through 8 are repeated until all of the SMUs are tested.

Figure 3-29 Connection for SMU Current test (Lower than 10 µA ranges)



SMU current test (for 100 µA to 1 A ranges)

This test consists of the current setting accuracy test and current measurement accuracy test; it verifies the current setting and measurement accuracy.

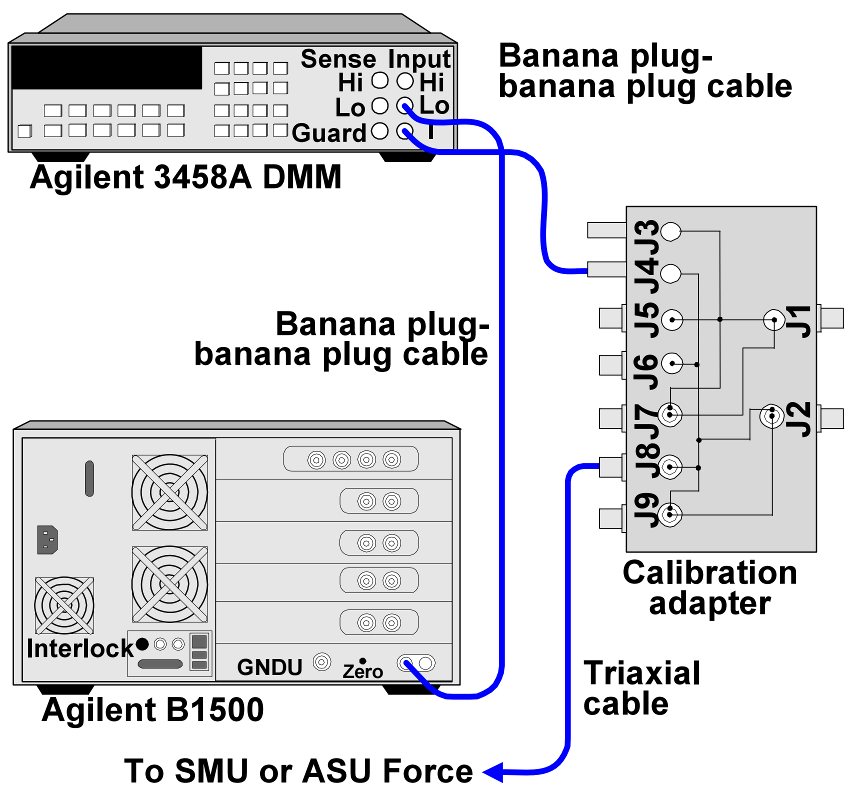
Required equipment

Triaxial cable (04142-61641)
Calibration adapter (04155-65041)
Banana plug to banana plug cable (Agilent 11058A)
Digital multimeter (Agilent 3458A)

Test procedure

1. Connect DMM-Lo to the circuit common terminal on the mainframe front panel.
2. Connect DMM-I to the calibration adapter J4.
3. Click **Continue**.
4. Connect the SMU Force or ASU Force to the calibration adapter J8 according to the displayed instruction.
5. Click **Continue**. The SMU current setting test and current measurement test are executed.
6. Steps 4 and 5 are repeated until all of the selected SMUs are tested.
7. Steps 1 through 6 are repeated until all of the selected current ranges are tested.

Figure 3-30 Connection for SMU current test (for 100 µA to 1 A ranges)



SMU CMR test

This test verifies the SMU common mode rejection accuracy.

Required equipment

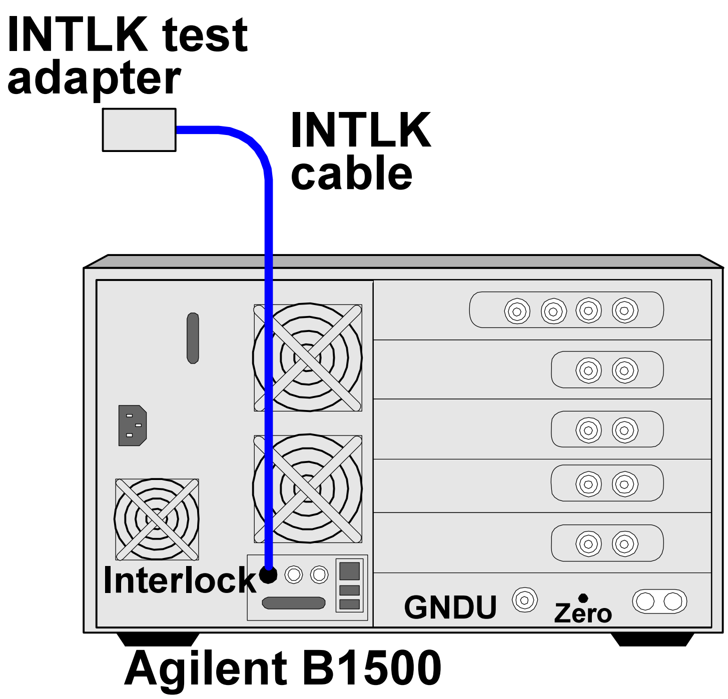
INTLK cable (04155-61614)

INTLK test adapter (04155-65043)

Test procedure

1. Disconnect all cables and plugs from the SMU. (Set the SMU to “open” condition.)
2. Connect the INTLK test adapter to the Interlock terminal on the B1500A front panel with the INTLK cable.
3. Set the INTLK test adapter switch to 1 (ON).
4. Click **Continue**. The SMU CMR test is executed.

Figure 3-31 Connection for SMU CMR test



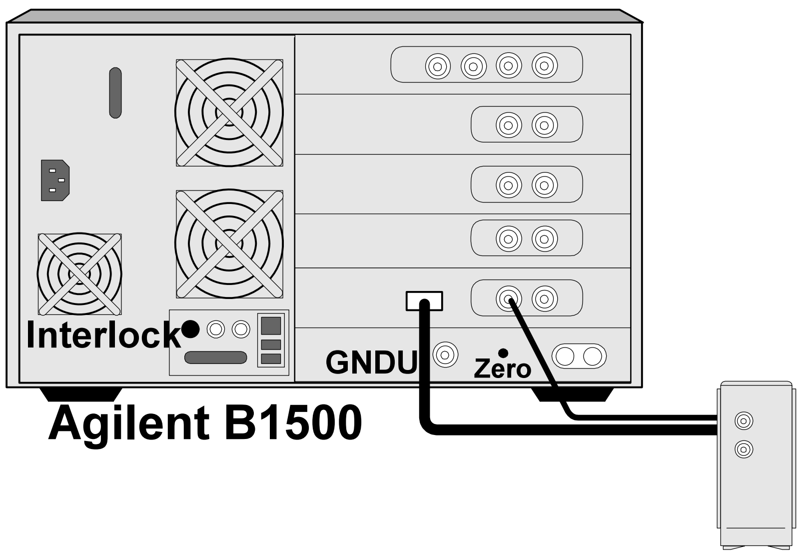
Serial interchange

After pass the all test items, serial number will be interchanged between B1527A HRSMU and E5288A ASU. The serial number of B1527A will be written on EEPROM of E5288A, the one of E5288A will be written on EEPROM of B1527A.

Test procedure

1. Disconnect all cables and plugs from the SMU. (Set the SMU to “open” condition.)
2. Click **Continue**. The SMU CMR test is executed.

Figure 3-32 Connection for serial interchange



CMU self-test

This test verifies CMU terminal function.

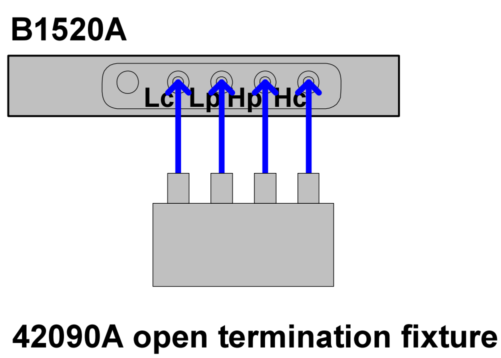
Required equipment

Open termination fixture (42090A)

Test procedure

1. Disconnect all cables and plugs from the CMU. (Set the CMU to “open” condition.)
2. Click **Continue**.
3. Connect the 42090A open termination fixture to CMU.
4. Click **Continue**. The CMU self-test is executed.

Figure 3-33 Connection for CMU self-est



CMU frequency accuracy test

This test verifies frequency accuracy of CMU internal frequency reference.

Required equipment

Frequency counter (53131A)

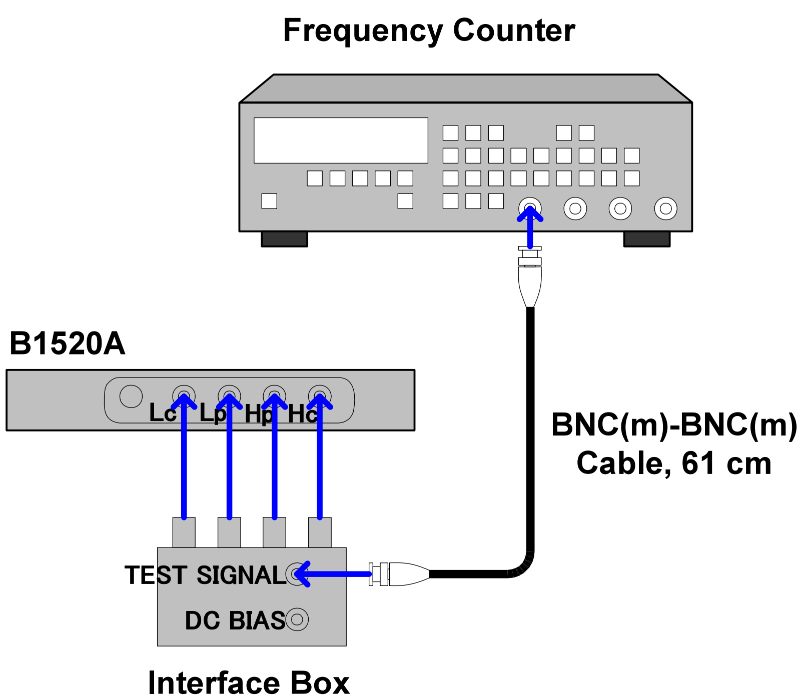
4TP-to-BNC interface box (04294-61002)

BNC(m) - BNC(m) cable, 61 cm (8120-1839)

Test procedure

1. Connect the 04294-61002 interface box to CMU.
2. Connect the 8120-1839 BNC - BNC cable to 53131A frequency counter and TEST SIGNAL terminal on interface box.
3. Click **Continue**. The CMU frequency accuracy test is executed.

Figure 3-34 Connection for CMU external test



CMU OSC level/monitor accuracy test

This test verifies CMU signal power level and monitor accuracy.

Required equipment

Multimeter (3458A)

Power meter (E4418A/B or E4419A/B)

Power sensor (8482A)

BNC(m) - BNC(m) cable, 61 cm (8120-1839)

Dual banana - BNC(f) adapter (1251-2277)

N(m) - BNC(m) adapter (1250-0077)

4TP - BNC interface box (04294-61002)

Open termination fixture (42090A)

Test procedure

1. Connect the 04294-61002 interface box to CMU. Connect the 8120-1839 BNC - BNC cable to TEST SIGNAL terminal on interface box and 3458A multimeter through 1251-2277 dual banana - BNC adapter. See Figure 3-35 for connection.
2. Click **Continue**.
3. Connect 42090A open termination fixture as shown in Figure 3-38.
4. Click **Continue**.
5. Connect 8482A power sensor to power meter as shown in Figure 3-36.
6. Click **Continue**. Power sensor will be calibrated with power meter.
7. Connect 8482A power sensor to power meter and TEST SIGNAL terminal on interface box through 1250-0077 N - BNC adapter as shown in Figure 3-37 and click **Continue**.
8. Disconnect the all equipment from CMU, and then connect 42090A open termination fixture to CMU.
9. Click **Continue**.

Figure 3-35 Connection for CMU OSC level/monitor accuracy test 1 of 4

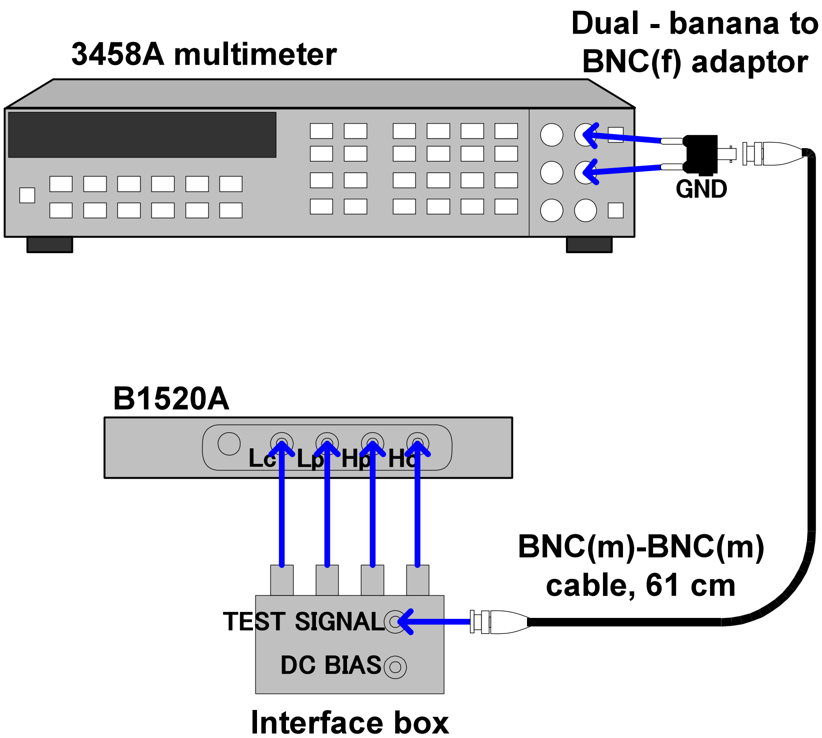


Figure 3-36 Connection for CMU OSC level/monitor accuracy test 2 of 4

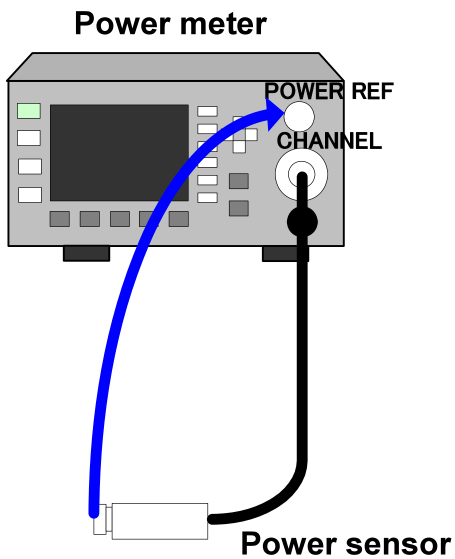


Figure 3-37 Connection for CMU OSC level/monitor accuracy test 3 of 4

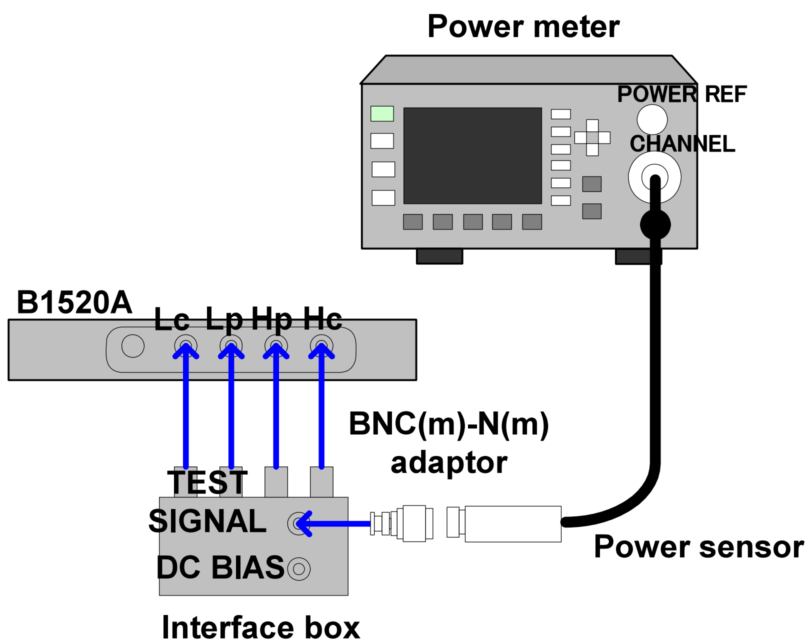
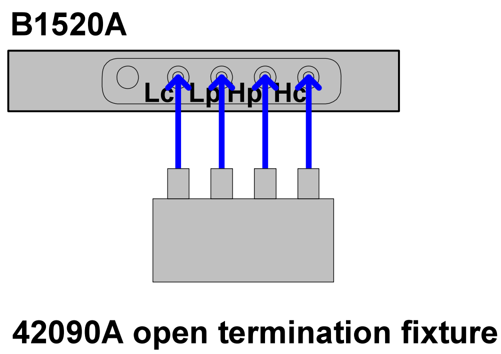


Figure 3-38 Connection for CMU OSC level/monitor accuracy test 4 of 4



CMU DC bias level/monitor accuracy test

This test verifies accuracy of DC bias level and monitor.

Required equipment

Multimeter (3458A)

BNC(m) - BNC(m) cable, 61 cm (8120-1839)

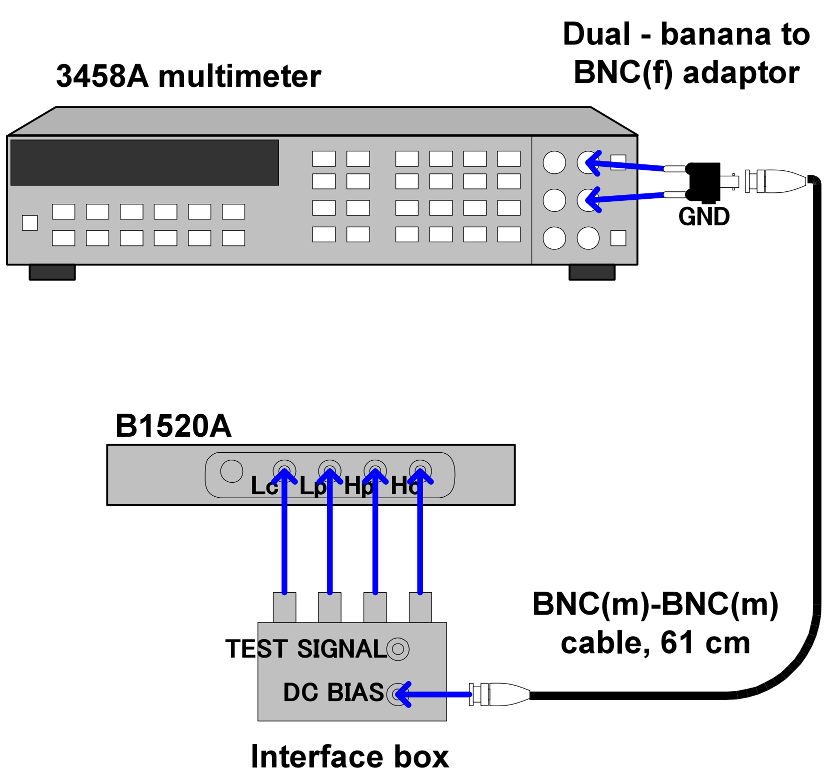
Dual-banana to BNC(f) adapter (1251-2277)

4TP-BNC interface box (04294-65002)

Test procedure

1. Connect interface box to CMU module.
2. Connect DC BIAS terminal of interface box and 3458A terminal with BNC cable through Dual-banana-to-BNC adapter.
3. Click **Continue**.

Figure 3-39 Connection for CMU DC bias level/monitor accuracy test



CMU measurement accuracy test

This test verifies measurement accuracy from 1 kHz to 5 MHz.

Required equipment

Standard capacitor set (16380A)

Standard capacitor set (16380C)

Standard resistor set (42030A)

Open termination fixture (42090A)

Short termination fixture (42091A)

Capacitor holder (B1500-65001)

BNC(f) - BNC(f) adapter (1250-0800 4ea)

100 Ω resister (04294-61001)

1.5 m test lead (N1300A-001)

3.0 m test lead (N1300A-002)

Test procedure

1. Connect the standard capacitor to CMU module with B1500-65001 capacitor holder. See Figure 3-40 for connection.
2. Click **Continue**.
3. Step 1 and 2 are repeated until all of the standard capacitors are tested.
4. Disconnect capacitor holder, and connect the standard resistor to CMU module. See Figure 3-41 for connection
5. Click **Continue**.
6. Step 4 and 5 are repeated until all of the standard resisters are tested.
7. Click **Continue**.
8. Step 1 to 7 are repeated for 1.5 m test lead and 3.0 m test lead. Before repeat step 1, test lead compensation with 100 Ω resister, open termination fixture, and short termination fixture will be needed. Follow the procedure provided by PV software.

Figure 3-40 Connection for CMU measurement accuracy test for standard capacitor

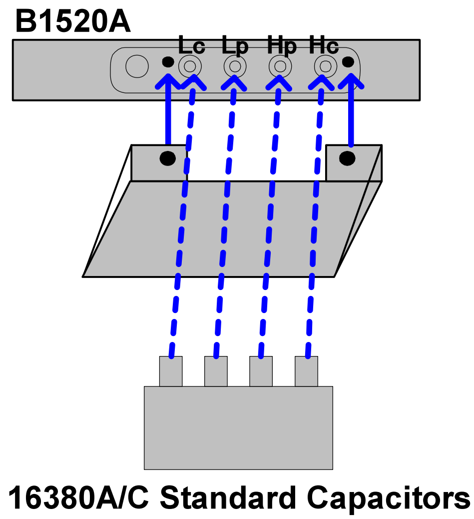


Figure 3-41 Connection for CMU measurement accuracy test for termination fixture and standard resistor

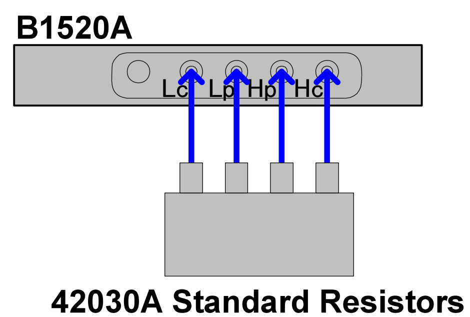
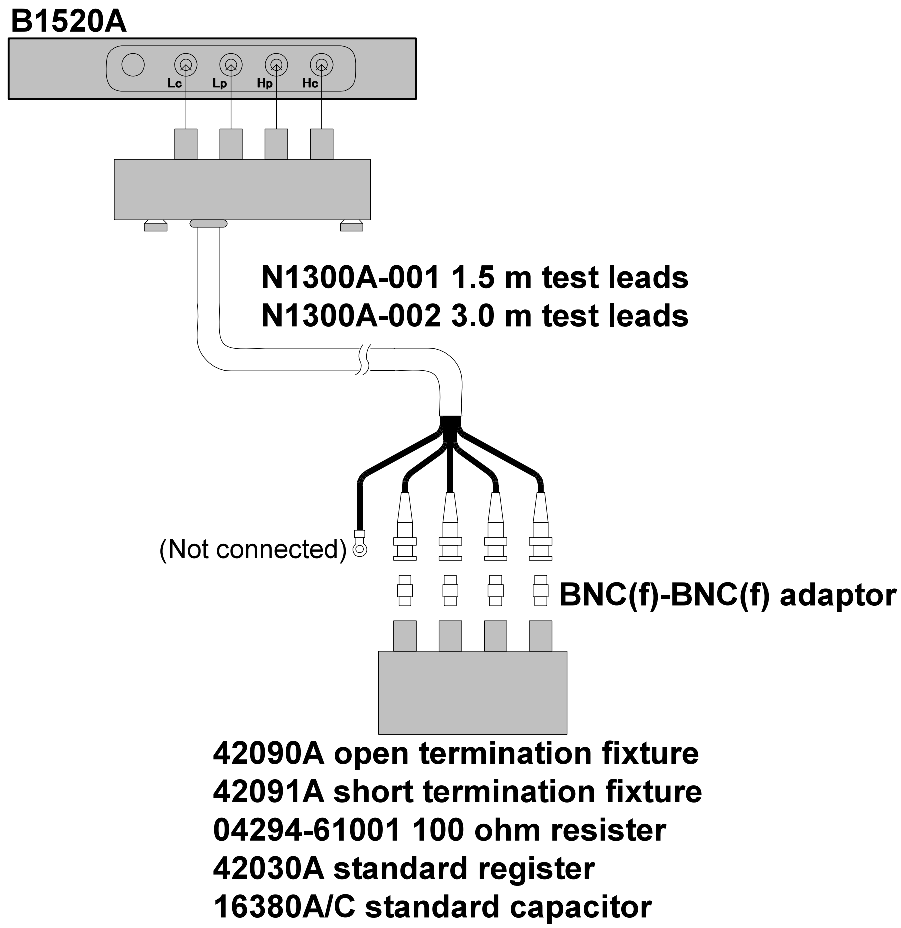


Figure 3-42 Connection for CMU measurement accuracy test with test leads



SPGU Pulse level test

The pulse level test confirms the output voltage capability for the output channels of the HV-SPGU modules.

The pulse level test takes about 1 minute for one module.

Required equipment

multimeter (3458A)

mini pin plug-banana plug cable (04155-61648)

calibration adapter (04155-65041)

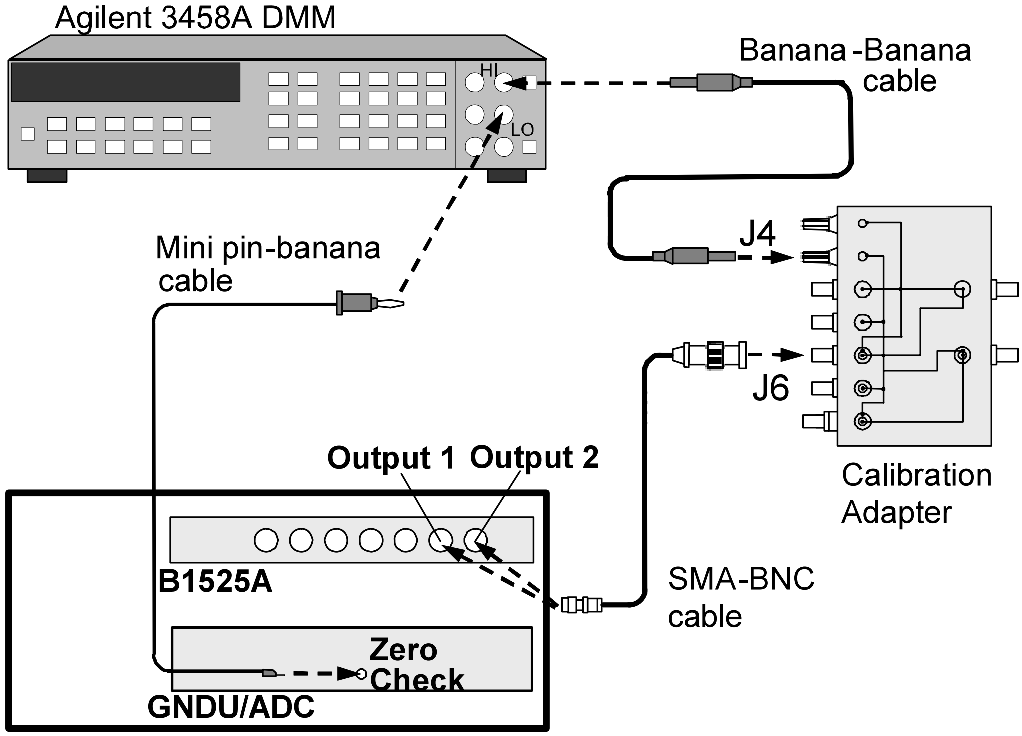
banana plug-banana-plug cable (11058A)

SMA-BNC cable 2m (E3190-61611)

Test procedure

1. Connect DMM-Lo to the GNDU zero check terminal using the mini pin-banana cable.
2. Connect DMM-Hi to the calibration adapter J4 using the banana-banana cable.
3. Connect the BNC connector of the SMA-BNC cable to the calibration adapter J6.
4. Click **Continue**.
5. Connect the SMA connector of the SMA-BNC cable to the SPGU Output 1 on the specified slot using the 5 lb-in torque wrench (8710-1582).
6. Click **Continue**. The test is executed for SPGU channel 1 of the specified slot.
7. Disconnect the SMA connector of the SMA-BNC cable, then connect it to the SPGU Output 2 on the specified slot using the 5 lb-in torque wrench (8710-1582).
8. Click **Continue**. The test is executed for SPGU channel 2 of the specified slot.
9. Steps 5 to 8 are repeated until all of the selected SPGUs are tested.

Figure 3-43 Connection for SPGU pulse level test



SPGU Pulse shape test

The pulse shape test confirms the pulse wave capability for the output channels of the HV-SPGU modules.

The pulse shape test takes about 10 minutes for one module.

Required equipment

oscilloscope (86100C with 86112A)

SMA-SMA cable 2m (N9158-61604), 2 ea

20 dB attenuator (8493C opt 020)

30 dB attenuator (8493C opt 030)

Test procedure

1. Install the 20 dB attenuator on the trigger terminal on the 86100C.
2. Connect the Trig Out terminal on the SPGU installed in youngest slot to the 20 dB attenuator using the SMA-SMA cable and 5 lb-in torque wrench (8710-1582).
3. Install the 30 dB attenuator on the channel 1 terminal of the 86112A.
4. Connect an end of the SMA-SMA cable to the 30 dB attenuator using 5 lb-in torque wrench (8710-1582).
5. Click **Continue**.
6. Connect the other end of the SMA-SMA cable to the SPGU Output 1 on the specified slot using the 5 lb-in torque wrench (8710-1582).
7. Click **Continue**. The test is executed for SPGU channel 1 of the specified slot.
8. Disconnect the SMA connector of the SMA-SMA cable from the SPGU Output 1, then connect it to the SPGU Output 2 on the specified slot using the 5 lb-in torque wrench (8710-1582).
9. Click **Continue**. The test is executed for SPGU channel 2 of the specified slot.
10. Steps 6 to 9 are repeated until all of the selected SPGUs are tested.

Figure 3-44 Connection for SPGU pulse shape test (1)

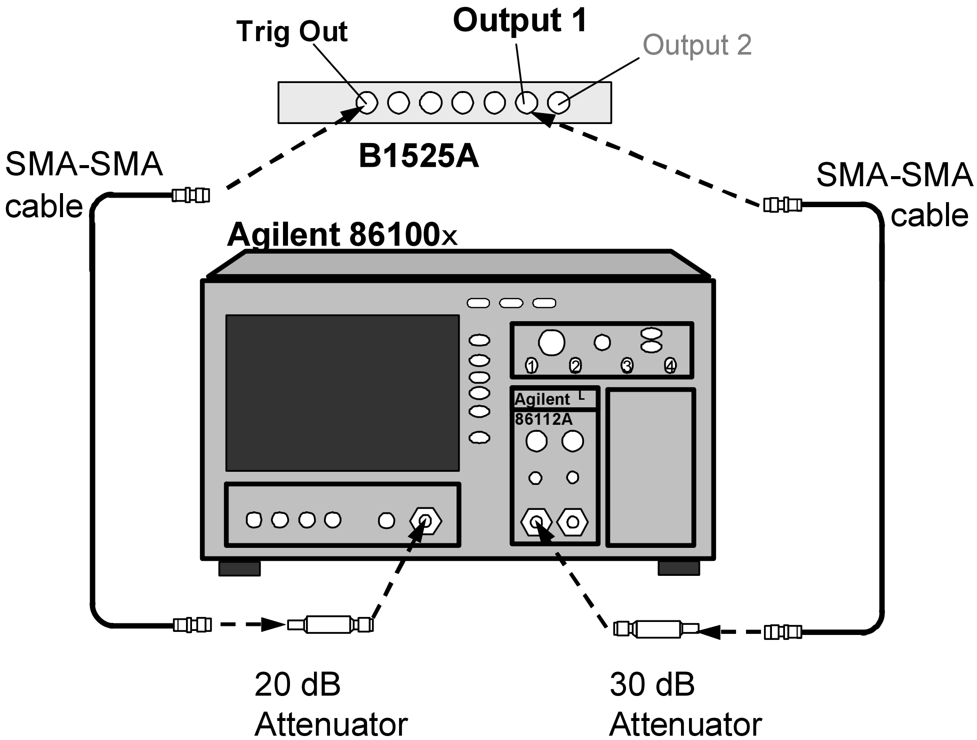
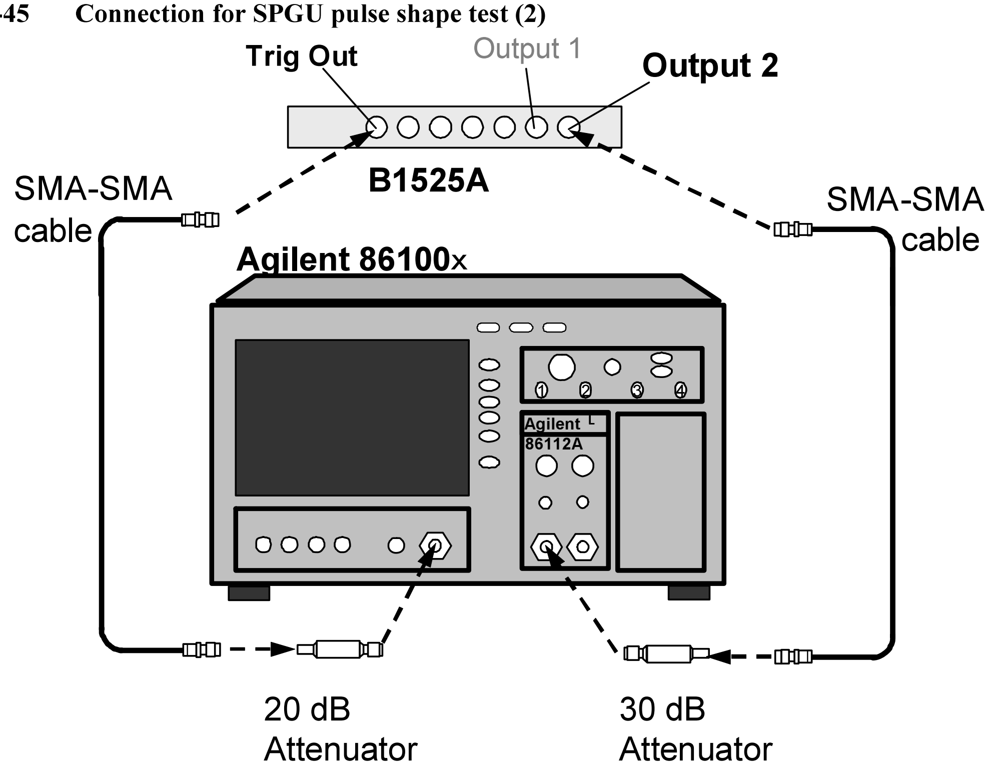


Figure 3-45 Connection for SPGU pulse shape test (2)



Calibration and Adjustment Procedure

This section describes the following calibration and adjustment procedure, required equipment, and cable connections for each calibration.

- “ADC reference voltage calibration”
- “ADC reference resistor calibration”
- “SMU range resistor calibration pre-test”
- “SMU range resistor calibration”
- “CMU NULL/VRD Direct/VRD heterodyne offset adjustment”
- “CMU NULL gain phase adjustment (without test leads)”
- “CMU MODEM offset adjustment”
- “CMU Hpot DC output/monitor adjustment”
- “CMU Hcur/Hpot AC level monitor adjustment (Low frequency)”
- “CMU Hcur/Hpot AC level monitor adjustment (High frequency)”
- “CMU Hcur AC level adjustment”
- “CMU relative Z adjustment”
- “CMU NULL gain phase adjustment (cable 1.5m, 3m)”
- “CMU absolute Z adjustment”
- “SPGU 50 ohm calibration”
- “SPGU ADC calibration”
- “SPGU skew calibration”

NOTE The ADC/SMU/CMU calibration must be done in the following order:

1. ADC reference voltage calibration
2. ADC reference resistor calibration
3. SMU/ASU calibration
4. CMU calibration

ADC reference voltage calibration

This calibration confirms the reference voltage values and updates them in the EEPROM of the GNDU/ADC module.

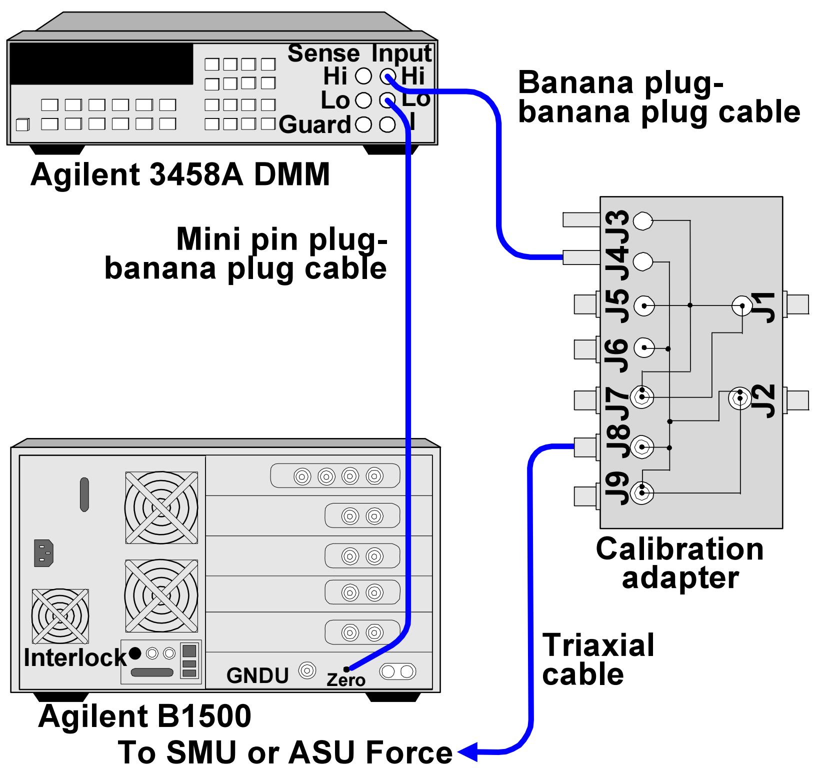
Required equipment

Triaxial cable (04142-61641)
Calibration adapter (04155-65041)
Mini pin plug to banana plug cable (04155-61648)
Banana plug to banana plug cable (Agilent 11058A)
Digital multimeter (Agilent 3458A)

Calibration procedure

1. Connect DMM-Lo to the zero check terminal on the mainframe front panel.
2. Connect DMM-Hi to the calibration adapter J4.
3. Click **Continue**. The ADC reference voltage calibration pre-test is executed.
4. Connect the SMU Force to the calibration adapter J8.
5. Click **Continue**. The ADC reference voltage calibration is executed.

Figure 3-46 Connection for reference voltage calibration



ADC reference resistor calibration

This calibration confirms the reference resistor values and updates them in the EEPROM of the GNDU/ADC module.

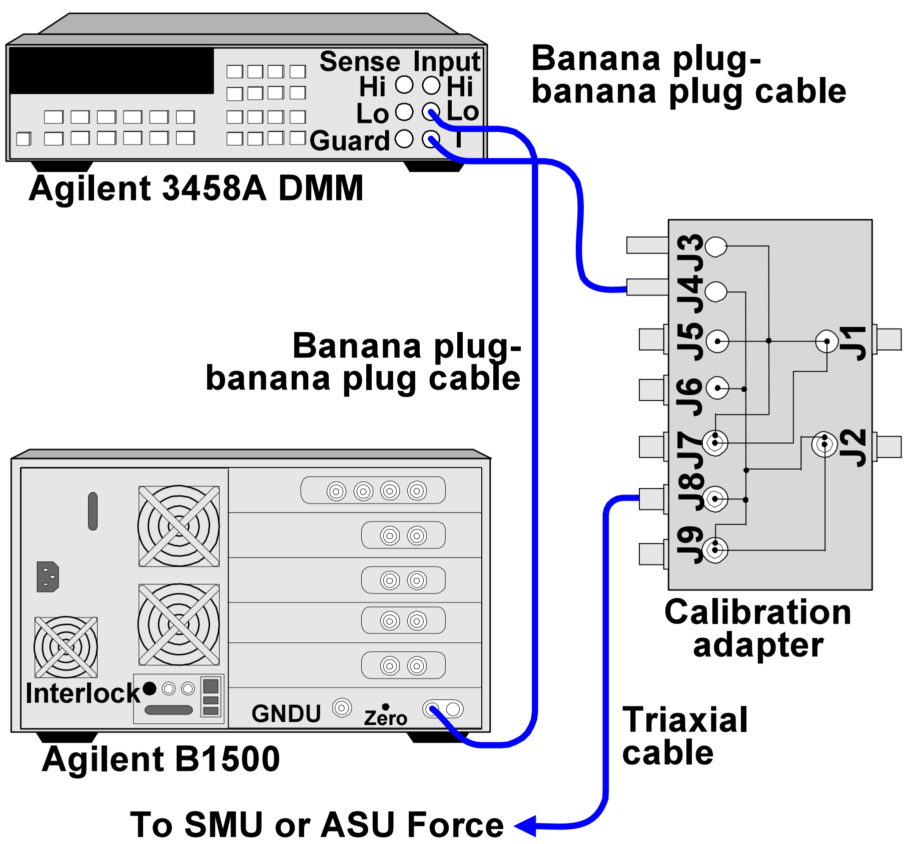
Required equipment

Triaxial cable (04142-61641)
Calibration adapter (04155-65041)
Banana plug to banana plug cable (Agilent 11058A)
Digital multimeter (Agilent 3458A)

Calibration procedure

1. Connect DMM-Lo to the circuit common terminal on the mainframe front panel.
2. Connect DMM-Hi to the calibration adapter J4.
3. Click **Continue**. The ADC reference resistor calibration pre-test is executed.
4. Connect the SMU Force to the calibration adapter J8.
5. Click **Continue**. The ADC reference resistor calibration is executed.

Figure 3-47 Connection for reference resistor calibration



SMU range resistor calibration pre-test

This test is the pre-measurement for the SMU range resistor calibration test, and verifies the guard potential offset voltage.

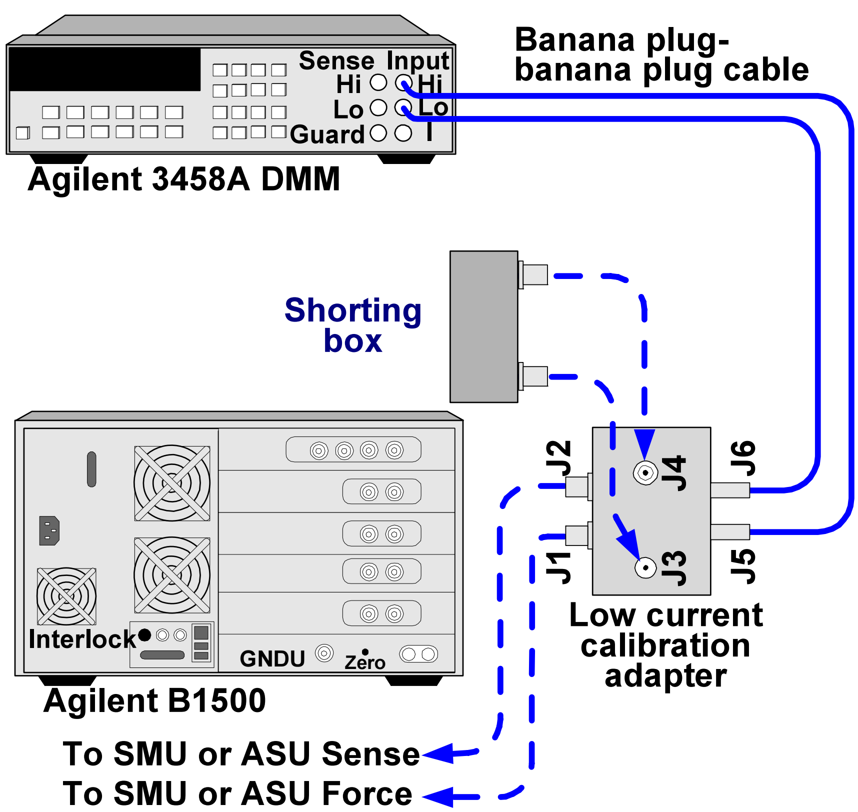
Required equipment

Triaxial cable (04142-61641)
Low current calibration adapter (E5299-65001)
Shorting box (04155-65042)
Banana plug to banana plug cable (Agilent 11058A)
Digital multimeter (Agilent 3458A)

Procedure

1. Connect DMM-Lo to the low current calibration adapter J6.
2. Connect DMM-Hi to the low current calibration adapter J5.
3. Connect the shorting box to the calibration adapter J3 and J4.
4. Click **Continue**.
5. Connect the SMU Force or ASU Force to the calibration adapter J1, SMU Sense or ASU Sense to the J2 according to the displayed instruction.
6. Click **Continue**. The SMU current pre-test is executed.
7. Steps 6 and 7 are repeated until all SMUs are tested.

Figure 3-48 Connection for SMU range resistor calibration pre-test



SMU range resistor calibration

This calibration confirms the 500 MΩ, 5 GΩ, and 50 GΩ range resistor value on each SMU and updates them in the EEPROM of each SMU. If ASU connected, 100 GΩ and 5 TΩ range resistor will be added to this calibration.

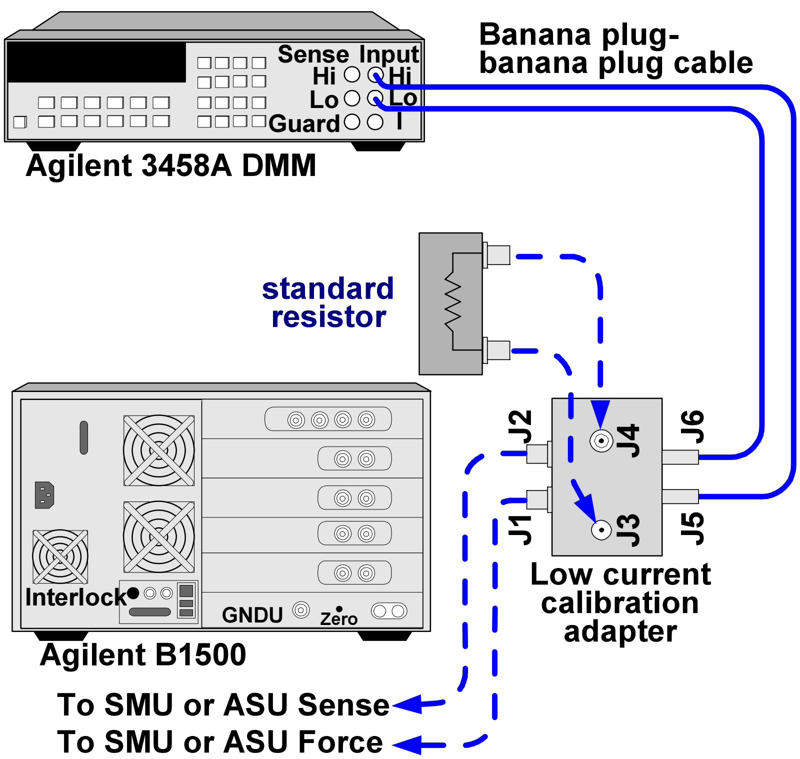
Required equipment

Triaxial cable (04142-61641)
Low current calibration adapter (E5299-65001)
Banana plug to banana plug cable (Agilent 11058A)
BNC shorting cap (1250-0929)
Standard resistor set (Agilent 16353A)
Digital multimeter (Agilent 3458A)

Calibration procedure

1. Connect DMM-Lo to the calibration adapter J6.
2. Connect DMM-Hi to the calibration adapter J5.
3. Connect the standard resistor to the calibration adapter J3 and J4.
4. Connect the SMU Force or ASU Force to the calibration adapter J1, SMU Sense or ASU Sense to J2.
5. Click **Continue**. The SMU range resistor calibration is executed.
6. Steps 5 and 6 are repeated until all of the selected SMUs are calibrated.

Figure 3-49 Connection for SMU range resistor calibration for B1500A



CMU NULL/VRD Direct/VRD heterodyne offset adjustment

This adjustment adjusts the offset of NULL and VRD.

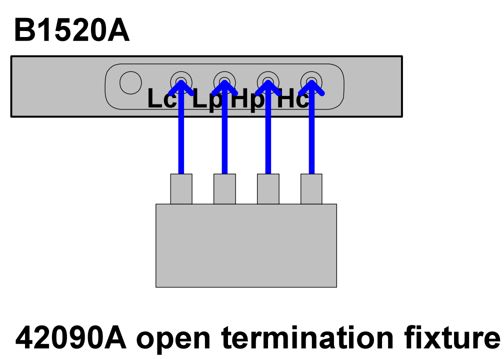
Required equipment

Open termination fixture (42090A)

Calibration procedure

1. Connect open termination fixture to CMU module.
2. Execute adjustment.

Figure 3-50 Connection for CMU NULL/VRD Direct/VRD heterodyne offset adjustment



CMU NULL gain phase adjustment (without test leads)

This adjustment adjusts the gain and phase for NULL loop.

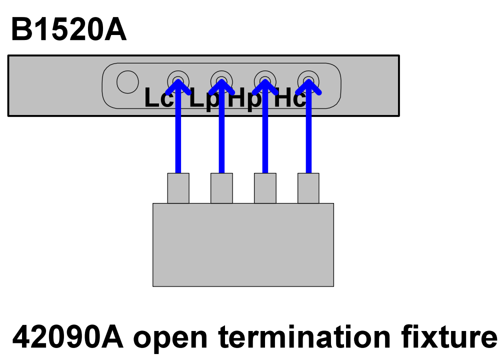
Required equipment

Open termination fixture (42090A)

Calibration procedure

1. Connect open termination fixture to CMU module.
2. Execute adjustment.

Figure 3-51 Connection for CMU NULL gain phase adjustment (cable 0m)



CMU MODEM offset adjustment

This adjustment adjusts the offset for NULL loop.

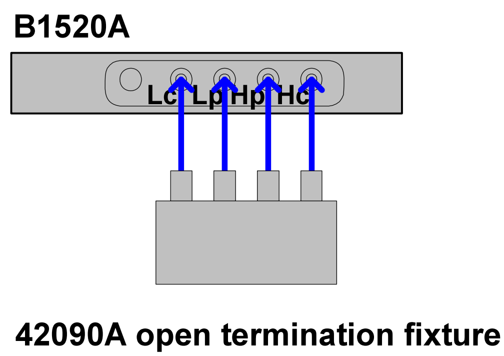
Required equipment

Open termination fixture (42090A)

Calibration procedure

1. Connect open termination fixture to CMU module.
2. Execute adjustment.

Figure 3-52 Connection for CMU MODEM offset adjustment



CMU Hpot DC output/monitor adjustment

This adjustment adjusts the voltage offset between high (Hc, Hp) and low (Lc, Lp).

Required equipment

Multimeter (3458A)

BNC(m) - BNC(m) cable, 61 cm (8120-1839)

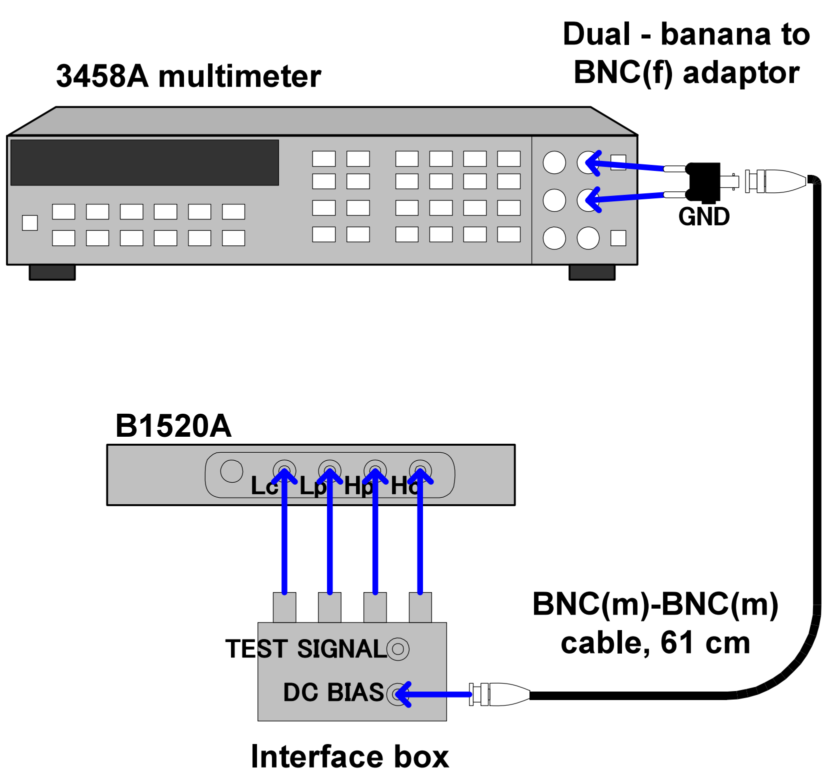
Dual-banana to BNC(f) adapter (1251-2277)

4TP-BNC interface box (04294-65002)

Calibration procedure

1. Connect interface box to CMU module.
2. Connect DC BIAS terminal of interface box and 3458A terminal with BNC cable through Dual-banana-to-BNC adapter.
3. Execute adjustment.

Figure 3-53 Connection for CMU Hpot DC output/monitor adjustment



CMU Hcur/Hpot AC level monitor adjustment (Low frequency)

This adjustment adjusts the Hcur/Hpot AC level monitor less than 1MHz.

Required equipment

Multimeter (3458A)

BNC(m) - BNC(m) cable, 61 cm (8120-1839)

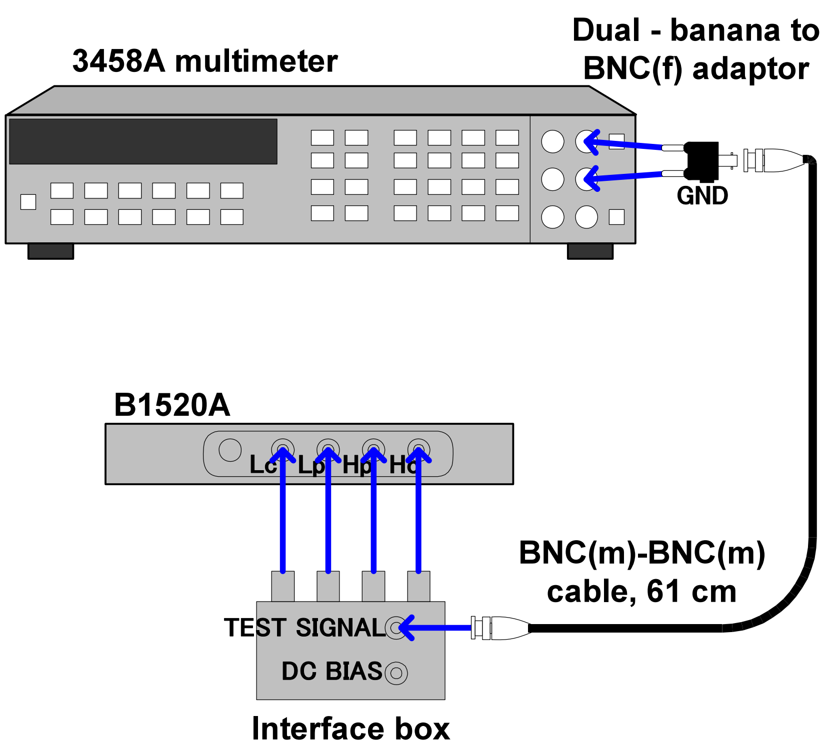
Dual-banana to BNC(f) adapter (1251-2277)

4TP-BNC interface box (04294-65002)

Calibration procedure

1. Connect interface box to CMU module.
2. Connect TEST SIGNAL terminal of interface box and 3458A terminal with BNC cable through Dual-banana-to-BNC adapter.
3. Execute adjustment.

Figure 3-54 Connection for CMU Hcur/Hpot AC level monitor adjustment (Low frequency)



CMU Hcur/Hpot AC level monitor adjustment (High frequency)

This adjustment adjusts the Hcur/Hpot AC level monitor more than 1MHz.

Required equipment

Power meter (E4418A/B or E4419A/B)

Power sensor (8482A)

Dual-banana to BNC(f) adapter (1251-2277)

N(m) - BNC(m) adapter (1250-0077)

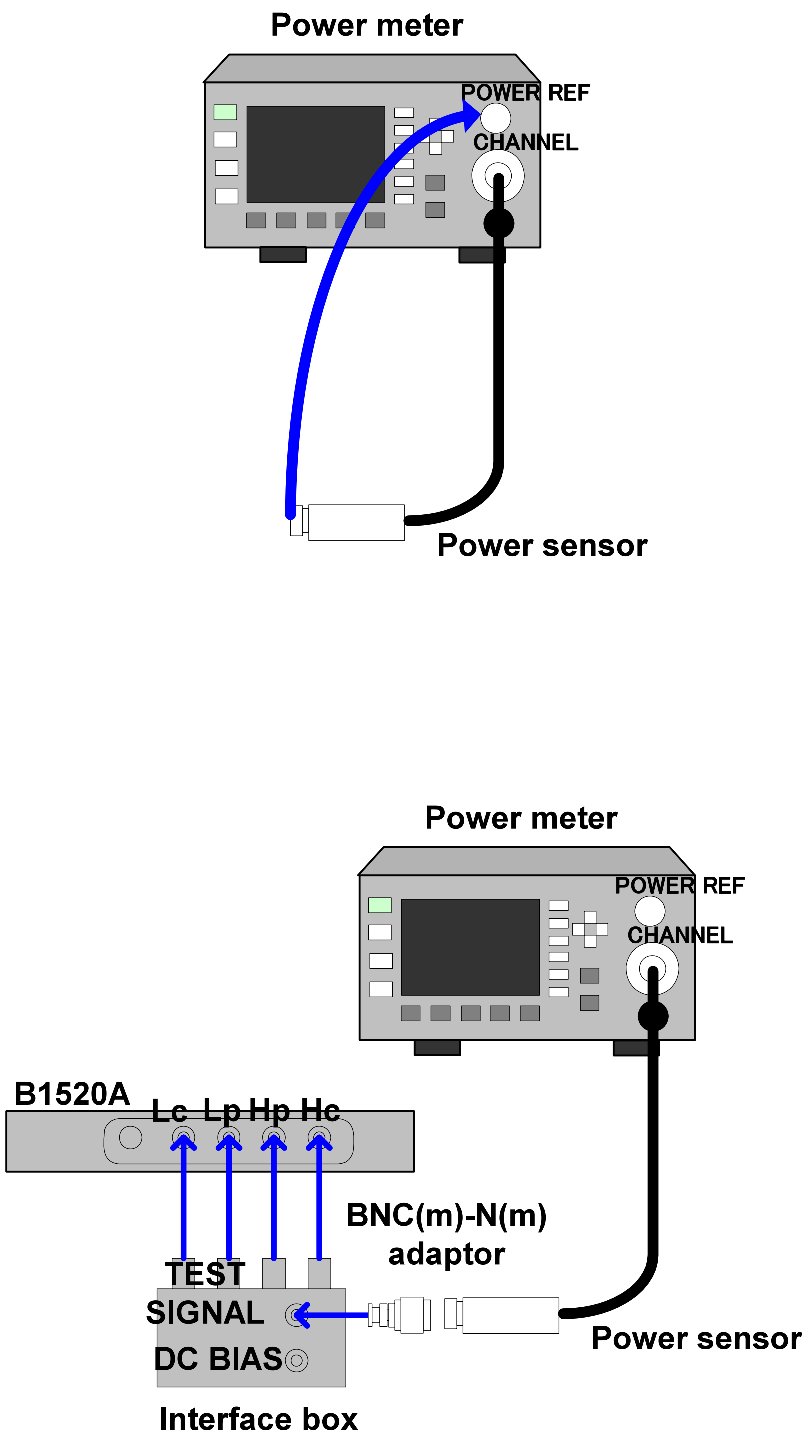
4TP-BNC interface box (04294-65002)

Open termination fixture (42090A)

Calibration procedure

1. Connect the 8482A power sensor to power meter as Figure 3-55.
2. Execute adjustment. Power sensor will be calibrated for power meter.
3. Connect interface box to CMU, and connect power sensor to power meter and TEST SIGNAL terminal on interface box through N(m) - BNC(m) adapter. See Figure 3-55.
4. Execute adjustment.

Figure 3-55 Connection for CMU Hcur/Hpot AC level monitor adjustment (High frequency)



CMU Hcur AC level adjustment

This adjustment adjusts the AC level output.

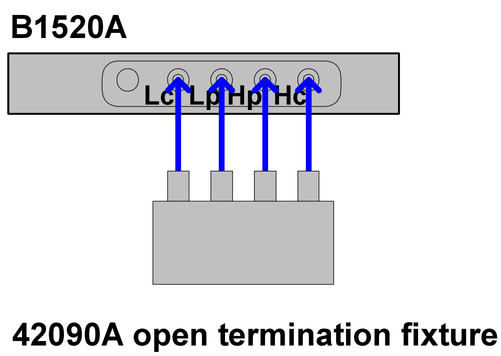
Required equipment

Open termination fixture (42090A)

Calibration procedure

1. Connect open termination fixture to CMU module.
2. Execute adjustment.

Figure 3-56 Connection for CMU Hcur AC level adjustment



CMU relative Z adjustment

This adjustment adjusts the range impedance.

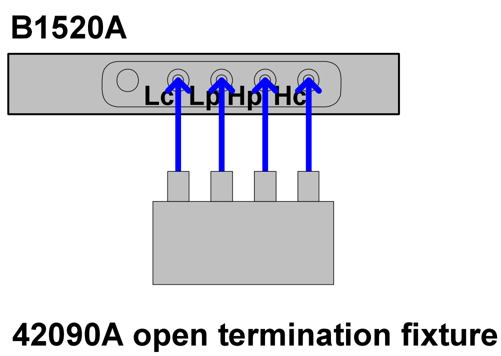
Required equipment

Open termination fixture (42090A)

Calibration procedure

1. Connect open termination fixture to CMU module.
2. Execute adjustment.

Figure 3-57 Connection for CMU relative Z adjustment



CMU NULL gain phase adjustment (cable 1.5m, 3m)

This adjustment adjusts the gain and phase for NULL loop.

Required equipment

Open termination fixture (42090A)

BNC(f) - BNC(f) adapter (1250-0080 4ea)

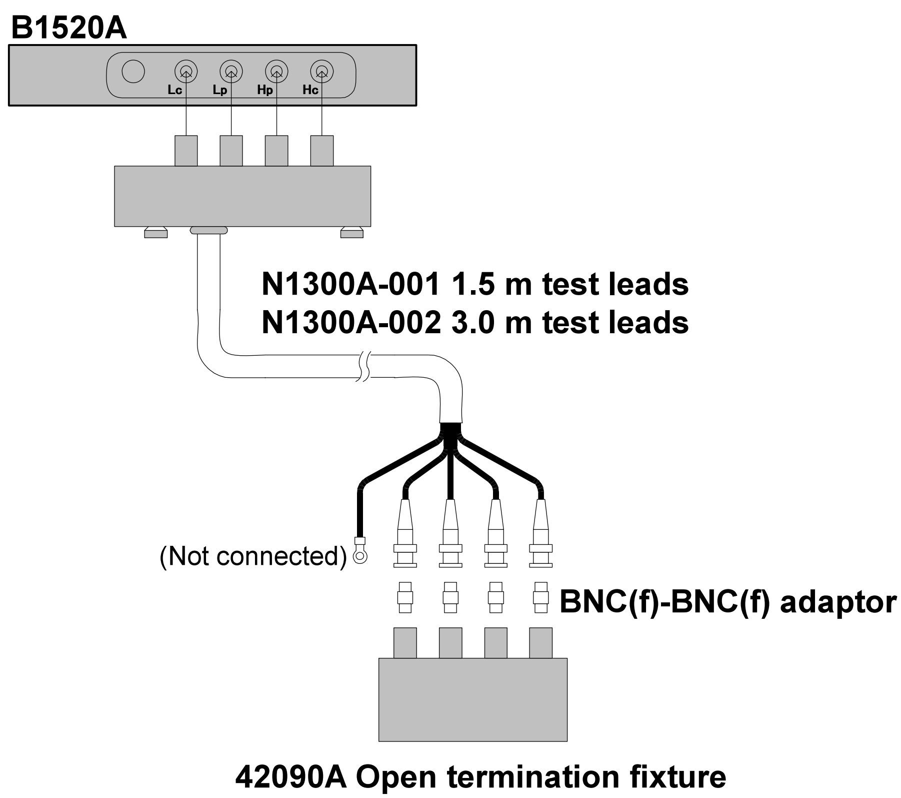
1.5 m test leads (N1300A-001)

3.0 m test leads (N1300A-002)

Calibration procedure

1. Connect N1300A-001 1.5 m test lead to CMU and 42090A open termination fixture through 1250-0080 BNC-BNC adapter.
2. Click continue.
3. Connect N1300A-002 3.0 m test lead to CMU and 42090A open termination fixture through 1250-0080 BNC-BNC adapter.
4. Click continue.

Figure 3-58 Connection for CMU NULL gain phase adjustment (cable 1.5m, 3m)



CMU absolute Z adjustment

This adjustment adjusts the absolute impedance for CMU module, and compensate test lead.

Required equipment

Standard capacitor set (16380A 100 pF)

Capacitor holder (B1500-65001)

BNC(f) - BNC(f) adapter (1250-0080 4ea)

100 Ω resistor (04294-61001)

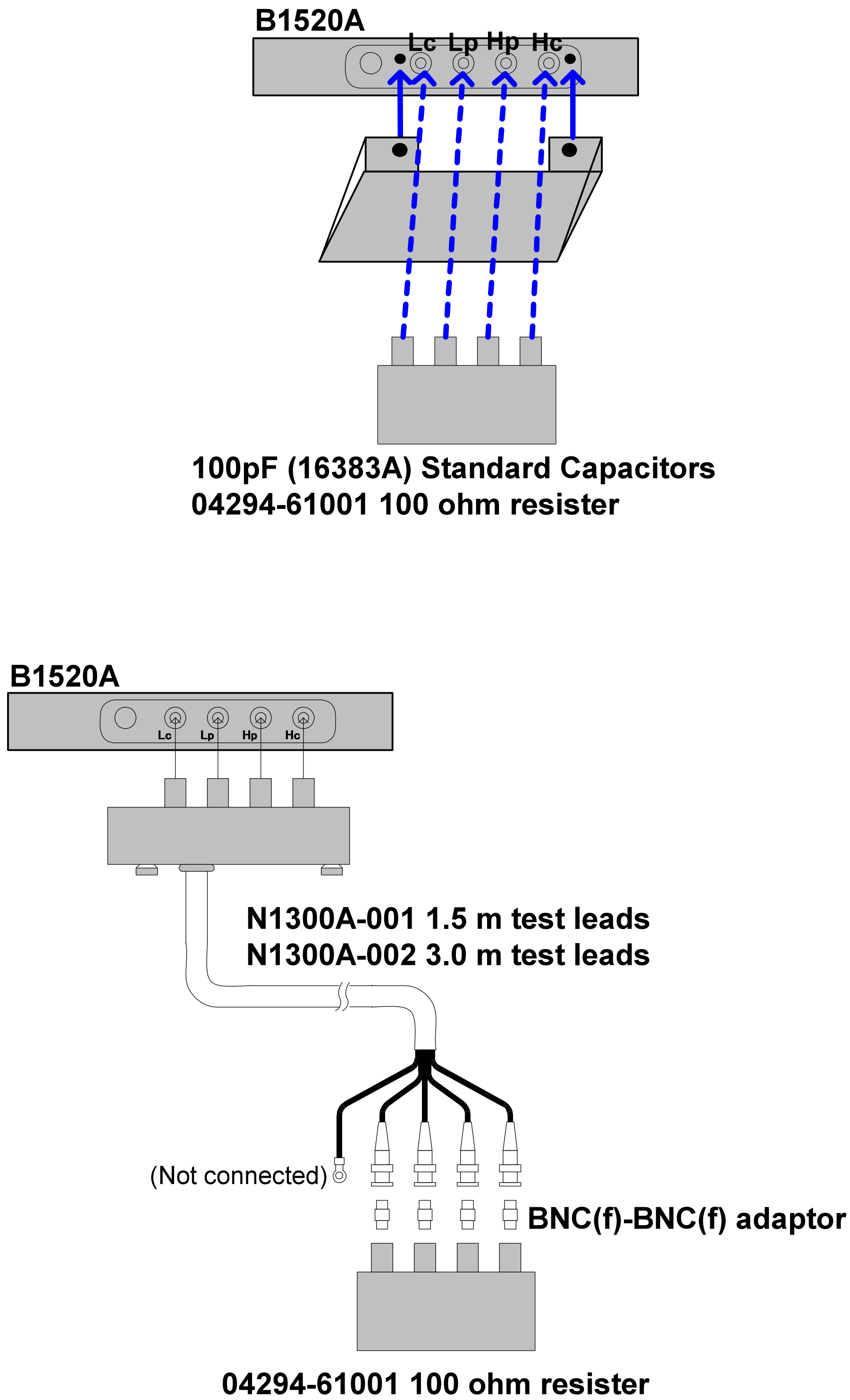
1.5 m test lead (N1300A-001)

3.0 m test lead (N1300A-002)

Calibration procedure

1. Connect 100 pF standard capacitor to CMU. See Figure 3-59.
2. Execute adjustment.
3. Connect 100 Ω resister to CMU.
4. Execute adjustment.
5. Connect 1.5 m testlead to CMU and 100 Ω resistor through BNC-BNC adapter. See Figure 3-59.
6. Execute adjustment.
7. Connect 3.0 m testlead to CMU and 100 Ω resistor through BNC-BNC adapter. See Figure 3-59.
8. Execute adjustment.

Figure 3-59 Connection for CMU absolute Z adjustment



SPGU 50 ohm calibration

This calibrates the output resistance on each channel of the HV-SPGU modules.

Required equipment

multimeter (3458A)

BNC-banana plug (1251-2277)

BNC shorting cap (1250-0929)

50 ohm feedthru (04192-61002)

SMA-BNC cable (E3190-61611)

Calibration procedure

1. Connect the BNC shorting cap to DMM-Lo/Hi using the BNC-banana plug.
2. Click **Continue**. The calibration is executed for getting the reference data.
3. Disconnect the BNC shorting cap from the BNC-banana plug, then connect the 50 ohm Feedthu to the BNC-banana plug.
4. Click **Continue**. The calibration is executed for getting the reference data.
5. Connect the specified SPGU Output 1 to the BNC-banana plug using the SMA-BNC cable with the 50 ohm Feedthru.
6. Click **Continue**. The calibration is executed for SPGU channel 1 of the specified slot.
7. Connect the specified SPGU Output 1 to the BNC-banana plug using the SMA-BNC cable without the 50 ohm Feedthru.
8. Click **Continue**. The calibration is executed for SPGU channel 1 of the specified slot.
9. Connect the specified SPGU Output 2 to the BNC-banana plug using the SMA-BNC cable with the 50 ohm Feedthru.
10. Click **Continue**. The calibration is executed for SPGU channel 2 of the specified slot.
11. Connect the specified SPGU Output 2 to the BNC-banana plug using the SMA-BNC cable without the 50 ohm Feedthru.
12. Click **Continue**. The calibration is executed for SPGU channel 2 of the specified slot.
13. Steps 5 to 12 are repeated until all of the selected SPGUs are tested.

Figure 3-60 Connection for SPGU 50 ohm calibration (1)

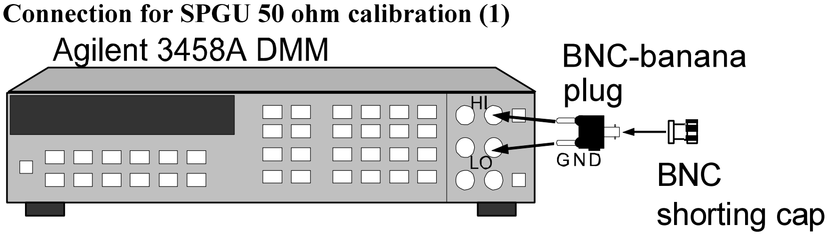


Figure 3-61 **Connection for SPGU 50 ohm calibration (2)**

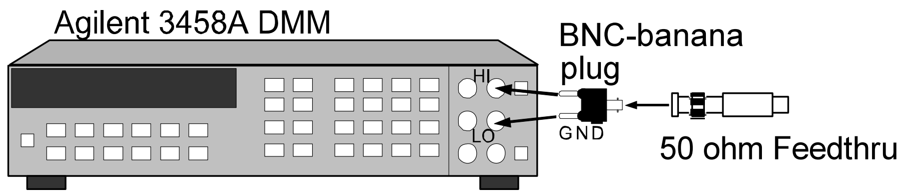


Figure 3-62 **Connection for SPGU 50 ohm calibration (3)**

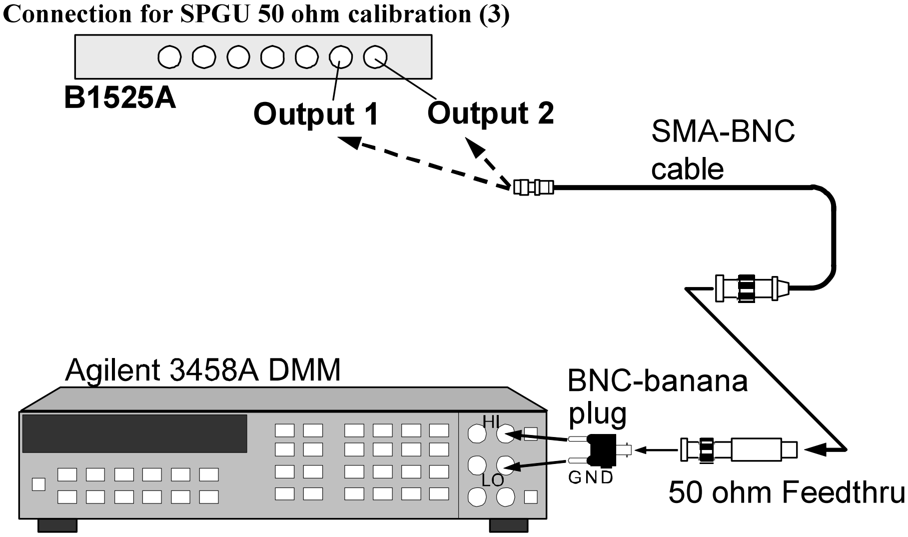
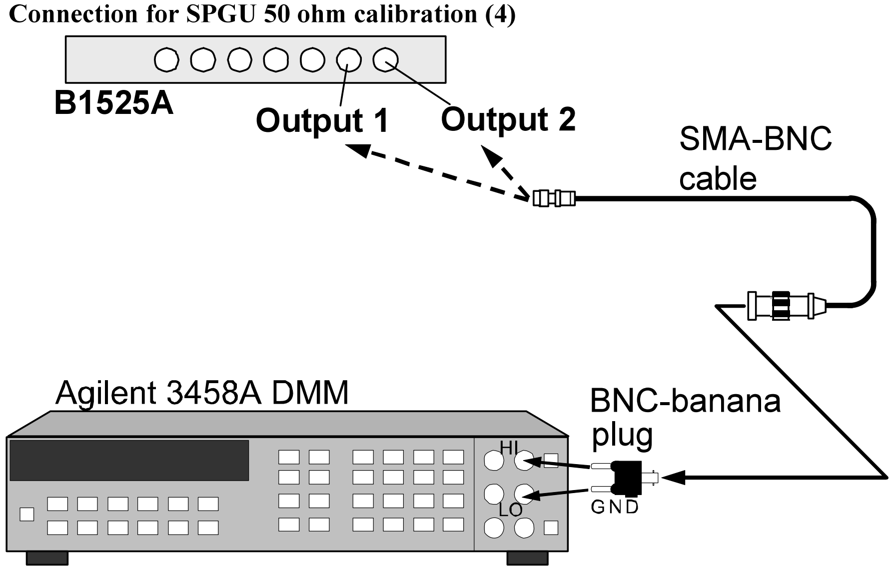


Figure 3-63 **Connection for SPGU 50 ohm calibration (4)**



SPGU ADC calibration

This calibrates the ADC on each channel of the HV-SPGU modules.

Required equipment

multimeter (3458A)

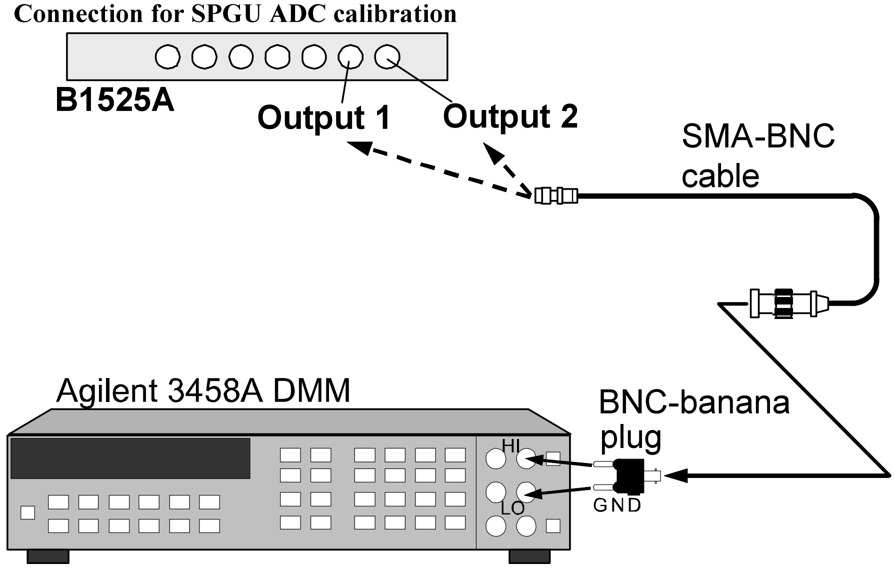
BNC-banana plug (1251-2277)

SMA-BNC cable (E3190-61611)

Calibration procedure

1. Connect the SMA-BNC cable to DMM-Lo/Hi using the BNC-banana plug.
2. Click **Continue**.
3. Connect the SMA connector of the SMA-BNC cable to the SPGU Output 1 on the specified slot using the 5 lb-in torque wrench (8710-1582).
4. Click **Continue**. The calibration is executed for SPGU channel 1 of the specified slot.
5. Disconnect the SMA connector of the SMA-BNC cable, then connect it to the SPGU Output 2 on the specified slot using the 5 lb-in torque wrench (8710-1582).
6. Click **Continue**. The calibration is executed for SPGU channel 2 of the specified slot.
7. Steps 3 to 6 are repeated until all of the selected SPGUs are tested.

Figure 3-64 Connection for SPGU ADC calibration



SPGU skew calibration

This calibrates the timing skew between the HV-SPGU modules if multiple HV-SPGU modules are installed.

Required equipment

oscilloscope (86100C with 86112A)

SMA-SMA cable 2m (N9158-61604), 2 ea

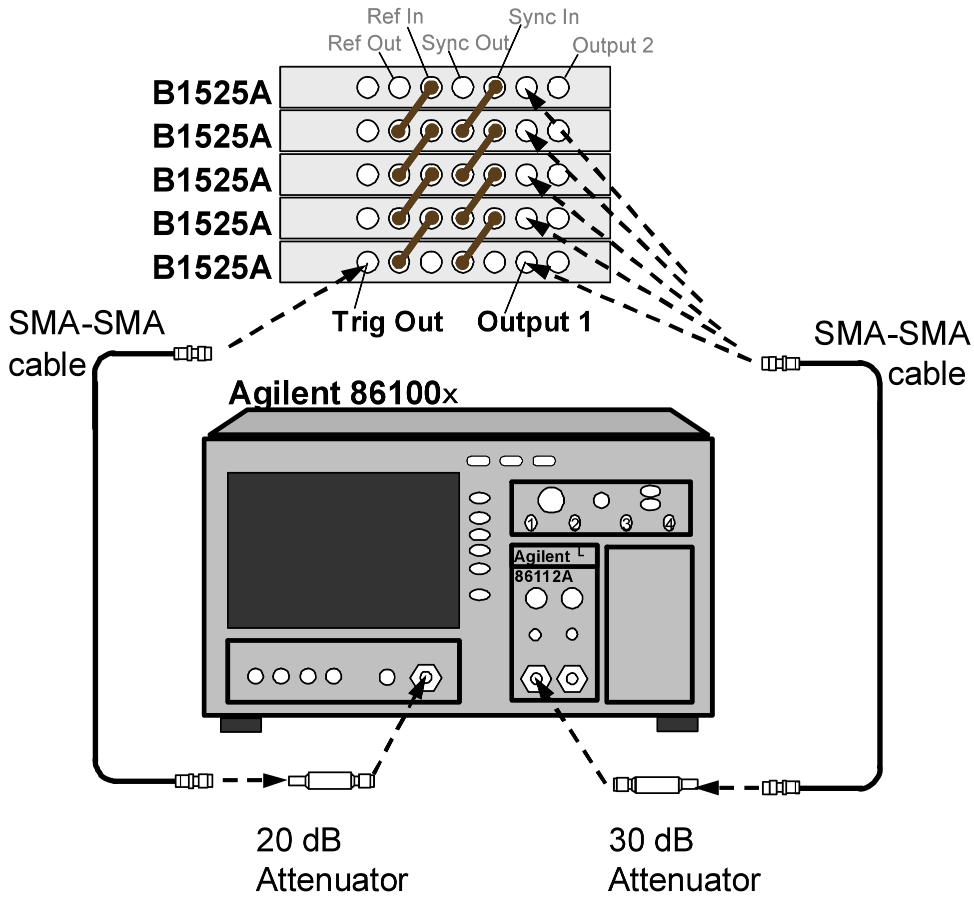
20 dB attenuator (8493C opt 020)

30 dB attenuator (8493C opt 030)

Calibration procedure

1. Install the 20 dB attenuator on the trigger terminal on the 86100C.
2. Connect the Trig Out terminal on the SPGU installed in youngest slot to the 20 dB attenuator using the SMA-SMA cable and 5 lb-in torque wrench (8710-1582).
3. Install the 30 dB attenuator on the channel 1 terminal of the 86112A.
4. Connect an end of the SMA-SMA cable to the 30 dB attenuator using 5 lb-in torque wrench (8710-1582).
5. Click **Continue**.
6. Connect the other end of the SMA-SMA cable to the SPGU Output 1 on the specified slot using the 5 lb-in torque wrench (8710-1582).
7. Click **Continue**. The skew data is measured for the SPGU module in the specified slot.
8. Repeat steps 6 and 7 according to the displayed instructions, if non-calibrated modules are present.

Figure 3-65 Connection for SPGU skew calibration



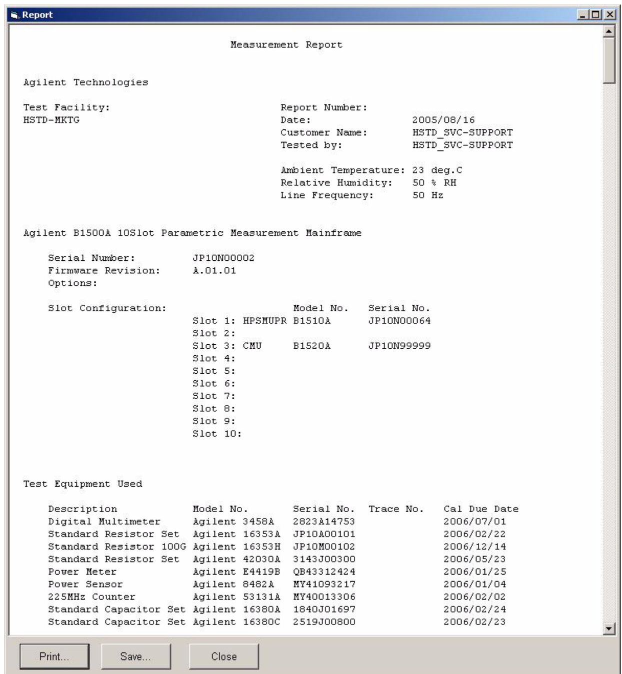
Printing Test Result

The test results can be printed out on paper or can be shown on the display. To report the test results, use the following procedure.

NOTE This report function formats and displays the latest test result only. If you execute the performance verification repeatedly, use the `Advanced Report` tab.

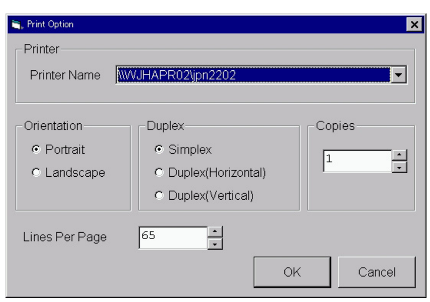
1. Click **Report** on the `Run` tab. The Report Window appears as shown in Figure 3-66.

Figure 3-66 Report window



2. Click **Print**. The Print Option window appears as shown in Figure 3-67.

Figure 3-67 Print Option window



3. Enter or select appropriate print options.
4. Click **OK**. The test report is printed out to the specified printer with the specified print options.

Advanced test data edit

This section describes the advanced test data edit function provided by the calibration software.

To store formatted data in a text file

1. Click **Save** on Report window.
2. Enter the file name you want to store the data.
3. Click **OK**. The formatted data is stored in the specified file.

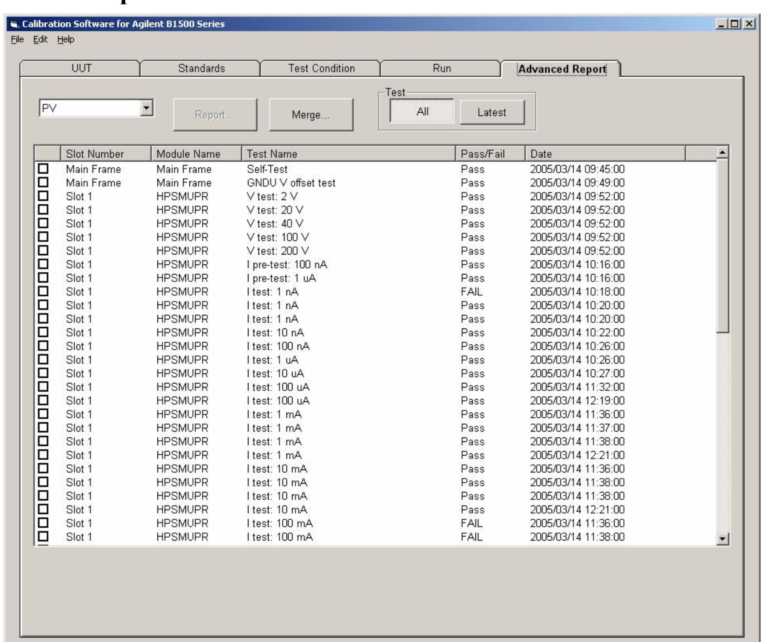
To merge two test data

1. Open the `Advanced Report` tab by clicking the tab.
2. Click **Merge** in the `Advanced Report` tab.
3. Enter the file name you want to merge.
4. Click **OK**. The specified file is merged into the file specified in Result File.

To print out a part of test data

1. Open the `Advanced Report` tab by clicking the tab.
2. Click **All** in the `Advanced Report` tab. All test results included in the result file appears in the window.

Figure 3-68 Advanced Report tab



3. Select a test name in the `Advanced Report` tab.
4. Click **Report** in the `Advance Report` tab. The Report window appears and displays selected test data.

To edit test report format

The test result file is stored in CSV format. If you use an editor that can read CSV format, you can format the test data as you like.

Test data example

Figure 3-69 through Figure 3-78 shows an example of the formatted test data.

Figure 3-69 B1500A test record example (1/10)

```
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                                 Measurement Report

Agilent Technologies

Test Facility:                             Report Number:
HSTD-MKTG                                  Date:                2005/08/16
                                           Customer Name:       HSTD_SVC-SUPPORT
                                           Tested by:           HSTD_SVC-SUPPORT

                                           Ambient Temperature: 23 deg.C
                                           Relative Humidity:   50 % RH
                                           Line Frequency:      50 Hz


Agilent B1500A 10Slot Parametric Measurement Mainframe

    Serial Number:          JP10N00002
    Firmware Revision:      A.01.01
    Options:

    Slot Configuration:                     Model No.   Serial No.
                            Slot 1: HPSMUPR B1510A      JP10N00064
                            Slot 2:
                            Slot 3: CMU     B1520A      JP10N99999
                            Slot 4:
                            Slot 5:
                            Slot 6:
                            Slot 7:
                            Slot 8:
                            Slot 9:
                            Slot 10:


Test Equipment Used

    Description             Model No.       Serial No.  Trace No.   Cal Due Date
    Digital Multimeter      Agilent 3458A   2823A14753              2006/07/01
    Standard Resistor Set   Agilent 16353A  JP10A00101              2006/02/22
    Standard Resistor 100G  Agilent 16353H  JP10M00102              2006/12/14
    Standard Resistor Set   Agilent 42030A  3143J00300              2006/05/23
    Power Meter             Agilent E4419B  QB43312424              2006/01/25
    Power Sensor            Agilent 8482A   MY41093217              2006/01/04
    225MHz Counter          Agilent 53131A  MY40013306              2006/02/02
    Standard Capacitor Set  Agilent 16380A  1840J01697              2006/02/24
    Standard Capacitor Set  Agilent 16380C  2519J00800              2006/02/23


Comment:

      ________________________________________________________________________
```

Figure 3-70 B1500A test record example (2/10)

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Description	Minimum	Results	Maximum	Uncertainty	P/F
Main Frame / Main Frame / Self-Test					
					Pass
Main Frame / Main Frame / GNDU V offset test					
	-100.00000 uV	9.89984 uV	100.00000 uV	2.82000 uV	Pass
Slot 1 / HPSMUPR / V test: 2 V					
-2.2V DMM	-2.20069 V	-2.20023 V	-2.19931 V	0.00002 V	Pass
-2.2V HRADC	-2.20045 V	-2.20022 V	-2.20002 V	0.00002 V	Pass
-2.2V HSADC	-2.20079 V	-2.20030 V	-2.19968 V	0.00002 V	Pass
-2V DMM	-2.00046 V	-2.00014 V	-1.99954 V	0.00002 V	Pass
-2V HRADC	-2.00034 V	-2.00012 V	-1.99993 V	0.00002 V	Pass
-2V HSADC	-2.00068 V	-2.00030 V	-1.99960 V	0.00002 V	Pass
0V DMM	-240.00000 uV	20.95640 uV	240.00000 uV	3.06000 uV	Pass
0V HRADC	-63.04360 uV	0.00000 uV	104.95600 uV	5.32000 uV	Pass
0V HSADC	-399.04400 uV	0.00000 uV	440.95600 uV	5.32000 uV	Pass
2V DMM	1.99954 V	2.00014 V	2.00046 V	0.00002 V	Pass
2V HRADC	1.99994 V	2.00008 V	2.00035 V	0.00002 V	Pass
2V HSADC	1.99960 V	2.00020 V	2.00068 V	0.00002 V	Pass
2.2V DMM	2.19931 V	2.20036 V	2.20069 V	0.00002 V	Pass
2.2V HRADC	2.20015 V	2.20030 V	2.20058 V	0.00002 V	Pass
2.2V HSADC	2.19981 V	2.20050 V	2.20092 V	0.00002 V	Pass
Slot 1 / HPSMUPR / V test: 20 V					
-22V DMM	-22.00598 V	-22.00099 V	-21.99402 V	0.00027 V	Pass
-22V HRADC	-22.00272 V	-22.00084 V	-21.99926 V	0.00027 V	Pass
-22V HSADC	-22.00471 V	-22.00200 V	-21.99727 V	0.00027 V	Pass
-20V DMM	-20.00396 V	-20.00108 V	-19.99604 V	0.00024 V	Pass
-20V HRADC	-20.00270 V	-20.00098 V	-19.99946 V	0.00024 V	Pass
-20V HSADC	-20.00468 V	-20.00200 V	-19.99748 V	0.00024 V	Pass
0V DMM	-1.80000 mV	-0.29181 mV	1.80000 mV	0.03730 mV	Pass
0V HRADC	-831.81200 uV	-320.00000 uV	248.18800 uV	40.80000 uV	Pass
0V HSADC	-2.69181 mV	0.00000 mV	2.10819 mV	0.04080 mV	Pass
20V DMM	19.99604 V	20.00079 V	20.00396 V	0.00024 V	Pass
20V HRADC	19.99917 V	20.00046 V	20.00241 V	0.00024 V	Pass
20V HSADC	19.99719 V	20.00200 V	20.00439 V	0.00024 V	Pass
22V DMM	21.99402 V	22.00155 V	22.00598 V	0.00027 V	Pass
22V HRADC	21.99982 V	22.00116 V	22.00328 V	0.00027 V	Pass
22V HSADC	21.99783 V	22.00200 V	22.00527 V	0.00027 V	Pass
Slot 1 / HPSMUPR / V test: 40 V					
-44V DMM	-44.01375 V	-44.00415 V	-43.98625 V	0.00053 V	Pass
-44V HRADC	-44.00739 V	-44.00528 V	-44.00091 V	0.00053 V	Pass
-44V HSADC	-44.01291 V	-44.00800 V	-43.99539 V	0.00053 V	Pass
-40V DMM	-40.00792 V	-40.00008 V	-39.99208 V	0.00048 V	Pass
-40V HRADC	-40.00308 V	-40.00120 V	-39.99708 V	0.00048 V	Pass
-40V HSADC	-40.00848 V	-40.00400 V	-39.99168 V	0.00048 V	Pass
0V DMM	-3.60000 mV	-0.71644 mV	3.60000 mV	0.03730 mV	Pass
0V HRADC	-1.31644 mV	-0.80000 mV	-0.11644 mV	0.04220 mV	Pass
0V HSADC	-5.51644 mV	0.00000 mV	4.08356 mV	0.04220 mV	Pass
40V DMM	39.99208 V	40.00047 V	40.00792 V	0.00048 V	Pass
40V HRADC	39.99747 V	40.00124 V	40.00347 V	0.00048 V	Pass
40V HSADC	39.99207 V	40.00200 V	40.00887 V	0.00048 V	Pass
44V DMM	43.98625 V	44.00036 V	44.01375 V	0.00053 V	Pass
44V HRADC	43.99712 V	44.00104 V	44.00360 V	0.00053 V	Pass
44V HSADC	43.99160 V	44.00400 V	44.00912 V	0.00053 V	Pass

Figure 3-71 B1500A test record example (3/10)

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Description	Minimum	Results	Maximum	Uncertainty	P/F
Slot 1 / HPSMUPR / V test: 100 V					
-110V DMM	-110.02988 V	-109.99756 V	-109.97012 V	0.00053 V	Pass
-110V HRADC	-110.00698 V	-110.00000 V	-109.98814 V	0.00053 V	Pass
-110V HSADC	-110.02276 V	-110.00500 V	-109.97236 V	0.00053 V	Pass
-100V DMM	-100.01980 V	-100.00222 V	-99.98020 V	0.00048 V	Pass
-100V HRADC	-100.01092 V	-100.00470 V	-99.99352 V	0.00048 V	Pass
-100V HSADC	-100.02622 V	-100.01000 V	-99.97822 V	0.00048 V	Pass
0V DMM	-9.00000 mV	1.75352 mV	9.00000 mV	0.03730 mV	Pass
0V HRADC	0.25352 mV	1.80000 mV	3.25352 mV	0.04220 mV	Pass
0V HSADC	-10.24648 mV	5.00000 mV	13.75352 mV	0.04220 mV	Pass
100V DMM	99.98020 V	100.00365 V	100.01980 V	0.00048 V	Pass
100V HRADC	99.99495 V	100.00500 V	100.01235 V	0.00048 V	Pass
100V HSADC	99.97965 V	100.01000 V	100.02765 V	0.00048 V	Pass
110V DMM	109.97012 V	109.99929 V	110.02988 V	0.00053 V	Pass
110V HRADC	109.98987 V	110.00090 V	110.00871 V	0.00053 V	Pass
110V HSADC	109.97409 V	110.01000 V	110.02449 V	0.00053 V	Pass
Slot 1 / HPSMUPR / V test: 200 V					
-200V DMM	-200.03960 V	-199.98918 V	-199.96040 V	0.00119 V	Pass
-200V HRADC	-200.00766 V	-199.99620 V	-199.97070 V	0.00119 V	Pass
-200V HSADC	-200.05518 V	-200.01000 V	-199.92318 V	0.00119 V	Pass
0V DMM	-18.00000 mV	3.41817 mV	18.00000 mV	0.03730 mV	Pass
0V HRADC	1.73817 mV	3.20000 mV	5.09817 mV	0.63400 mV	Pass
0V HSADC	-20.58183 mV	10.00000 mV	27.41817 mV	0.63400 mV	Pass
200V DMM	199.96040 V	199.98259 V	200.03960 V	0.00119 V	Pass
200V HRADC	199.96411 V	199.98460 V	200.00107 V	0.00119 V	Pass
200V HSADC	199.91659 V	199.99000 V	200.04859 V	0.00119 V	Pass
Slot 1 / HPSMUPR / I pre-test: 100 nA					
-115nA DMM	-600.00000 uV	-128.17800 uV	600.00000 uV		Pass
-115nA SMU	-115.60000 nA	-115.01000 nA	-114.40000 nA		Pass
-100nA DMM	-600.00000 uV	-128.64700 uV	600.00000 uV		Pass
-100nA SMU	-100.60000 nA	-100.01000 nA	-99.40000 nA		Pass
-10nA DMM	-600.00000 uV	-129.08600 uV	600.00000 uV		Pass
-10nA SMU	-10.60000 nA	-10.00000 nA	-9.40000 nA		Pass
10nA DMM	-600.00000 uV	-128.46900 uV	600.00000 uV		Pass
10nA SMU	9.40000 nA	10.00000 nA	10.60000 nA		Pass
100nA DMM	-600.00000 uV	-127.95700 uV	600.00000 uV		Pass
100nA SMU	99.40000 nA	100.01000 nA	100.60000 nA		Pass
115nA DMM	-600.00000 uV	-127.56700 uV	600.00000 uV		Pass
115nA SMU	114.40000 nA	115.01000 nA	115.60000 nA		Pass
Slot 1 / HPSMUPR / I pre-test: 1 uA					
-1.15uA DMM	-600.00000 uV	-133.78400 uV	600.00000 uV		Pass
-1.15uA SMU	-1.15600 uA	-1.15005 uA	-1.14400 uA		Pass
-1uA DMM	-600.00000 uV	-133.34300 uV	600.00000 uV		Pass
-1uA SMU	-1.00600 uA	-1.00005 uA	-0.99400 uA		Pass
-100nA DMM	-600.00000 uV	-130.05400 uV	600.00000 uV		Pass
-100nA SMU	-106.00000 nA	-100.00000 nA	-94.00000 nA		Pass
100nA DMM	-600.00000 uV	-128.42500 uV	600.00000 uV		Pass
100nA SMU	94.00000 nA	100.00000 nA	106.00000 nA		Pass
1uA DMM	-600.00000 uV	-129.13000 uV	600.00000 uV		Pass
1uA SMU	0.99400 uA	1.00005 uA	1.00600 uA		Pass
1.15uA DMM	-600.00000 uV	-129.54900 uV	600.00000 uV		Pass
1.15uA SMU	1.14400 uA	1.15005 uA	1.15600 uA		Pass
Slot 1 / HPSMUPR / I test: 1 nA					
-1.15nA DMM	-1.15087 nA	-1.15000 nA	-1.14913 nA	0.00063 nA	Pass
-1.15nA HRADC	-1.15000 nA	-1.15003 nA	-1.15000 nA	0.00064 nA	Pass

Figure 3-72 B1500A test record example (4/10)

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Description	Minimum	Results	Maximum	Uncertainty	P/F
-1.15nA HSADC	-1.15000 nA	-1.15010 nA	-1.15000 nA	0.00064 nA	Pass
-1nA DMM	-1.00078 nA	-1.00000 nA	-0.99922 nA	0.00055 nA	Pass
-1nA HRADC	-1.00000 nA	-1.00002 nA	-0.99900 nA	0.00055 nA	Pass
-1nA HSADC	-1.00000 nA	-1.00005 nA	-0.99800 nA	0.00055 nA	Pass
-100pA DMM	-100.24000 pA	-100.00000 pA	-99.76000 pA	0.05860 pA	Pass
-100pA HRADC	-100.00000 pA	-99.96500 pA	-99.90000 pA	0.06080 pA	Pass
-100pA HSADC	-100.00000 pA	-99.95000 pA	-99.80000 pA	0.06080 pA	Pass
100pA DMM	99.76000 pA	99.80000 pA	100.24000 pA	0.05860 pA	Pass
100pA HRADC	99.70000 pA	100.01200 pA	100.00000 pA	0.06080 pA	Pass
100pA HSADC	99.50000 pA	100.05000 pA	100.00000 pA	0.06080 pA	Pass
1nA DMM	0.99922 nA	1.00000 nA	1.00078 nA	0.00055 nA	Pass
1nA HRADC	0.99900 nA	1.00004 nA	1.00000 nA	0.00055 nA	Pass
1nA HSADC	0.99800 nA	1.00010 nA	1.00000 nA	0.00055 nA	Pass
1.15nA DMM	1.14913 nA	1.15000 nA	1.15087 nA	0.00063 nA	Pass
1.15nA HRADC	1.15000 nA	1.15003 nA	1.15000 nA	0.00064 nA	Pass
1.15nA HSADC	1.15000 nA	1.15010 nA	1.15000 nA	0.00064 nA	Pass
Slot 1 / HPSMUPR / I test: 10 nA					
-11.5nA DMM	-11.50870 nA	-11.50000 nA	-11.49130 nA	0.00708 nA	Pass
-11.5nA HRADC	-11.50000 nA	-11.50010 nA	-11.50000 nA	0.00708 nA	Pass
-11.5nA HSADC	-11.50000 nA	-11.50050 nA	-11.50000 nA	0.00708 nA	Pass
-10nA DMM	-10.00780 nA	-10.00000 nA	-9.99220 nA	0.00616 nA	Pass
-10nA HRADC	-10.00000 nA	-9.99999 nA	-10.00000 nA	0.00616 nA	Pass
-10nA HSADC	-10.00000 nA	-10.00050 nA	-9.99000 nA	0.00616 nA	Pass
-1nA DMM	-1.00240 nA	-1.00000 nA	-0.99760 nA	0.00064 nA	Pass
-1nA HRADC	-1.00000 nA	-0.99965 nA	-0.99900 nA	0.00064 nA	Pass
-1nA HSADC	-1.00000 nA	-0.99950 nA	-0.99700 nA	0.00064 nA	Pass
1nA DMM	0.99760 nA	1.00000 nA	1.00240 nA	0.00064 nA	Pass
1nA HRADC	0.99900 nA	0.99983 nA	1.00000 nA	0.00064 nA	Pass
1nA HSADC	0.99700 nA	1.00000 nA	1.00000 nA	0.00064 nA	Pass
10nA DMM	9.99220 nA	10.00000 nA	10.00780 nA	0.00616 nA	Pass
10nA HRADC	10.00000 nA	9.99984 nA	10.00000 nA	0.00616 nA	Pass
10nA HSADC	9.99000 nA	10.00050 nA	10.00000 nA	0.00616 nA	Pass
11.5nA DMM	11.49130 nA	11.50000 nA	11.50870 nA	0.00708 nA	Pass
11.5nA HRADC	11.50000 nA	11.50020 nA	11.50000 nA	0.00708 nA	Pass
11.5nA HSADC	11.50000 nA	11.50100 nA	11.50000 nA	0.00708 nA	Pass
Slot 1 / HPSMUPR / I test: 100 nA					
-115nA DMM	-115.05300 nA	-115.00000 nA	-114.94800 nA	0.01340 nA	Pass
-115nA HRADC	-115.00000 nA	-115.00200 nA	-115.00000 nA	0.01340 nA	Pass
-115nA HSADC	-115.00000 nA	-115.01000 nA	-115.00000 nA	0.01340 nA	Pass
-100nA DMM	-100.04800 nA	-100.00000 nA	-99.95200 nA	0.01170 nA	Pass
-100nA HRADC	-100.00000 nA	-100.00400 nA	-100.00000 nA	0.01170 nA	Pass
-100nA HSADC	-100.00000 nA	-100.01000 nA	-99.90000 nA	0.01170 nA	Pass
-10nA DMM	-10.02100 nA	-10.00000 nA	-9.97900 nA	0.00164 nA	Pass
-10nA HRADC	-10.00000 nA	-9.99710 nA	-9.98000 nA	0.00168 nA	Pass
-10nA HSADC	-10.00000 nA	-10.00000 nA	-9.98000 nA	0.00168 nA	Pass
10nA DMM	9.97900 nA	10.00000 nA	10.02100 nA	0.00164 nA	Pass
10nA HRADC	9.98000 nA	9.99810 nA	10.00000 nA	0.00168 nA	Pass
10nA HSADC	9.98000 nA	10.00000 nA	10.00000 nA	0.00168 nA	Pass
100nA DMM	99.95200 nA	100.00000 nA	100.04800 nA	0.01170 nA	Pass
100nA HRADC	99.90000 nA	100.00100 nA	100.00000 nA	0.01170 nA	Pass
100nA HSADC	99.90000 nA	100.01000 nA	100.00000 nA	0.01170 nA	Pass
115nA DMM	114.94800 nA	115.00000 nA	115.05300 nA	0.01340 nA	Pass
115nA HRADC	115.00000 nA	115.00300 nA	115.00000 nA	0.01340 nA	Pass
115nA HSADC	115.00000 nA	115.01000 nA	115.00000 nA	0.01340 nA	Pass
Slot 1 / HPSMUPR / I test: 1 uA					
-1.15uA DMM	-1.15053 uA	-1.15000 uA	-1.14948 uA	0.00011 uA	Pass
-1.15uA HRADC	-1.15000 uA	-1.15001 uA	-1.15000 uA	0.00011 uA	Pass
-1.15uA HSADC	-1.15000 uA	-1.15010 uA	-1.15000 uA	0.00011 uA	Pass

Figure 3-73 B1500A test record example (5/10)

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Description	Minimum	Results	Maximum	Uncertainty	P/F
-1uA DMM	-1.00048 uA	-1.00000 uA	-0.99952 uA	0.00010 uA	Pass
-1uA HRADC	-1.00000 uA	-1.00000 uA	-1.00000 uA	0.00010 uA	Pass
-1uA HSADC	-1.00000 uA	-1.00005 uA	-0.99900 uA	0.00010 uA	Pass
-100nA DMM	-100.21000 nA	-100.00000 nA	-99.79000 nA	0.01490 nA	Pass
-100nA HRADC	-100.00000 nA	-99.99800 nA	-99.90000 nA	0.01520 nA	Pass
-100nA HSADC	-100.00000 nA	-100.05000 nA	-99.80000 nA	0.01520 nA	Pass
100nA DMM	99.79000 nA	100.00000 nA	100.21000 nA	0.01490 nA	Pass
100nA HRADC	99.90000 nA	99.97100 nA	100.00000 nA	0.01520 nA	Pass
100nA HSADC	99.80000 nA	100.00000 nA	100.00000 nA	0.01520 nA	Pass
1uA DMM	0.99952 uA	1.00000 uA	1.00048 uA	0.00010 uA	Pass
1uA HRADC	1.00000 uA	0.99999 uA	1.00000 uA	0.00010 uA	Pass
1uA HSADC	0.99900 uA	1.00005 uA	1.00000 uA	0.00010 uA	Pass
1.15uA DMM	1.14948 uA	1.15000 uA	1.15053 uA	0.00011 uA	Pass
1.15uA HRADC	1.15000 uA	1.14998 uA	1.15000 uA	0.00011 uA	Pass
1.15uA HSADC	1.15000 uA	1.15005 uA	1.15000 uA	0.00011 uA	Pass
Slot 1 / HPSMUPR / I test: 10 uA					
-11.5uA DMM	-11.50440 uA	-11.50000 uA	-11.49570 uA	0.00078 uA	Pass
-11.5uA HRADC	-11.50000 uA	-11.50010 uA	-11.50000 uA	0.00078 uA	Pass
-11.5uA HSADC	-11.50000 uA	-11.50050 uA	-11.50000 uA	0.00078 uA	Pass
-10uA DMM	-10.00390 uA	-10.00000 uA	-9.99610 uA	0.00068 uA	Pass
-10uA HRADC	-10.00000 uA	-10.00030 uA	-10.00000 uA	0.00068 uA	Pass
-10uA HSADC	-10.00000 uA	-10.00100 uA	-10.00000 uA	0.00068 uA	Pass
-1uA DMM	-1.00120 uA	-1.00000 uA	-0.99880 uA	0.00013 uA	Pass
-1uA HRADC	-1.00000 uA	-0.99996 uA	-0.99900 uA	0.00013 uA	Pass
-1uA HSADC	-1.00000 uA	-1.00050 uA	-0.99900 uA	0.00013 uA	Pass
1uA DMM	0.99880 uA	1.00000 uA	1.00120 uA	0.00013 uA	Pass
1uA HRADC	0.99800 uA	1.00003 uA	1.00000 uA	0.00013 uA	Pass
1uA HSADC	0.99800 uA	1.00000 uA	1.00000 uA	0.00013 uA	Pass
10uA DMM	9.99610 uA	10.00000 uA	10.00390 uA	0.00068 uA	Pass
10uA HRADC	10.00000 uA	10.00040 uA	10.00000 uA	0.00068 uA	Pass
10uA HSADC	10.00000 uA	10.00100 uA	10.00000 uA	0.00068 uA	Pass
11.5uA DMM	11.49570 uA	11.50000 uA	11.50440 uA	0.00078 uA	Pass
11.5uA HRADC	11.50000 uA	11.50010 uA	11.50000 uA	0.00078 uA	Pass
11.5uA HSADC	11.50000 uA	11.50100 uA	11.50000 uA	0.00078 uA	Pass
Slot 1 / HPSMUPR / I test: 100 uA					
					Pass
Slot 1 / HPSMUPR / I test: 1 mA					
-115uA DMM	-115.03300 uA	-115.00100 uA	-114.96700 uA	0.00289 uA	Pass
-115uA HRADC	-115.02300 uA	-115.00100 uA	-114.97800 uA	0.00291 uA	Pass
-115uA HSADC	-115.04700 uA	-115.01000 uA	-114.95400 uA	0.00291 uA	Pass
-100uA DMM	-100.03000 uA	-100.00000 uA	-99.97000 uA	0.00255 uA	Pass
-100uA HRADC	-100.02000 uA	-100.00000 uA	-99.98050 uA	0.00257 uA	Pass
-100uA HSADC	-100.04200 uA	-100.01000 uA	-99.95830 uA	0.00257 uA	Pass
-10uA DMM	-10.01110 uA	-9.99659 uA	-9.98890 uA	0.00096 uA	Pass
-10uA HRADC	-10.00020 uA	-9.99650 uA	-9.99299 uA	0.00100 uA	Pass
-10uA HSADC	-10.01160 uA	-10.00000 uA	-9.98159 uA	0.00100 uA	Pass
10uA DMM	9.98890 uA	9.99706 uA	10.01110 uA	0.00096 uA	Pass
10uA HRADC	9.99346 uA	9.99740 uA	10.00070 uA	0.00100 uA	Pass
10uA HSADC	9.98206 uA	10.00000 uA	10.01210 uA	0.00100 uA	Pass
100uA DMM	99.97000 uA	100.00200 uA	100.03000 uA	0.00255 uA	Pass
100uA HRADC	99.98190 uA	100.00200 uA	100.02100 uA	0.00257 uA	Pass
100uA HSADC	99.95970 uA	100.01000 uA	100.04400 uA	0.00257 uA	Pass
115uA DMM	114.96700 uA	115.00100 uA	115.03300 uA	0.00289 uA	Pass
115uA HRADC	114.97800 uA	115.00200 uA	115.02300 uA	0.00291 uA	Pass
115uA HSADC	114.95400 uA	115.01000 uA	115.04700 uA	0.00291 uA	Pass

Figure 3-74 B1500A test record example (6/10)

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Description	Minimum	Results	Maximum	Uncertainty	P/F
Slot 1 / HPSMUPR / I test: 10 mA					
-1.15mA DMM	-1.15037 mA	-1.15006 mA	-1.14963 mA	0.00003 mA	Pass
-1.15mA HRADC	-1.15030 mA	-1.15007 mA	-1.14982 mA	0.00003 mA	Pass
-1.15mA HSADC	-1.15046 mA	-1.15020 mA	-1.14966 mA	0.00003 mA	Pass
-1mA DMM	-1.00033 mA	-1.00003 mA	-0.99967 mA	0.00002 mA	Pass
-1mA HRADC	-1.00024 mA	-1.00003 mA	-0.99981 mA	0.00002 mA	Pass
-1mA HSADC	-1.00039 mA	-1.00015 mA	-0.99967 mA	0.00002 mA	Pass
-100uA DMM	-100.11400 uA	-99.99580 uA	-99.88600 uA	0.00630 uA	Pass
-100uA HRADC	-100.05000 uA	-99.98600 uA	-99.94180 uA	0.00713 uA	Pass
-100uA HSADC	-100.14000 uA	-100.00000 uA	-99.85180 uA	0.00713 uA	Pass
100uA DMM	99.88600 uA	99.98850 uA	100.11400 uA	0.00630 uA	Pass
100uA HRADC	99.93450 uA	99.99500 uA	100.04300 uA	0.00713 uA	Pass
100uA HSADC	99.84450 uA	100.00000 uA	100.13300 uA	0.00713 uA	Pass
1mA DMM	0.99967 mA	0.99999 mA	1.00033 mA	0.00002 mA	Pass
1mA HRADC	0.99977 mA	1.00001 mA	1.00020 mA	0.00002 mA	Pass
1mA HSADC	0.99963 mA	1.00010 mA	1.00035 mA	0.00002 mA	Pass
1.15mA DMM	1.14963 mA	1.15001 mA	1.15037 mA	0.00003 mA	Pass
1.15mA HRADC	1.14977 mA	1.15003 mA	1.15026 mA	0.00003 mA	Pass
1.15mA HSADC	1.14962 mA	1.15010 mA	1.15041 mA	0.00003 mA	Pass
Slot 1 / HPSMUPR / I test: 100 mA					
-11.5mA DMM	-11.50366 mA	-11.50094 mA	-11.49634 mA	0.00028 mA	Pass
-11.5mA HRADC	-11.50313 mA	-11.50033 mA	-11.49875 mA	0.00028 mA	Pass
-11.5mA HSADC	-11.50490 mA	-11.50150 mA	-11.49698 mA	0.00028 mA	Pass
-10mA DMM	-10.00330 mA	-10.00022 mA	-9.99670 mA	0.00025 mA	Pass
-10mA HRADC	-10.00214 mA	-9.99980 mA	-9.99830 mA	0.00026 mA	Pass
-10mA HSADC	-10.00382 mA	-10.00100 mA	-9.99662 mA	0.00026 mA	Pass
-1mA DMM	-1.00114 mA	-0.99975 mA	-0.99886 mA	0.00006 mA	Pass
-1mA HRADC	-1.00005 mA	-0.99972 mA	-0.99945 mA	0.00007 mA	Pass
-1mA HSADC	-1.00119 mA	-1.00000 mA	-0.99831 mA	0.00007 mA	Pass
1mA DMM	0.99886 mA	0.99972 mA	1.00114 mA	0.00006 mA	Pass
1mA HRADC	0.99942 mA	0.99976 mA	1.00002 mA	0.00007 mA	Pass
1mA HSADC	0.99828 mA	1.00000 mA	1.00116 mA	0.00007 mA	Pass
10mA DMM	9.99670 mA	10.00015 mA	10.00330 mA	0.00025 mA	Pass
10mA HRADC	9.99823 mA	9.99991 mA	10.00207 mA	0.00026 mA	Pass
10mA HSADC	9.99655 mA	10.00050 mA	10.00375 mA	0.00026 mA	Pass
11.5mA DMM	11.49634 mA	11.50070 mA	11.50366 mA	0.00028 mA	Pass
11.5mA HRADC	11.49851 mA	11.50032 mA	11.50289 mA	0.00028 mA	Pass
11.5mA HSADC	11.49674 mA	11.50100 mA	11.50466 mA	0.00028 mA	Pass
Slot 1 / HPSMUPR / I test: 1 A					
-115mA DMM	-115.04005 mA	-115.00984 mA	-114.95995 mA	0.00028 mA	Pass
-115mA HRADC	-115.04104 mA	-115.00480 mA	-114.97864 mA	0.00028 mA	Pass
-115mA HSADC	-115.09084 mA	-115.01500 mA	-114.92884 mA	0.00028 mA	Pass
-100mA DMM	-100.03600 mA	-100.00867 mA	-99.96400 mA	0.00025 mA	Pass
-100mA HRADC	-100.03627 mA	-100.00470 mA	-99.98107 mA	0.00026 mA	Pass
-100mA HSADC	-100.08067 mA	-100.01500 mA	-99.93667 mA	0.00026 mA	Pass
-10mA DMM	-10.01170 mA	-10.00131 mA	-9.98830 mA	0.00006 mA	Pass
-10mA HRADC	-10.00731 mA	-10.00060 mA	-9.99531 mA	0.00007 mA	Pass
-10mA HSADC	-10.01931 mA	-10.00000 mA	-9.98331 mA	0.00007 mA	Pass
10mA DMM	9.98830 mA	9.99768 mA	10.01170 mA	0.00006 mA	Pass
10mA HRADC	9.99168 mA	9.99780 mA	10.00368 mA	0.00007 mA	Pass
10mA HSADC	9.97968 mA	10.00000 mA	10.01568 mA	0.00007 mA	Pass
100mA DMM	99.96400 mA	100.00522 mA	100.03600 mA	0.00025 mA	Pass
100mA HRADC	99.97762 mA	100.00240 mA	100.03282 mA	0.00026 mA	Pass
100mA HSADC	99.93322 mA	100.01000 mA	100.07722 mA	0.00026 mA	Pass
115mA DMM	114.95995 mA	115.00548 mA	115.04005 mA	0.00028 mA	Pass
115mA HRADC	114.97428 mA	115.00140 mA	115.03668 mA	0.00028 mA	Pass
115mA HSADC	114.92448 mA	115.01000 mA	115.08648 mA	0.00028 mA	Pass

Figure 3-75 B1500A test record example (7/10)

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Description	Minimum	Results	Maximum	Uncertainty	P/F
Slot 1 / HPSMUPR / CMR test					
-1A DMM	-1.00258 A	-1.00009 A	-0.99742 A		Pass
-1A HRADC	-1.00258 A	-1.00006 A	-0.99760 A		Pass
-1A HSADC	-1.00327 A	-1.00015 A	-0.99691 A		Pass
-100mA DMM	-100.42000 mA	-99.99955 mA	-99.58000 mA	0.00071 mA	Pass
-100mA HRADC	-100.32955 mA	-99.99500 mA	-99.66955 mA	0.00076 mA	Pass
-100mA HSADC	-100.47955 mA	-100.00000 mA	-99.51955 mA	0.00076 mA	Pass
100mA DMM	99.58000 mA	99.95748 mA	100.42000 mA	0.00071 mA	Pass
100mA HRADC	99.62748 mA	99.95900 mA	100.28748 mA	0.00076 mA	Pass
100mA HSADC	99.47748 mA	100.00000 mA	100.43748 mA	0.00076 mA	Pass
1A DMM	0.99742 A	1.00002 A	1.00258 A		Pass
1A HRADC	0.99753 A	0.99999 A	1.00251 A		Pass
1A HSADC	0.99684 A	1.00005 A	1.00320 A		Pass
Slot 3 / CMU / Self-Test					
5MHz	-240.00000 Hz	2.99800 Hz	240.00000 Hz	2.20000 Hz	Pass
Slot 3 / CMU / Frequency Accuracy Test					
16mV 1kHz Mon	-1.56000 mV	-0.03642 mV	1.56000 mV		Pass
16mV 100kHz Mon	-1.56000 mV	-0.05590 mV	1.56000 mV		Pass
32mV 1kHz Mon	-2.52000 mV	0.00612 mV	2.52000 mV		Pass
32mV 100kHz Mon	-2.52000 mV	-0.03450 mV	2.52000 mV		Pass
64mV 1kHz Mon	-4.44000 mV	0.00394 mV	4.44000 mV		Pass
64mV 100kHz Mon	-4.44000 mV	-0.07030 mV	4.44000 mV		Pass
125mV 1kHz Mon	-8.10000 mV	0.02560 mV	8.10000 mV		Pass
125mV 100kHz Mo	-8.10000 mV	-0.07100 mV	8.10000 mV		Pass
125mV 1kHz Mon	-8.10000 mV	0.02890 mV	8.10000 mV		Pass
125mV 100kHz Mo	-8.10000 mV	-0.06240 mV	8.10000 mV		Pass
250mV 1kHz Mon	-15.60000 mV	-0.04450 mV	15.60000 mV		Pass
250mV 10kHz Mon	-15.60000 mV	-0.06290 mV	15.60000 mV		Pass
250mV 100kHz Mo	-15.60000 mV	-0.23000 mV	15.60000 mV		Pass
16mV 1kHz Lev	-1.56000 mV	0.01590 mV	1.56000 mV		Pass
16mV 100kHz Lev	-1.56000 mV	0.02360 mV	1.56000 mV		Pass
32mV 1kHz Lev	-2.52000 mV	0.04020 mV	2.52000 mV		Pass
32mV 100kHz Lev	-2.52000 mV	0.06190 mV	2.52000 mV		Pass
64mV 1kHz Lev	-4.44000 mV	0.10200 mV	4.44000 mV		Pass
64mV 100kHz Lev	-4.44000 mV	0.14900 mV	4.44000 mV		Pass
125mV 1kHz Lev	-8.10000 mV	0.14500 mV	8.10000 mV		Pass
125mV 100kHz Le	-8.10000 mV	0.34500 mV	8.10000 mV		Pass
125mV 1kHz Lev	-8.10000 mV	0.09990 mV	8.10000 mV		Pass
125mV 100kHz Le	-8.10000 mV	0.38400 mV	8.10000 mV		Pass
250mV 1kHz Lev	-15.60000 mV	0.16800 mV	15.60000 mV		Pass
250mV 10kHz Lev	-15.60000 mV	0.25500 mV	15.60000 mV		Pass
250mV 100kHz Le	-15.60000 mV	0.54400 mV	15.60000 mV		Pass
250mV 1MHz Mon	-15.60000 mV	0.16100 mV	15.60000 mV		Pass
250mV 2MHz Mon	-15.60000 mV	0.24200 mV	15.60000 mV		Pass
250mV 3MHz Mon	-15.60000 mV	-0.13700 mV	15.60000 mV		Pass
250mV 4MHz Mon	-15.60000 mV	0.25700 mV	15.60000 mV		Pass
250mV 5MHz Mon	-15.60000 mV	0.21600 mV	15.60000 mV		Pass
250mV 1MHz Lev	-15.60000 mV	0.10400 mV	15.60000 mV		Pass
250mV 2MHz Lev	-15.60000 mV	-0.04000 mV	15.60000 mV		Pass
250mV 3MHz Lev	-15.60000 mV	0.27000 mV	15.60000 mV		Pass
250mV 4MHz Lev	-15.60000 mV	0.23100 mV	15.60000 mV		Pass
250mV 5MHz Lev	-15.60000 mV	0.31800 mV	15.60000 mV		Pass
Slot 3 / CMU / OSC Level / Monitor Accuracy Test					
0V Level	-3.00000 mV	0.29051 mV	3.00000 mV	0.00100 mV	Pass
0V Monitor	-6.00000 mV	-0.07749 mV	6.00000 mV	0.00100 mV	Pass
8V Level	-27.00000 mV	-0.58100 mV	27.00000 mV	0.12900 mV	Pass
8V Monitor	-15.60000 mV	-0.54100 mV	15.60000 mV	0.12900 mV	Pass

Figure 3-76 B1500A test record example (8/10)

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Description	Minimum	Results	Maximum	Uncertainty	P/F
12V Level	-39.00000 mV	-0.50900 mV	39.00000 mV	0.45400 mV	Pass
12V Monitor	-20.40000 mV	-0.36900 mV	20.40000 mV	0.45400 mV	Pass
25V Level	-78.00000 mV	-1.05000 mV	78.00000 mV	0.74000 mV	Pass
25V Monitor	-36.00000 mV	0.02710 mV	36.00000 mV	0.74000 mV	Pass
-8V Level	-27.00000 mV	0.53500 mV	27.00000 mV	0.12900 mV	Pass
-8V Monitor	-15.60000 mV	0.37500 mV	15.60000 mV	0.12900 mV	Pass
-12V Level	-39.00000 mV	0.30100 mV	39.00000 mV	0.45400 mV	Pass
-12V Monitor	-20.40000 mV	0.13100 mV	20.40000 mV	0.45400 mV	Pass
-25V Level	-78.00000 mV	-0.91600 mV	78.00000 mV	0.74000 mV	Pass
-25V Monitor	-36.00000 mV	0.13400 mV	36.00000 mV	0.74000 mV	Pass
Slot 3 / CMU / DC Bias Level / Monitor Accuracy Test					
250mV, 1MHz	0.99900 pF	1.00000 pF	1.00000 pF		Pass
250mV, 1MHz	-840.00000 u	101.20600 u	840.00000 u		Pass
250mV, 2MHz	0.99800 pF	1.00000 pF	1.00000 pF		Pass
250mV, 2MHz	-1.80000 m	0.16451 m	1.80000 m		Pass
Slot 3 / CMU / Cp-D Test: 1pF / No Cable					
250mV, 1kHz	9.85000 pF	10.00000 pF	10.10000 pF		Pass
250mV, 1kHz	-14.88000 m	-0.02846 m	14.88000 m		Pass
250mV, 1MHz	9.99000 pF	10.00000 pF	10.00000 pF		Pass
250mV, 1MHz	-540.00000 u	106.90600 u	540.00000 u		Pass
250mV, 2MHz	9.98000 pF	10.00000 pF	10.00000 pF		Pass
250mV, 2MHz	-1.68000 m	0.15715 m	1.68000 m		Pass
250mV, 5MHz	9.98000 pF	10.00000 pF	10.00000 pF		Pass
250mV, 5MHz	-1.68000 m	-0.22487 m	1.68000 m		Pass
100mV, 1kHz	9.78000 pF	10.00000 pF	10.20000 pF		Pass
100mV, 1kHz	-22.08000 m	0.00158 m	22.08000 m		Pass
Slot 3 / CMU / Cp-D Test: 10pF / No Cable					
250mV, 1kHz	99.80000 pF	100.00000 pF	100.00000 pF		Pass
250mV, 1kHz	-1.98000 m	0.13538 m	1.98000 m		Pass
250mV, 100kHz	99.90000 pF	100.00000 pF	100.00000 pF		Pass
250mV, 100kHz	-540.00000 u	-6.73604 u	540.00000 u		Pass
250mV, 1MHz	99.90000 pF	100.00000 pF	100.00000 pF		Pass
250mV, 1MHz	-540.00000 u	107.39700 u	540.00000 u		Pass
250mV, 2MHz	99.80000 pF	100.00000 pF	100.00000 pF		Pass
250mV, 2MHz	-1.68000 m	0.18973 m	1.68000 m		Pass
250mV, 5MHz	99.90000 pF	100.00000 pF	100.00000 pF		Pass
250mV, 5MHz	-1.68000 m	0.07283 m	1.68000 m		Pass
100mV, 1kHz	99.70000 pF	100.00000 pF	100.00000 pF		Pass
100mV, 1kHz	-2.76000 m	0.12684 m	2.76000 m		Pass
100mV, 100kHz	99.90000 pF	100.00000 pF	100.00000 pF		Pass
100mV, 100kHz	-600.00000 u	-6.54635 u	600.00000 u		Pass
100mV, 1MHz	99.90000 pF	100.00000 pF	100.06100 pF		Pass
100mV, 1MHz	-600.00000 u	116.79000 u	600.00000 u		Pass
100mV, 2MHz	99.80000 pF	100.00000 pF	100.00000 pF		Pass
100mV, 2MHz	-1.68000 m	0.23780 m	1.68000 m		Pass
100mV, 5MHz	99.90000 pF	100.00000 pF	100.00000 pF		Pass
100mV, 5MHz	-1.74000 m	0.59518 m	1.74000 m		Pass
Slot 3 / CMU / Cp-D Test: 100pF / No Cable					
250mV, 1kHz	0.99900 nF	1.00000 nF	1.00000 nF		Pass
250mV, 1kHz	-660.00000 u	156.94100 u	660.00000 u		Pass
250mV, 10kHz	0.99900 nF	1.00000 nF	1.00000 nF		Pass
250mV, 10kHz	-540.00000 u	-13.37790 u	540.00000 u		Pass
250mV, 100kHz	0.99900 nF	1.00000 nF	1.00000 nF		Pass
250mV, 100kHz	-540.00000 u	-6.07199 u	540.00000 u		Pass
100mV, 1kHz	0.99900 nF	1.00000 nF	1.00000 nF		Pass
100mV, 1kHz	-780.00000 u	159.59900 u	780.00000 u		Pass

Figure 3-77 B1500A test record example (9/10)

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 +-------------------------------------------------------------------------------+
 | Description     |   Minimum     |   Results     |   Maximum     | Uncertainty  | P/F  |
 |-------------------------------------------------------------------------------|
 | Slot 3 / CMU / Cp-D Test: 1000pF / No Cable                                    |
 |-------------------------------------------------------------------------------|
 |250mV, 1kHz      |   9.99664 nF |  10.00030 nF |  10.00830 nF |              | Pass |
 |250mV, 1kHz      |-450.00000 u  | 243.50700 u  | 630.00000 u  |              | Pass |
 |250mV, 10kHz     |   9.99564 nF |   9.99993 nF |  10.00700 nF |              | Pass |
 |250mV, 10kHz     |-470.00000 u  |  57.20320 u  | 610.00000 u  |              | Pass |
 |100mV, 1kHz      |   9.99610 nF |  10.00030 nF |  10.00880 nF |              | Pass |
 |100mV, 1kHz      |-510.00000 u  | 245.78500 u  | 690.00000 u  |              | Pass |
 |-------------------------------------------------------------------------------|
 | Slot 3 / CMU / Cp-D Test: 0.01uF / No Cable                                    |
 |-------------------------------------------------------------------------------|
 |250mV, 1kHz      |  99.94420 nF |  99.98430 nF | 100.05900 nF |              | Pass |
 |250mV, 1kHz      |-490.00000 u  | 208.63800 u  | 590.00000 u  |              | Pass |
 |250mV, 10kHz     |  99.94250 nF |  99.98650 nF | 100.06000 nF |              | Pass |
 |250mV, 10kHz     |-400.00000 u  | 130.55000 u  | 680.00000 u  |              | Pass |
 |100mV, 1kHz      |  99.93960 nF |  99.98390 nF | 100.06300 nF |              | Pass |
 |100mV, 1kHz      |-550.00000 u  | 208.35400 u  | 650.00000 u  |              | Pass |
 |-------------------------------------------------------------------------------|
 | Slot 3 / CMU / Cp-D Test: 0.1uF / No Cable                                     |
 |-------------------------------------------------------------------------------|
 |250mV, 1kHz      |   0.99958 uF |   0.99998 uF |   1.00066 uF |              | Pass |
 |250mV, 1kHz      |-450.00000 u  | 320.93000 u  | 630.00000 u  |              | Pass |
 |100mV, 1kHz      |   0.99952 uF |   0.99998 uF |   1.00072 uF |              | Pass |
 |100mV, 1kHz      |-510.00000 u  | 316.66300 u  | 690.00000 u  |              | Pass |
 |-------------------------------------------------------------------------------|
 | Slot 3 / CMU / Cp-D Test: 1uF / No Cable                                       |
 |-------------------------------------------------------------------------------|
 |250mV, 1kHz      |  9.98781  ohm|  9.99418  ohm| 10.00521  ohm|              | Pass |
 |100mV, 1kHz      |  9.98781  ohm|  9.99406  ohm| 10.00521  ohm|              | Pass |
 |-------------------------------------------------------------------------------|
 | Slot 3 / CMU / R Test: 10ohm / No Cable                                        |
 |-------------------------------------------------------------------------------|
 |250mV, 1kHz      |  0.99622  ohm|999.54610 mohm|  1.00330  ohm|              | Pass |
 |100mV, 1kHz      |  0.99622  ohm|999.57290 mohm|  1.00330  ohm|              | Pass |
 |-------------------------------------------------------------------------------|
 | Slot 3 / CMU / R Test: 1ohm / No Cable                                         |
 |-------------------------------------------------------------------------------|
 |250mV, 1kHz      | 97.02800 mohm|100.01360 mohm|103.02800 mohm|              | Pass |
 |100mV, 1kHz      | 97.02800 mohm|100.04340 mohm|103.02800 mohm|              | Pass |
 |-------------------------------------------------------------------------------|
 | Slot 3 / CMU / R Test: 100mohm / No Cable                                      |
 |-------------------------------------------------------------------------------|
 |250mV, 1kHz      |  7.00680 mohm|  9.92417 mohm| 13.00680 mohm|              | Pass |
 |100mV, 1kHz      |  7.00680 mohm|  9.99570 mohm| 13.00680 mohm|              | Pass |
 |-------------------------------------------------------------------------------|
 | Slot 3 / CMU / R Test: 10mohm / No Cable                                       |
 |-------------------------------------------------------------------------------|
 |250mV, 1kHz      |   9.85000 pF |  10.00000 pF |  10.20000 pF |              | Pass |
 |250mV, 1kHz      | -15.06000 m  |  -0.15497 m  |  15.06000 m  |              | Pass |
 |250mV, 1MHz      |   9.99000 pF |  10.00000 pF |  10.00000 pF |              | Pass |
 |250mV, 1MHz      |-960.00000 u  | 134.89300 u  | 960.00000 u  |              | Pass |
 |250mV, 2MHz      |   9.98000 pF |  10.00000 pF |  10.00000 pF |              | Pass |
 |250mV, 2MHz      |  -2.22000 m  |   0.23666 m  |   2.22000 m  |              | Pass |
 |250mV, 5MHz      |   9.97000 pF |  10.00000 pF |  10.00000 pF |              | Pass |
 |250mV, 5MHz      |  -2.82000 m  |   0.31007 m  |   2.82000 m  |              | Pass |
 |-------------------------------------------------------------------------------|
 | Slot 3 / CMU / Cp-D Test: 10pF / 1.5m Cable                                    |
 |-------------------------------------------------------------------------------|
 |250mV, 1kHz      |  99.80000 pF | 100.00000 pF | 100.00000 pF |              | Pass |
 |250mV, 1kHz      |  -2.10000 m  |   0.09047 m  |   2.10000 m  |              | Pass |
 |250mV, 100kHz    |  99.90000 pF | 100.00000 pF | 100.00000 pF |              | Pass |
 |250mV, 100kHz    |-720.00000 u  |  -6.45168 u  | 720.00000 u  |              | Pass |
 |250mV, 1MHz      |  99.90000 pF | 100.00000 pF | 100.00000 pF |              | Pass |
 |250mV, 1MHz      |-840.00000 u  | 143.36200 u  | 840.00000 u  |              | Pass |
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Figure 3-78 B1500A test record example (10/10)

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                                                      B1500A JP10N00002 Page 10/10

  +--------------------------------------------------------------------------------+
  | Description     |    Minimum     |    Results     |    Maximum     | Uncertainty  | P/F  |
  |--------------------------------------------------------------------------------|
  |250mV, 2MHz     |   99.80000 pF | 100.00000 pF | 100.00000 pF |              | Pass |
  |250mV, 2MHz     |   -2.16000 m  |    0.31923 m  |    2.16000 m  |              | Pass |
  |250mV, 5MHz     |   99.80000 pF | 100.00000 pF | 100.00000 pF |              | Pass |
  |250mV, 5MHz     |   -2.70000 m  |    0.41520 m  |    2.70000 m  |              | Pass |
  |--------------------------------------------------------------------------------|
  | Slot 3 / CMU / Cp-D Test: 100pF / 1.5m Cable                                  |
  |--------------------------------------------------------------------------------|
  |250mV, 1kHz     |   0.99310  ohm|999.60570 mohm|  1.00642  ohm|              | Pass |
  |--------------------------------------------------------------------------------|
  | Slot 3 / CMU / R Test: 1ohm / 1.5m Cable                                      |
  |--------------------------------------------------------------------------------|
  |250mV, 1kHz     | 93.96800 mohm| 99.98977 mohm|106.08800 mohm|              | Pass |
  |--------------------------------------------------------------------------------|
  | Slot 3 / CMU / R Test: 100mohm / 1.5m Cable                                   |
  |--------------------------------------------------------------------------------|
  |250mV, 1kHz     |    9.85000 pF |  10.00000 pF |  10.20000 pF |              | Pass |
  |250mV, 1kHz     |  -15.12000 m  |   -0.13599 m  |   15.12000 m  |              | Pass |
  |250mV, 1MHz     |    9.99000 pF |  10.00000 pF |  10.00000 pF |              | Pass |
  |250mV, 1MHz     |   -1.14000 m  |    0.14114 m  |    1.14000 m  |              | Pass |
  |250mV, 2MHz     |    9.98000 pF |  10.00000 pF |  10.00000 pF |              | Pass |
  |250mV, 2MHz     |   -2.52000 m  |    0.24155 m  |    2.52000 m  |              | Pass |
  |250mV, 5MHz     |    9.97000 pF |  10.00000 pF |  10.00000 pF |              | Pass |
  |250mV, 5MHz     |   -3.48000 m  |    0.38378 m  |    3.48000 m  |              | Pass |
  |--------------------------------------------------------------------------------|
  | Slot 3 / CMU / Cp-D Test: 10pF / 3.0m Cable                                   |
  |--------------------------------------------------------------------------------|
  |250mV, 1kHz     |   99.80000 pF | 100.00000 pF | 100.00000 pF |              | Pass |
  |250mV, 1kHz     |   -2.10000 m  |    0.13948 m  |    2.10000 m  |              | Pass |
  |250mV, 100kHz   |   99.90000 pF | 100.00000 pF | 100.00000 pF |              | Pass |
  |250mV, 100kHz   |-720.00000 u  |  -10.53070 u  |  720.00000 u  |              | Pass |
  |250mV, 1MHz     |   99.90000 pF | 100.00000 pF | 100.00000 pF |              | Pass |
  |250mV, 1MHz     |-960.00000 u  |  118.49800 u  |  960.00000 u  |              | Pass |
  |250mV, 2MHz     |   99.80000 pF | 100.00000 pF | 100.00000 pF |              | Pass |
  |250mV, 2MHz     |   -2.40000 m  |    0.34863 m  |    2.40000 m  |              | Pass |
  |250mV, 5MHz     |   99.70000 pF | 100.00000 pF | 100.00000 pF |              | Pass |
  |250mV, 5MHz     |   -3.30000 m  |    0.31968 m  |    3.30000 m  |              | Pass |
  |--------------------------------------------------------------------------------|
  | Slot 3 / CMU / Cp-D Test: 100pF / 3.0m Cable                                  |
  |--------------------------------------------------------------------------------|
  |250mV, 1kHz     |   0.99310  ohm|999.62350 mohm|  1.00642  ohm|              | Pass |
  |--------------------------------------------------------------------------------|
  | Slot 3 / CMU / R Test: 1ohm / 3.0m Cable                                      |
  |--------------------------------------------------------------------------------|
  |250mV, 1kHz     | 93.96800 mohm|100.05240 mohm|106.08800 mohm|              | Pass |
  |--------------------------------------------------------------------------------|
  | Slot 3 / CMU / R Test: 100mohm / 3.0m Cable                                   |
  |--------------------------------------------------------------------------------|
  |                                    NOT TESTED                                  |
  +--------------------------------------------------------------------------------+
```

4 Troubleshooting

Introduction

This chapter describes the Agilent B1500A troubleshooting procedures and the reference information, and consists of the following sections.

- "Introduction"
- "Troubleshooting Flow"
- "Troubleshooting Reference"

WARNING **The information in this manual is provided for use by service trained personnel only. To avoid electrical shock, do not perform any procedures in this manual unless you are qualified to do so.**

Potential shock hazard. Dangerous voltage may be present on the board assembly (including shield cover) for up to 10 seconds after you set the Line switch to off.

- **Power supply module: ±300 V maximum**
- **Other modules: ±270 V maximum**

CAUTION Before you start the troubleshooting, clear any obstructions around the fans and cooling air holes.

Before you access the inside of the instrument, make sure the power is turned off.

Troubleshooting tools

The troubleshooting in this chapter is performed by using the following tools:

- Built-in selftest and diagnostics
- Performance verification (PV) software

When you use the above tools, you may also perform the following to isolate the problem.

- Disconnect the connection between two assemblies, then perform the test.
- Remove an assembly, then perform the test.
- Swap on SMU module with another SMU module, then perform the test.
- Detach the power supply, and turn on the power supply only.

After repair

If you replace or swap a module or a board, you need to do the performance verification, calibration, and so on. See Chapter 5 , "Replacement Procedure," for details.

Notes for troubleshooting

- Before an assembly replacement, try to reconnect the cable or reinstall the assembly to check the connections. Sometimes bad connections cause problems.
- Before you start the troubleshooting, confirm the GPIB address, line frequency, and firmware revision so that you can set them properly when the troubleshooting is done.

CAUTION Do not block the ventilation opening on the side covers. Otherwise, thermal damage might occur.

Notes on B1500A modules and components

The following are notes for each module and component in the B1500A.

- Power supply module
  - ❏ The power supply module can operate with AC voltage 90 V to 260 V without any manual switching.
  - ❏ Each DC output line has the detection circuit for over load, over voltage, and under voltage. If any abnormal condition is detected, the power supply module shuts down by itself.
  - ❏ The power supply module detects the fan revolution speed. If the power supply fan slows down or stops, the power supply module detects it.
  - ❏ There is no serviceable part inside the power supply module. Do not open and access the inside.
  - ❏ The cable that connects the power supply module with the motherboard is set as a part of the power supply module.
  - ❏ The fuse is located inside the power supply module and is accessible from outside the module.
  - ❏ In the troubleshooting process, you may need to refer to the two LED error indicators on the instrument's rear panel. The picture below shows the location of the LEDs.

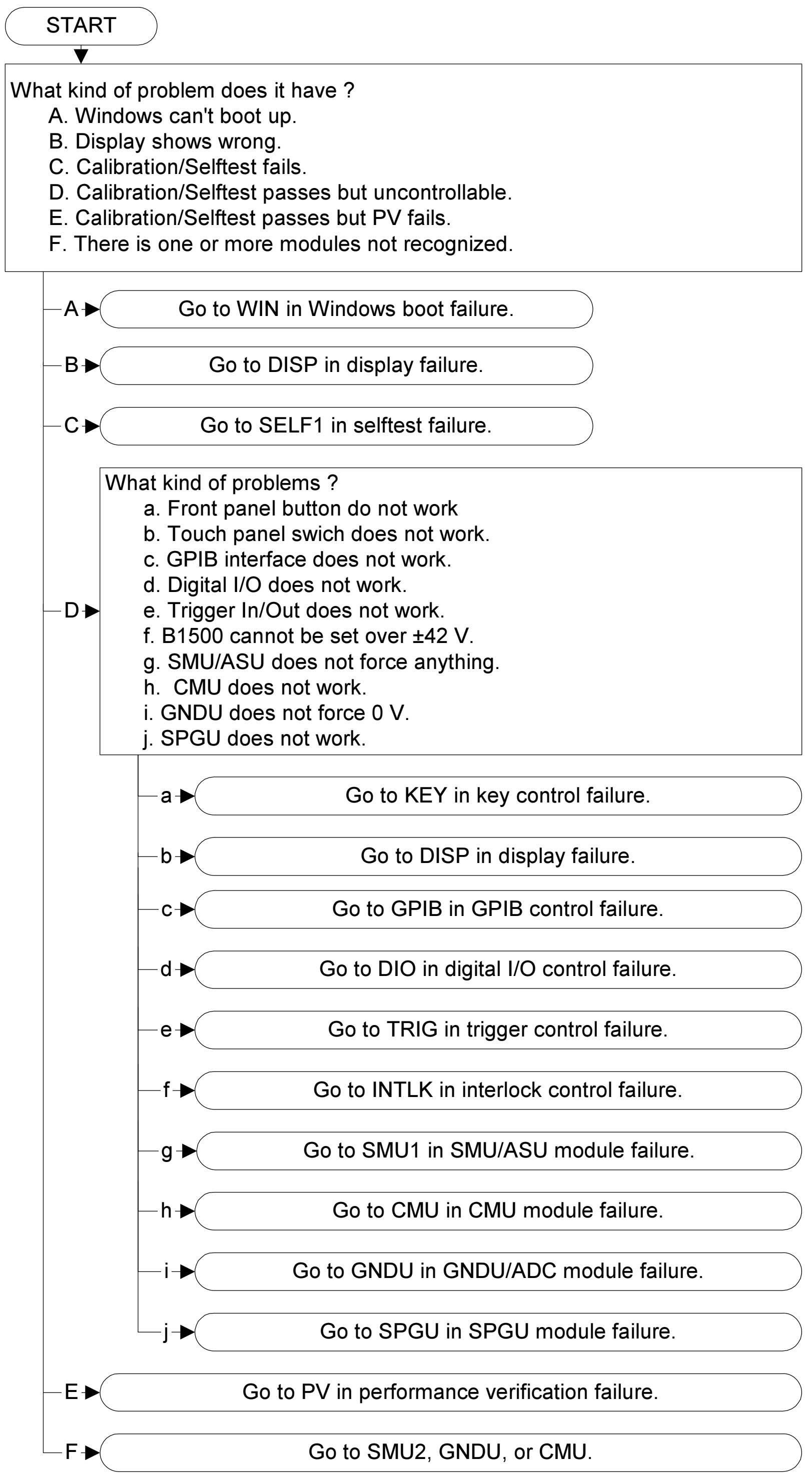
Figure 4-1 Rear panel LED error indicators

- Frame fan
  - ❑ The frame fan revolution is monitored by the CPU board. If the fans slow down or stop, this is detected as an error and shutdown occurs. It takes about 10 seconds before the shutdown is implemented.
  - ❑ If the fans are connected to the wrong connectors, shutdown occurs because the CPU board detects the error.
- LCD backlight
  - ❑ The LED array is used to provide power to the LCD backlight. No high voltage is used.
- GNDU/ADC module
  - ❑ If there are failures in ADC tests, the self-tests for the SMU will not be performed. However, if there are failures in GNDU, the self-tests for the SMU will still be performed.
  - ❑ If the self-test for the GNDU/ADC fails, the output relay will stay open, but the GNDU output will remain connected to the chassis common via the 11 kΩ resistor.

Troubleshooting Flow

This section describes the troubleshooting flow for the B1500A. Start from START in Figure 4-2.

Figure 4-2 Troubleshooting start



Power supply failure

Figure 4-3 If power supply back light does not light

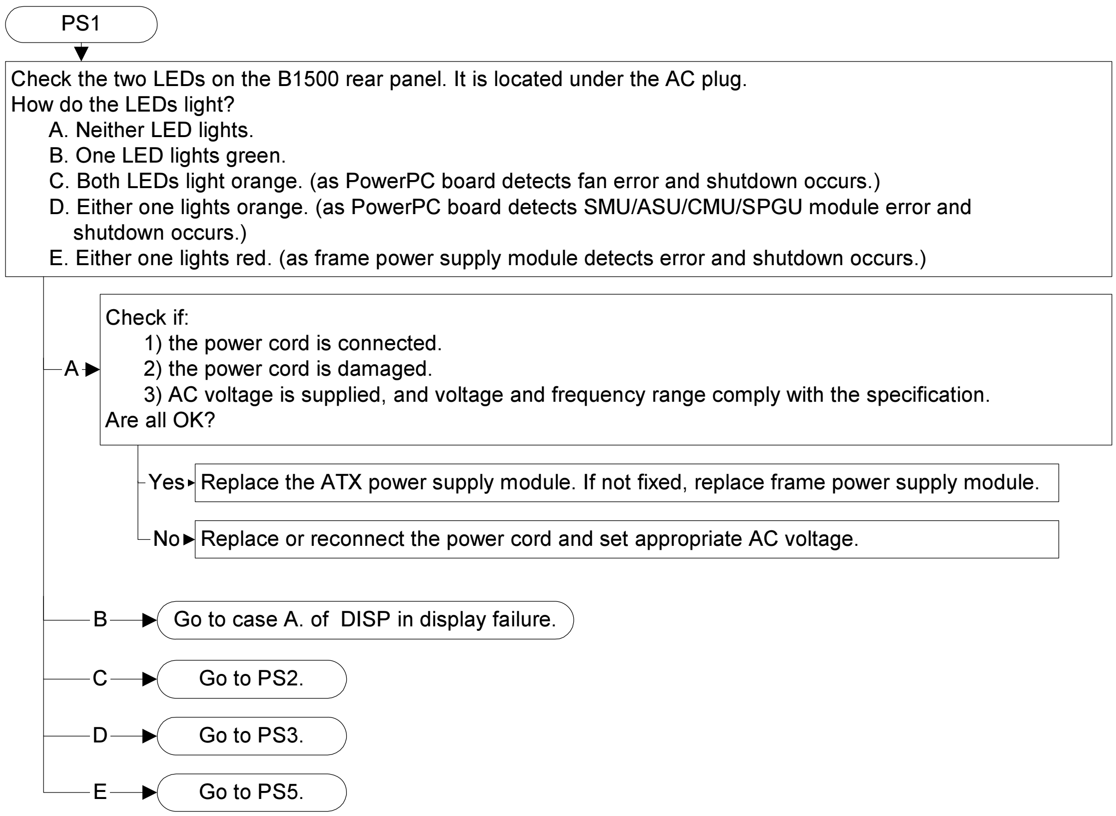


Figure 4-4 If both LEDs on rear panel light orange

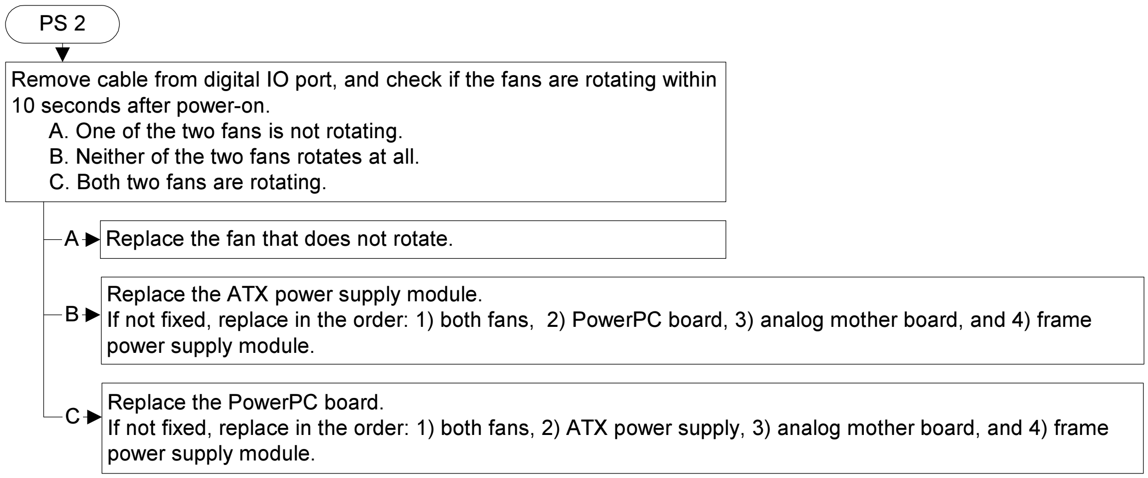


Figure 4-5 If one of LEDs on rear panel lights orange

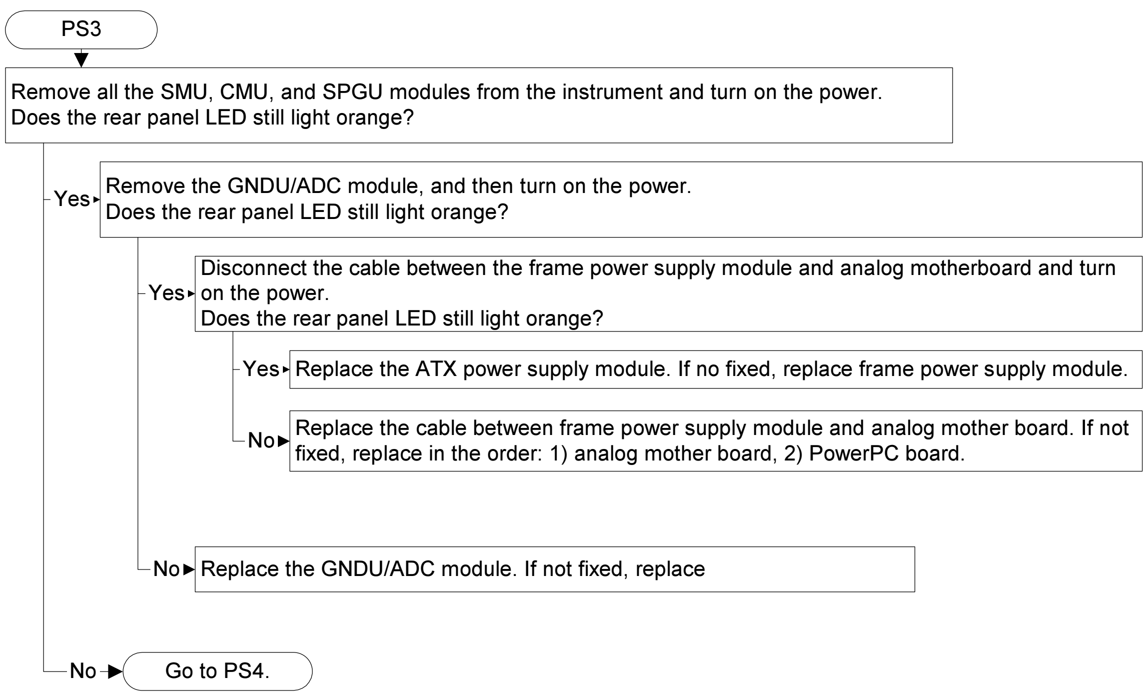


Figure 4-6 If one of rear panel LEDs lights orange SMU/ASU/CMU/SPGU module is installed

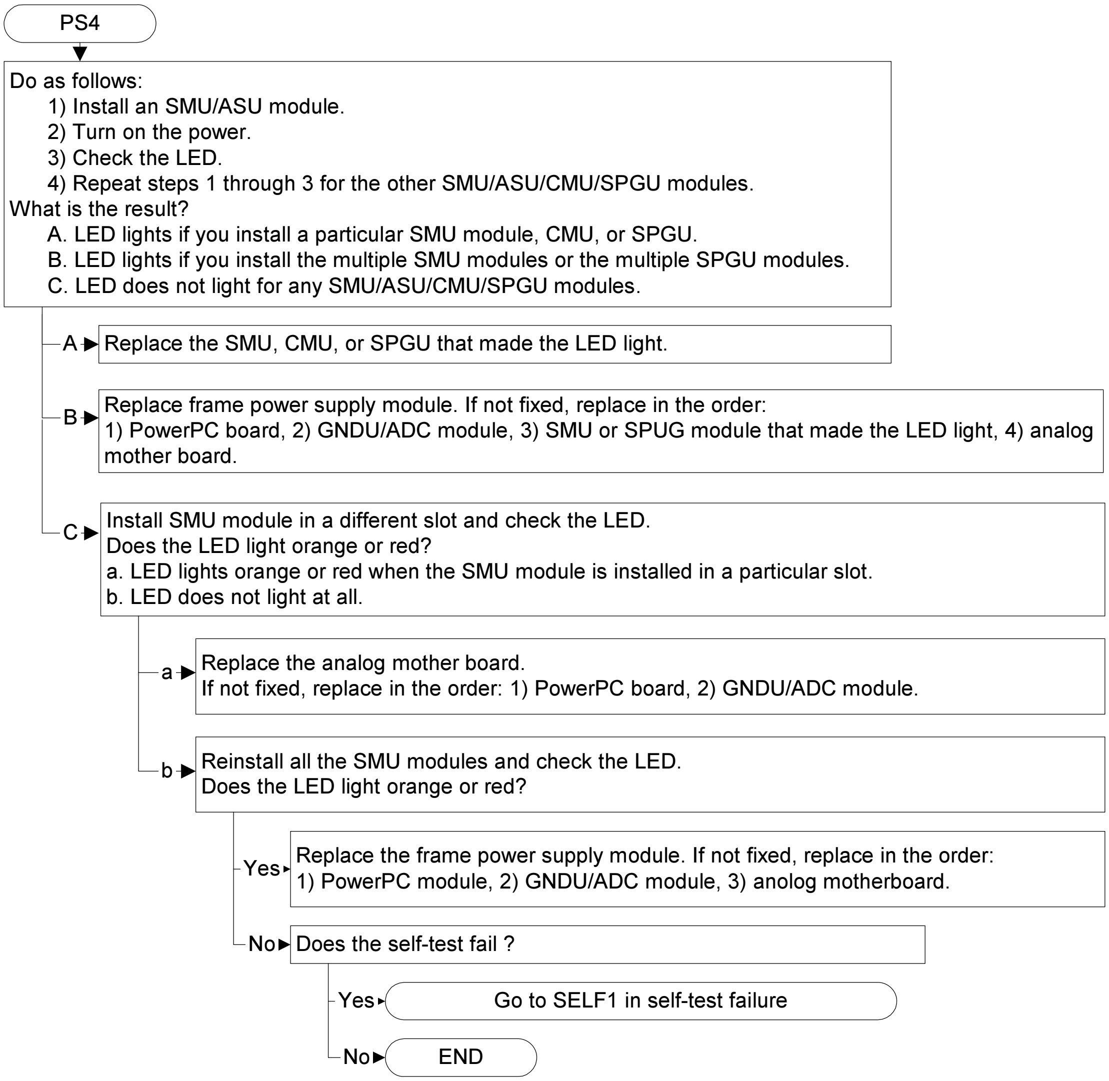
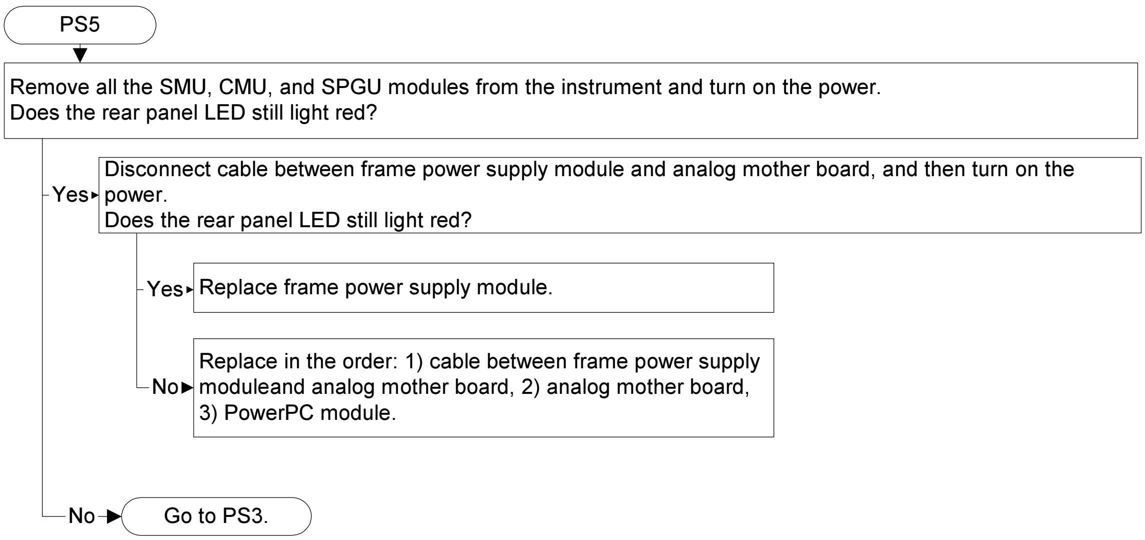
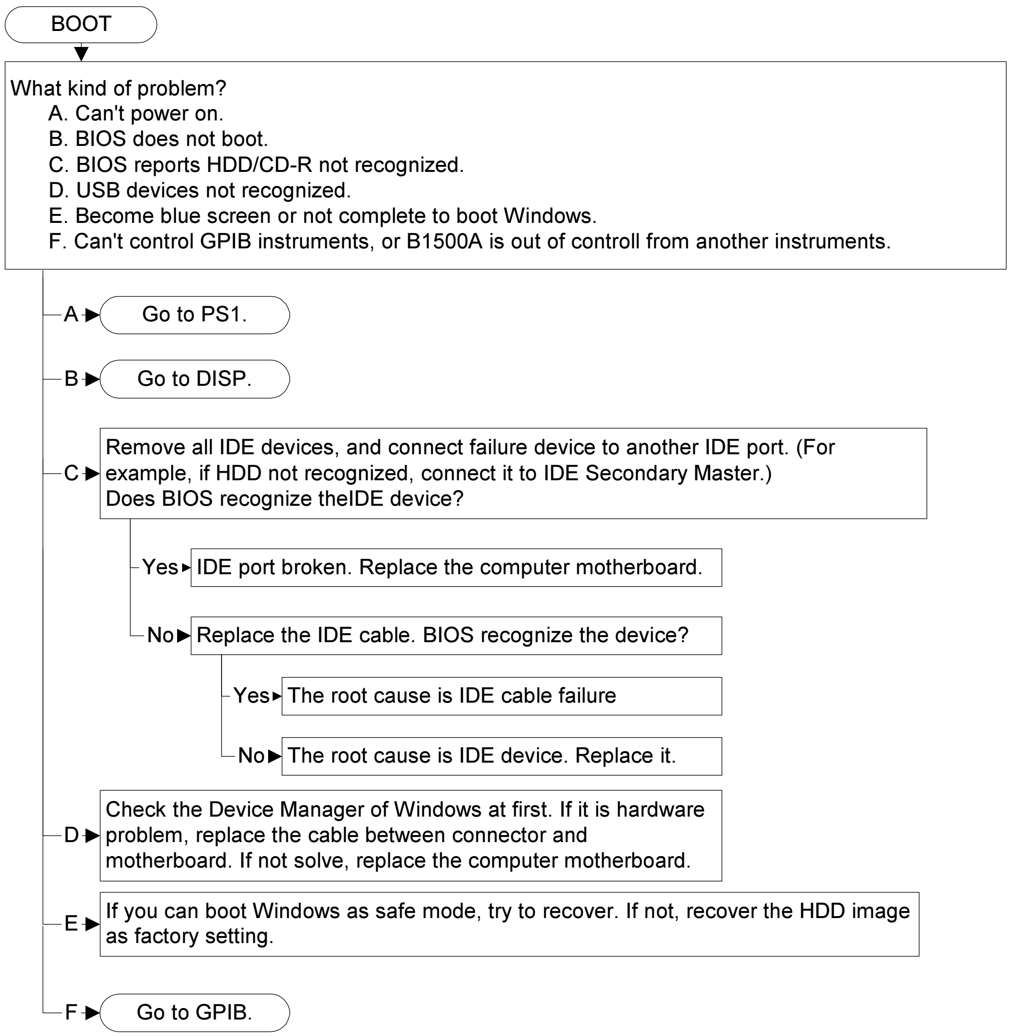


Figure 4-7 If one of LEDs on rear panel lights red



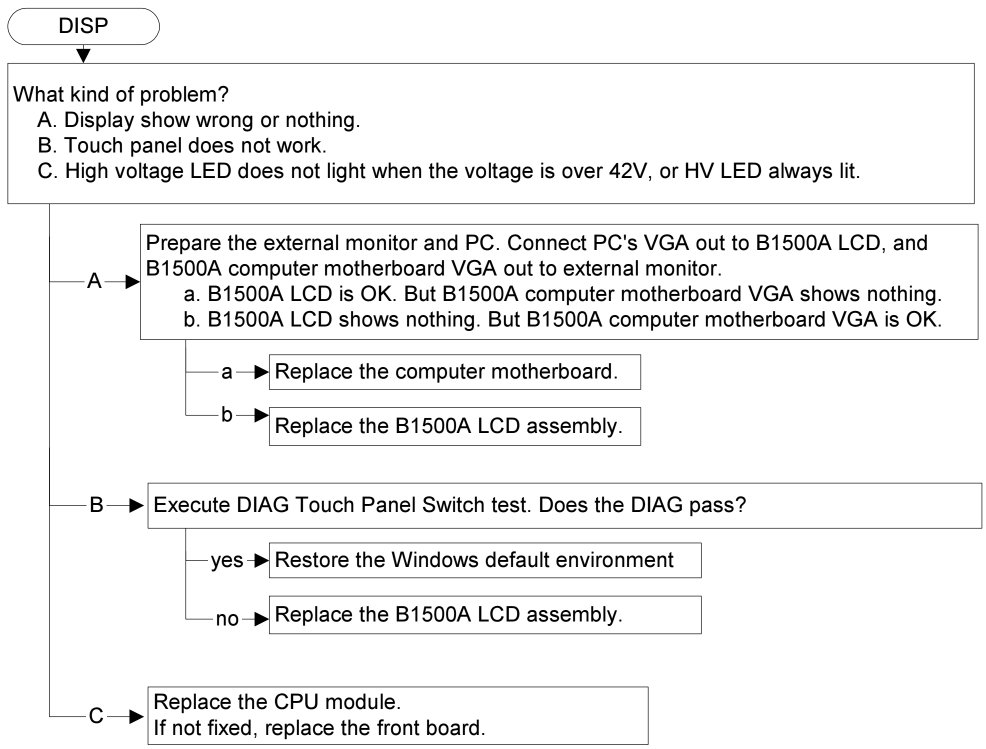
Windows failure

Figure 4-8 If Windows does not boot correctly



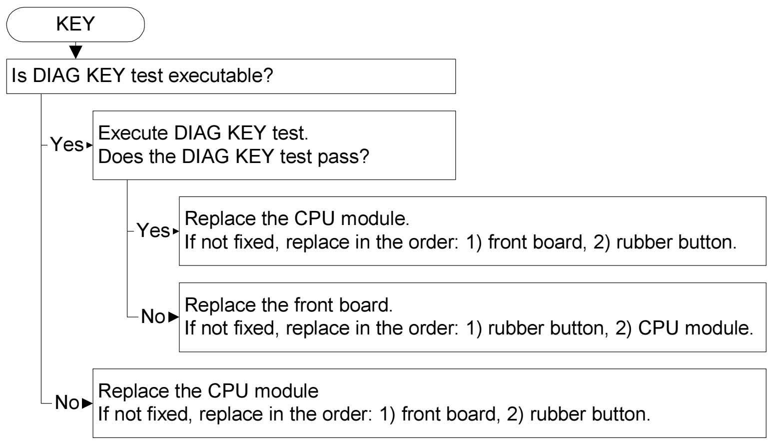
Front display failure

Figure 4-9 If front display looks wrong or back light does not light



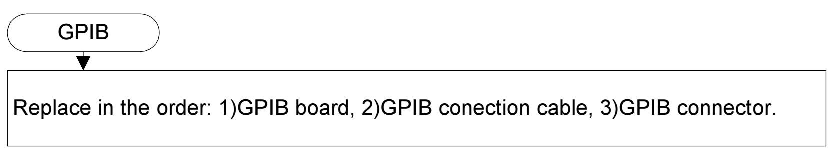
Front key failure

Figure 4-10 If front panel keys do not work



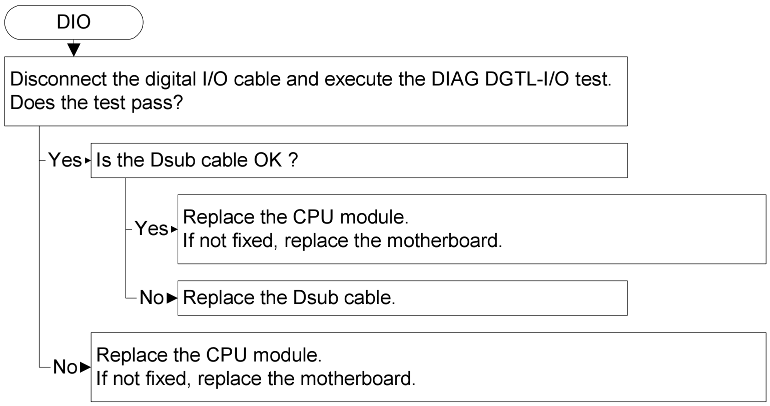
GPIB control failure

Figure 4-11 If GPIB control fails



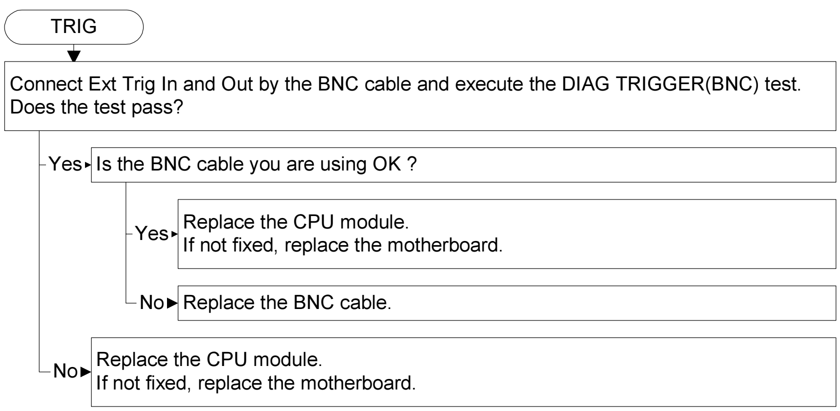
Digital I/O control failure

Figure 4-12 If digital I/O control fails



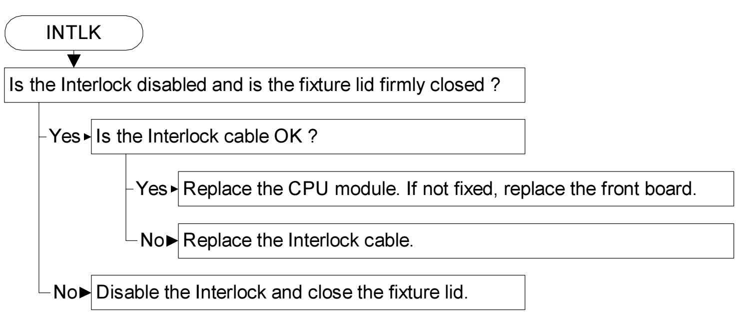
Trigger control failure

Figure 4-13 If trigger control fails but self-test passes



Interlock control failure

Figure 4-14 If interlock control fail (voltage over 42 V cannot be output)



Self-test failure

Figure 4-15 If the self-test fails

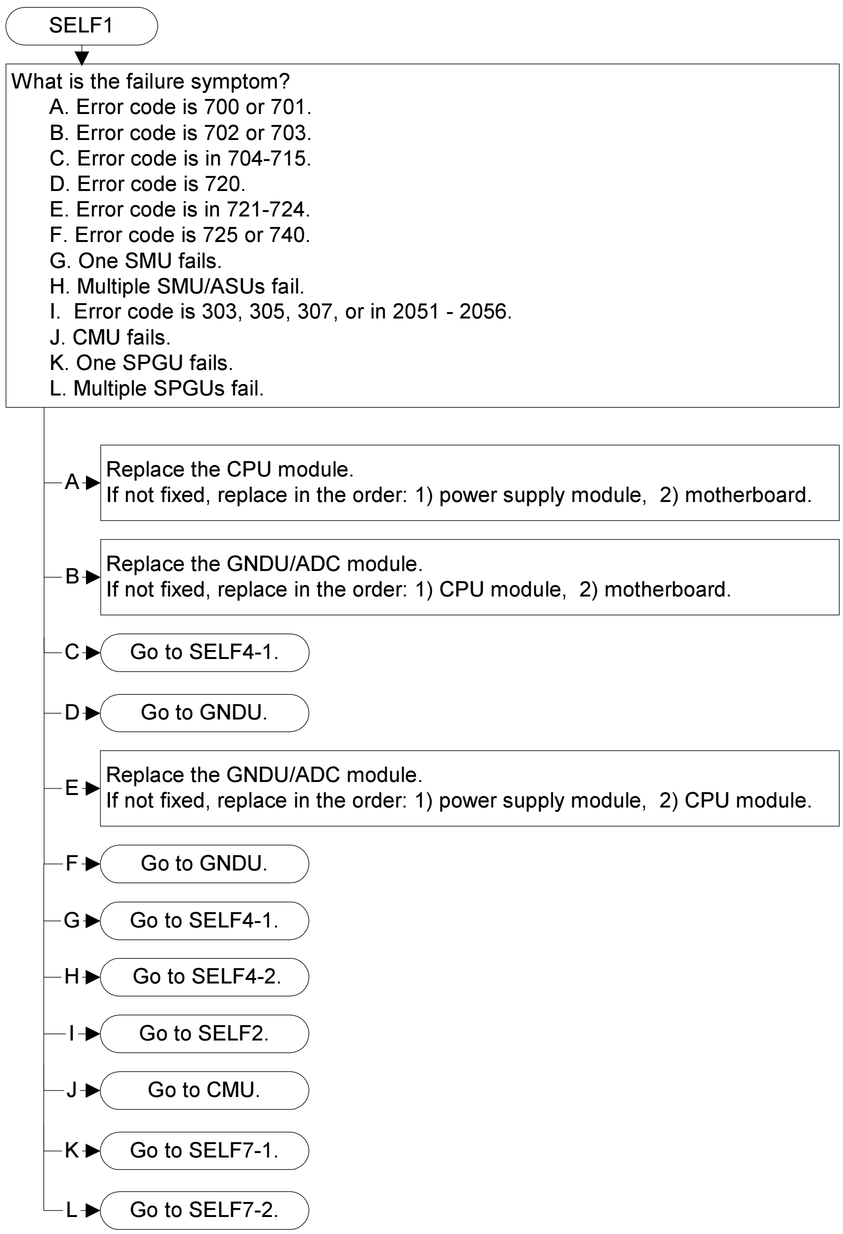


Figure 4-16 If self-test fails with error code 303, 305, or 307

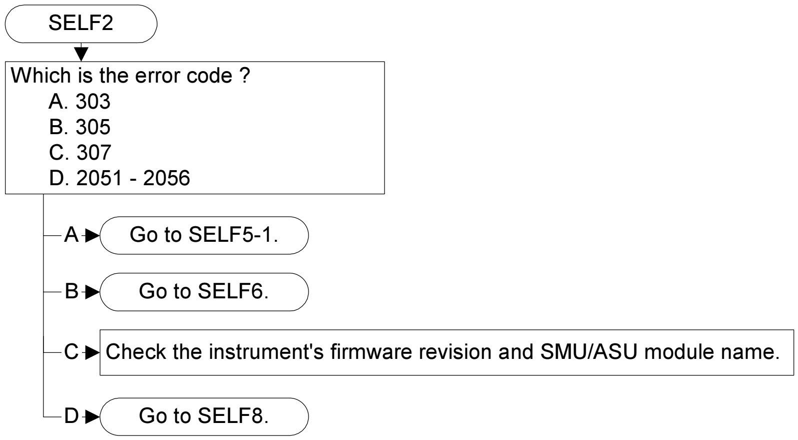


Figure 4-17 If GNDU or ADC self-test fails or ADC not installed; error code: 720, 725 or 740

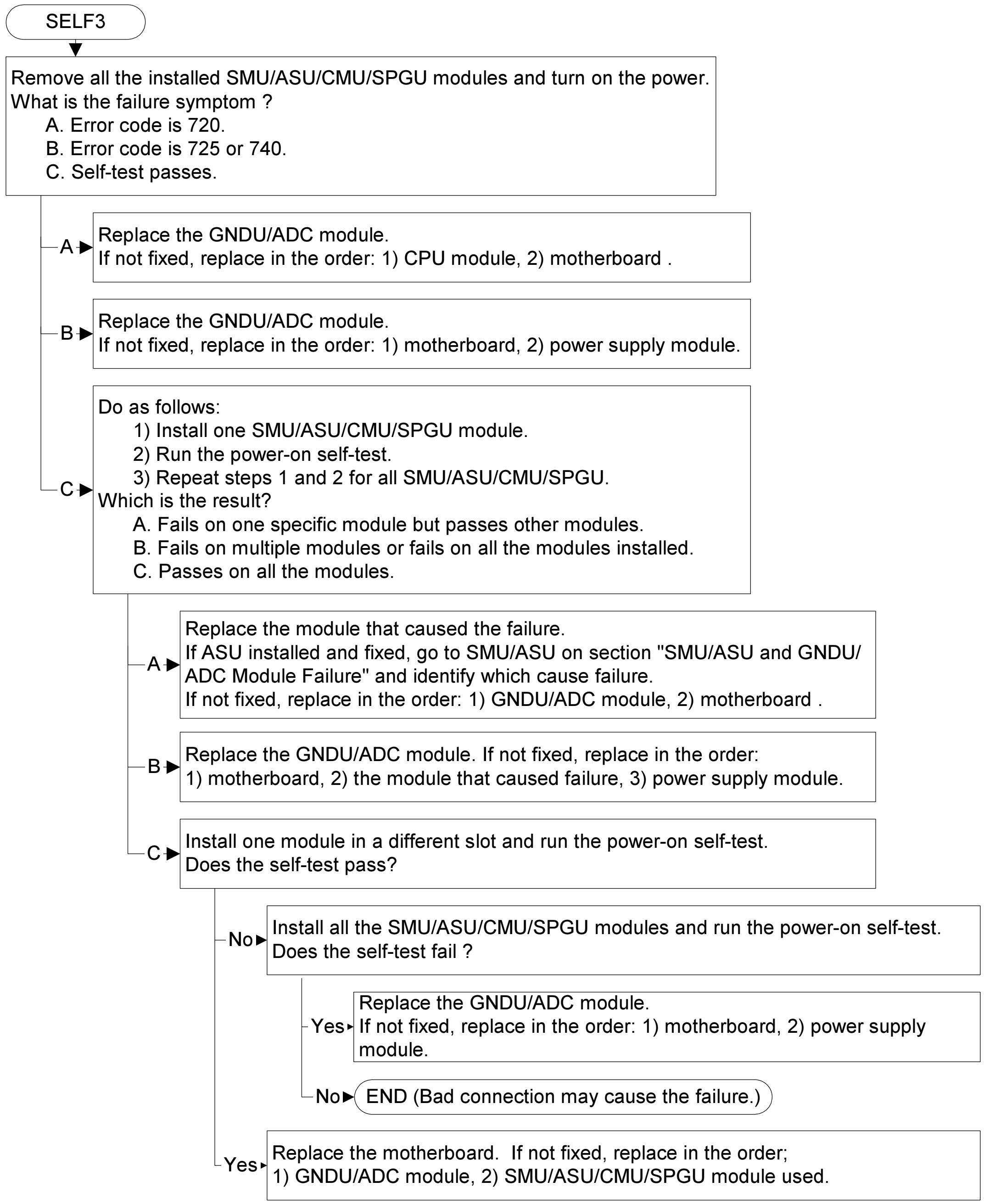


Figure 4-18 If only one SMU/ASU self-test fails

SELF4-1

Replace the failed SMU/ASU module with the passed SMU/ASU module and run the power-on self-test.
(If there is only one SMU/ASU module, change the slot and install the same SMU/ASU module.)

Which self-test fails ?
A. The failed SMU/ASU fails again and the passed SMU/ASU in the slot where the failed SMU/ASU was installed passes.
B. The failed SMU/ASU passes and the passed SMU/ASU in the slot where the failed SMU/ASU was installed fails.

A → Replace the failed SMU/ASU module.
If ASU installed and fixed, go to SMU/ASU on section "SMU/ASU and GNDU/ADC Module Failure" and identify which cause failure.
If not fixed, replace in the order: 1) GNDU/ADC module, 2) power supply module.

B → Replace in the order: 1) motherboard, 2) CPU module.

Figure 4-19 If CPU self-test fails with SMU/ASU status check fail 704-715 or multiple self-tests fail

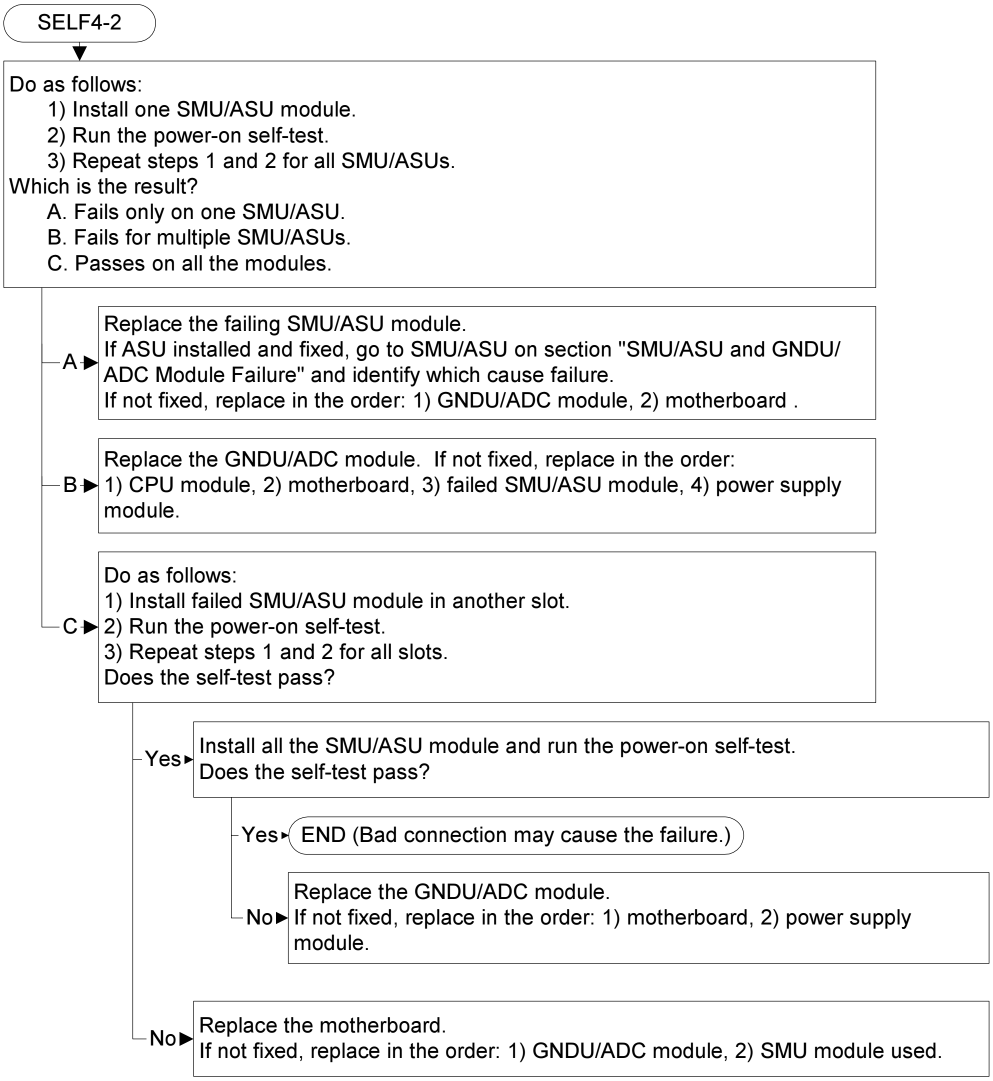


Figure 4-20 If self-test fails with an error code 303: excess voltage in MPSMU/HRSMU/ASU

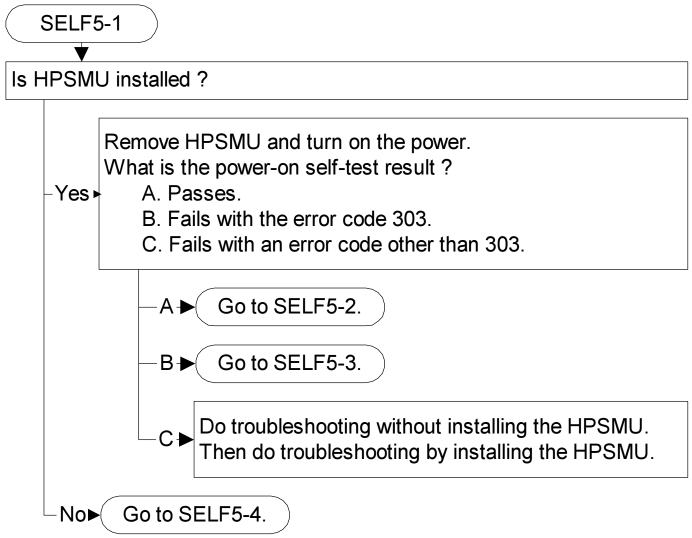


Figure 4-21 If SMU/ASU self-test fails when installing HPSMU with an error code 303

SELF5-2

Do as follows:
1) Install all the HPSMUs and one MPSMU/HRSMU/ASU.
2) Turn on the power.
3) Check the power-on self-test result.
4) Replace MPSMU with another MPSMU/HRSMU/ASU.
5) Repeat steps 1 through 4 for all MPSMU/HRSMU/ASUs one by one.

What is the power-on self-test result ?
A. Fails only with one MPSMU/HRSMU/ASU module. (If there is only one MPSMU/HRSMU/ASU and it fails, it is "B" below.)
B. Fails with all the MPSMU/HRSMU/ASU modules.
C. Passes.

A → Replace the MPSMU/HRSMU/ASU module that fails.

B → How many HPSMU modules are installed ?
a) One
b) Two or more.

- a → Replace the HPSMU module. If not fixed, replace in the order: 1) CPU module, 2) motherboard.
- b → Do as follows:
  1) Install the MPSMU/HRSMU/ASU module that fails.
  2) Install one HPSMU and turn on the power.
  3) Check the power-on self-test result.
  4) Then, replace HPSMU with another HPSMU module and turn on the power.
  5) Check the power-on self-test result.
  6) Repeat steps 1 through 5 for all the HPSMUs one by one.

  How does the power-on self-test fail ?
  i. Fails with only one HPSMU.
  ii. Fails with muitiple HPSMU.
  - i → Replace the HPSMU that fails.
  - ii → Replace the CPU module. If not fixed, replace in the order; 1) motherboard, 2) HPSMU modules that fails.

C → Install all the MPSMU/HRSMu/ASU modules and turn on the power.
What is the self-test result ?
a. Fails with the error code 303.
b. Fails with an error code other than 303.
c. Passes always.

- a → Replace the motherboard. If not fixed, replace the CPU module.
- b → Go to SELF1.
- c → END (Bad connection may cause the failure.)

Figure 4-22 If SMU/ASU self-test fails when HPSMU is deinstalled with an error code 303

SELF5-3

Do as follows:

1) Deinstall all the HPSMUs.
2) Install one MPSMU/HRSMU/ASU and turn on the power.
3) Check the power-on self-test result.
4) Replace MPSMU/HRSMU/ASU with another SMU/ASU and turn on the power.
5) Check the power-on self-test results.
6) Repeat steps 1 through 5 for all the MPSMU/HRSMU/ASUs one by one.

What is the power on self-test result ?

A. Fails only with one MPSMU/HRSMU/ASU module where there are multiple MPSMU/HRSMU/ASU modules.
B. Fails only with one MPSMU/HRSMU/ASU module where there is only one MPSMU/HRSMU/ASU module.
C. Fails with multiple MPSMU/HRSMU/ASU modules.
D. Passes.

- A ▶ Replace the MPSMU/HRSMU/ASU module that fails.
- B ▶ Install the MPSMU/HRSMU/ASU module in a different slot and turn on the power. Check the power-on self-test resutls.
  Does the self-test pass ?
  - Yes ▶ Replace the motherboard. If not fixed, replace in the order:
    1) CPU module, 2) MPSMU/HRSMU/ASU modules that fail.
  - No ▶ Replace the MPSMU/HRSMU/ASU module that fails. If not fixed, replace in the order:
    1) CPU module, 2) GNDU/ADC module, 3) motherboard.
- C ▶ Replace the CPU module. If not fixed, replace in the order:
  1) GNDU/ADC board, 2) motherboard, 3) MPSMU modules that fail.
- D ▶ Install all the MPSMU/HRSMU/ASU modules and turn on the power.
  Does the self-test pass?
  - Yes ▶ Install all the SMU/ASU modules and turn on the power.
    Does the self-test pass?
    - Yes ▶ END (Bad connection may cause the failure.)
    - No ▶ Replace the motherboard. If not fixed, replace in the order:
      1) CPU module, 2) failed MPSMU/HRSMU/ASU module
  - No ▶ Replace the motherboard. If not fixed, replace in the order:
    1) CPU module, 2) failed MPSMU/HRSMU/ASU module

Figure 4-23 If SMU/ASU self-test fails with an error code 303: MPSMU/HRSMU/ASU install error only

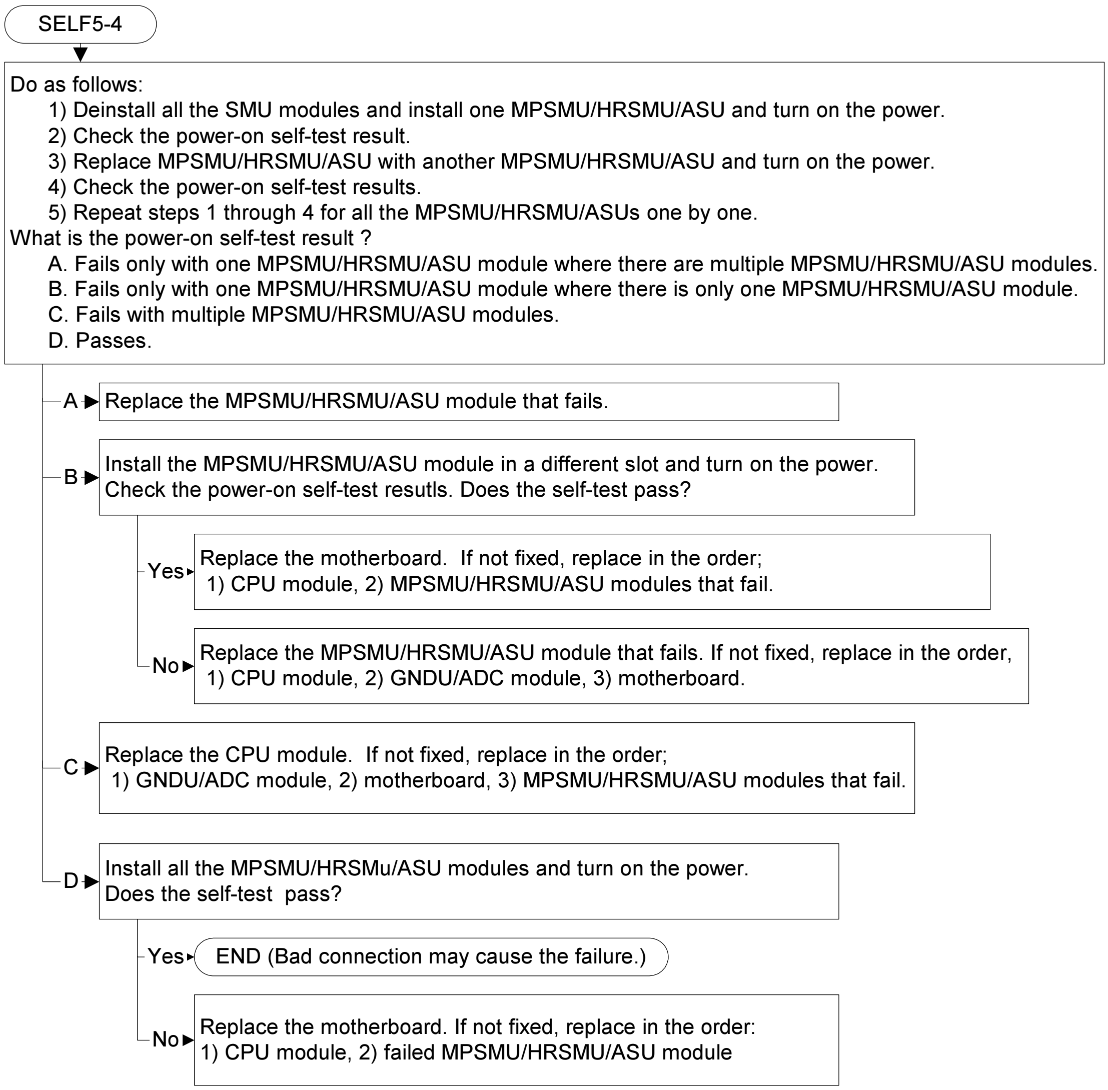


Figure 4-24 If SMU self-test fails with an error code 305: excess current in HPSMU

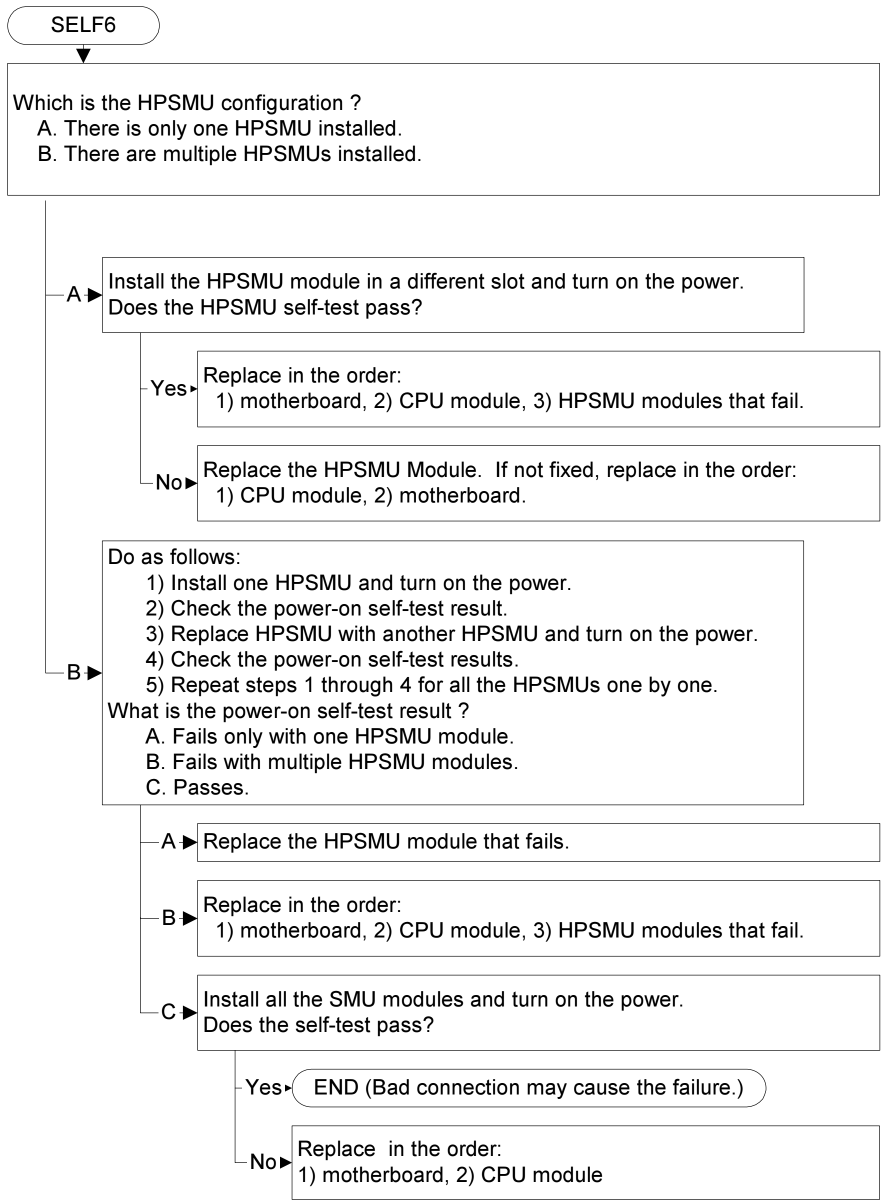


Figure 4-25 If only one SPGU self-test fails

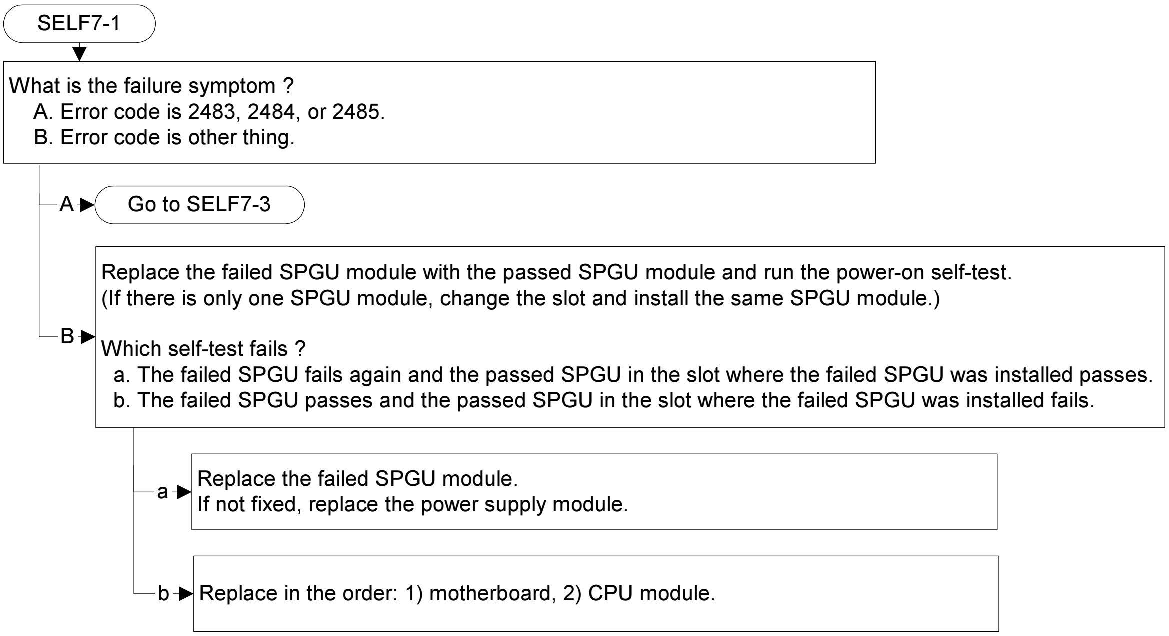


Figure 4-26 If multiple SPGUs self-test fail

SELF7-2

What is the failure symptom ?
A. Error code is 2483, 2484, or 2485.
B. Error code is other thing.

- A ▶ Go to SELF7-3
- B ▶ Do as follows:
  1) Install one SPGU module.
  2) Run the power-on self-test.
  3) Repeat steps 1 and 2 for all SPGUs.

  Which is the result?
  a. Fails only on one SPGU.
  b. Fails for multiple SPGUs.
  c. Passes on all the modules.
  - a ▶ Replace the failing SPGU module. If not fixed, replace the motherboard .
  - b ▶ Replace in the order: 1) CPU module, 2) motherboard, 3) failed SPGU module, 4) power supply module.
  - c ▶ Do as follows:
    1) Install failed SPGU module in another slot.
    2) Run the power-on self-test.
    3) Repeat steps 1 and 2 for all slots.

    Does the self-test pass?
    - Yes ▶ Install all the SPGU modules and run the power-on self-test. Does the self-test pass?
      - Yes ▶ END (Bad connection may cause the failure.)
      - No ▶ Replace in the order: 1) motherboard, 2) power supply module.
    - No ▶ Replace the motherboard. If not fixed, replace the failed SPGU module.

Figure 4-27 If SPGU self-test fails with an error code 2483, 2484, or 2485

SELF7-3

Replace two synchronization cables between the failed SPGU module in the smallest slot and the other SPGU module just under it.
Run the power-on self-test.
Which is the result?
- A. Passes on all the modules.
- B. Passes on the failed SPGU module in the smallest slot, but fails on other SPGU module(s).
- C. No change.

A ► END (Bad connection may cause the failure.)

B ► Go back to SELF7-3

C ► Take back the synchronization cables, then replace the other SPGU module just under the failed SPGU module in the smallest slot.
Run the power-on self-test.
Which is the result?
- a. Passes on all the modules.
- b. Passes on the failed SPGU module in the smallest slot, but fails on other SPGU module(s).
- c. No change.

a ► END

b ► Go back to SELF7-3

c ► Take back the replaced SPGU module, then replace the failed SPGU module in the smallest slot.
Run the power-on self-test.
Which is the result?
- A. Passes on all the modules.
- B. Passes on the failed SPGU module in the smallest slot, but fails on other SPGU module(s).
- C. No change.

A ► END

B ► Go back to SELF7-3

C ► Do as follows:
1) Replace two in the following equipment at the same time.
   - a. the failed SPGU module in the smallest slot
   - b. the other SPGU module just under it
   - c. two synchronization cables between both the SPGU modules.
2) Run the power-on selftest.
3) Repeat steps 1 and 2 for three cases (replacing a+b, b+c, and c+a).

Which is the result?
- a. Passes on all the modules.
- b. Passes on the failed SPGU module in the smallest slot, but fails on other SPGU module(s).
- c. No change.

a ► END

b ► Go back to SELF7-3

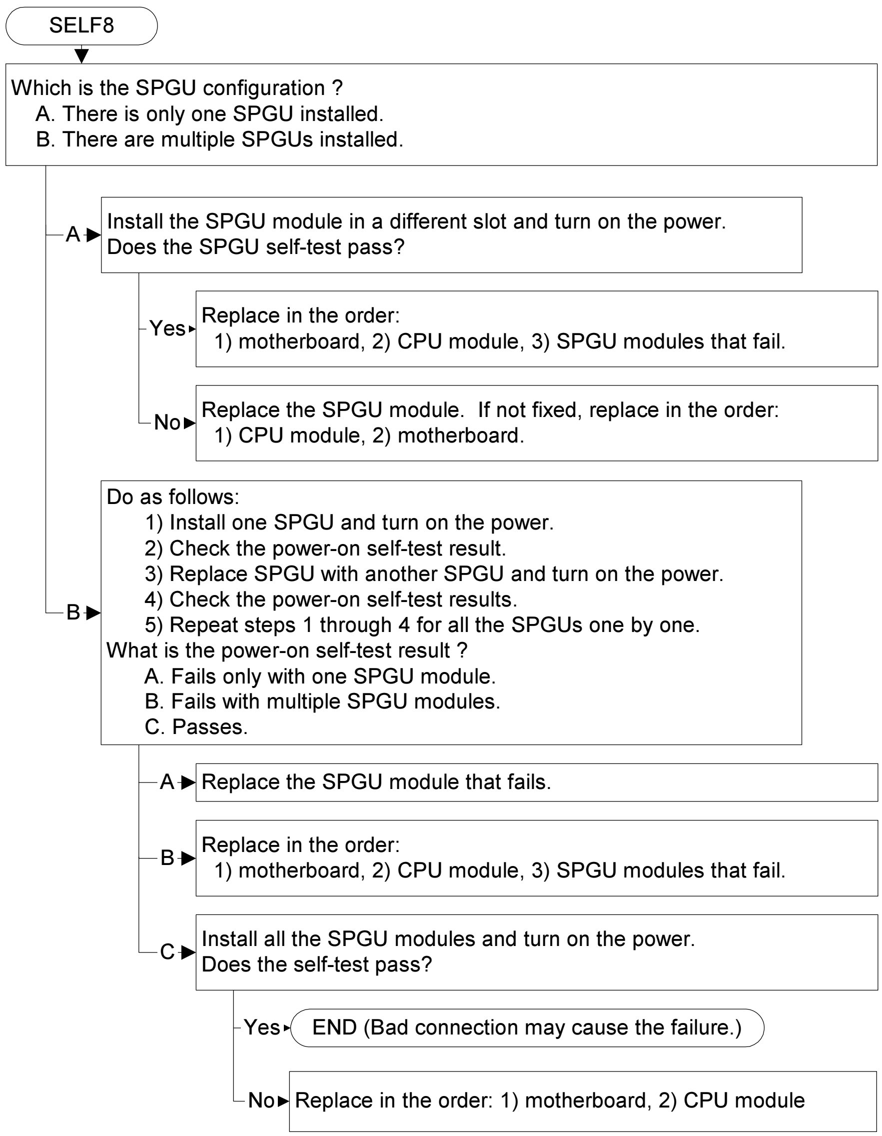
c ► Replace the following three equipment at the same time.
- a. the failed SPGU module in the smallest slot
- b. the other SPGU module just under it
- c. two synchronization cables between both the SPGU modules.

Run the power-on selftest.
Does the self-test pass?

Yes ► END

No ► Go back to SELF7-3

Figure 4-28 If SPGU self-test fails with an error code of 2051 to 2056



Module Failure

This section describes the troubleshooting procedure for failures regarding SMU, CMU, SPGU and GNDU/ADU modules.

Figure 4-29 If SMU/ASU module fails (there is no output from SMU/ASU)

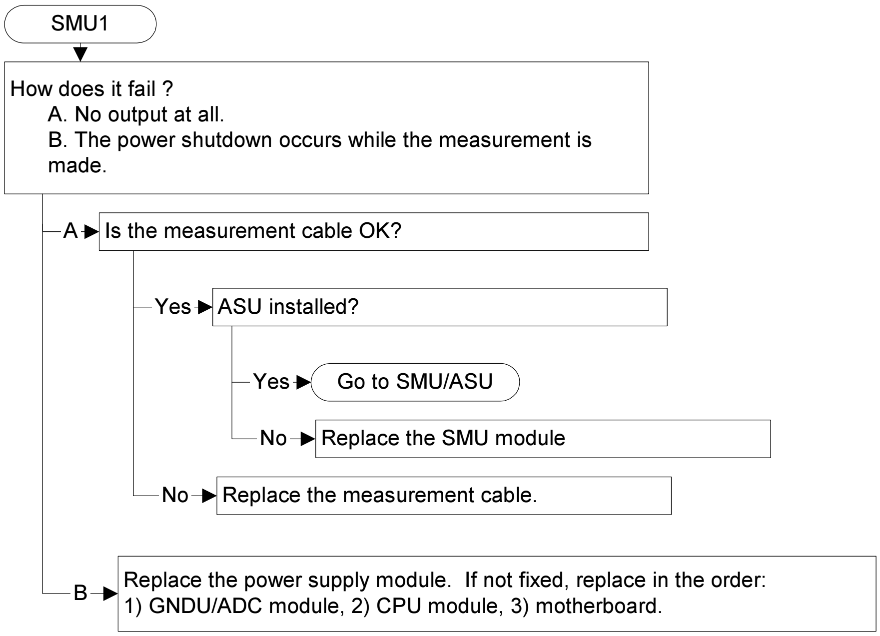


Figure 4-30 If SMU module fails (module not recognized by CPU)

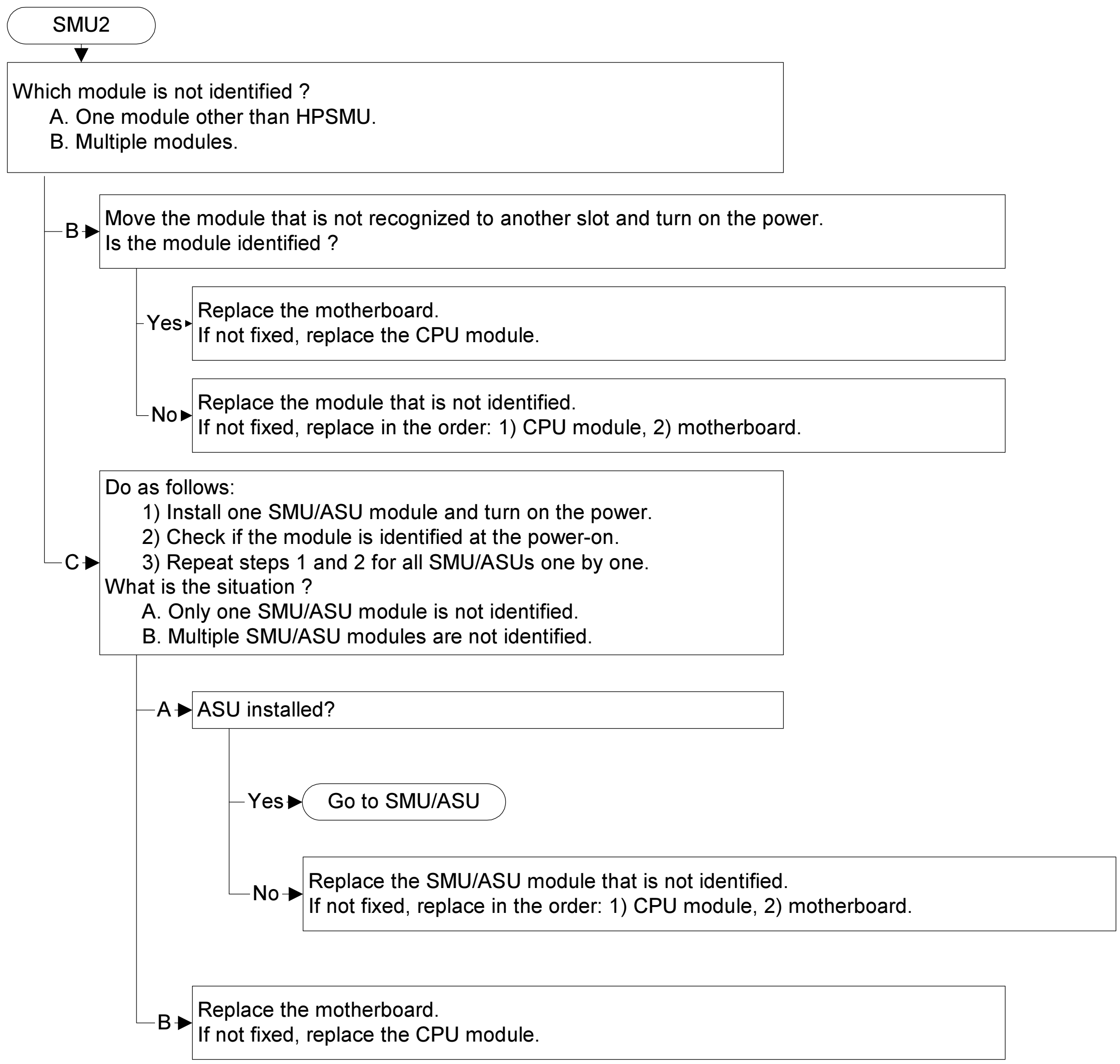


Figure 4-31 If HRSMU+ASU fails

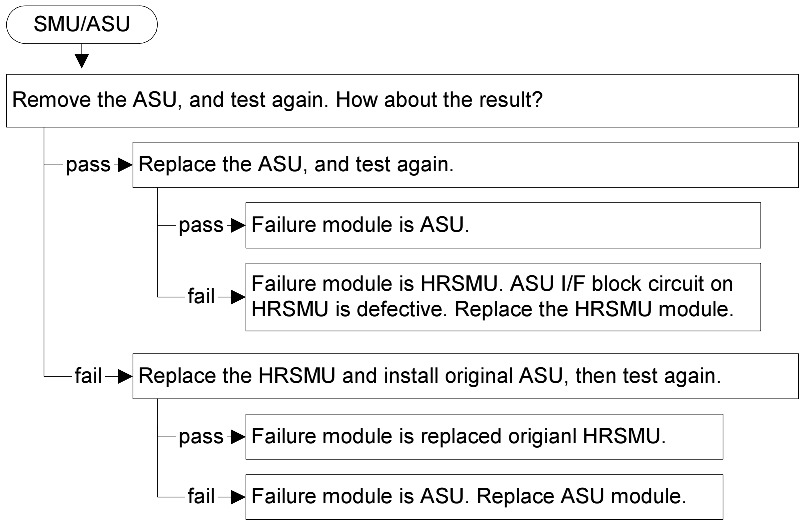


Figure 4-32 If ADC/GNDU fails but self-test passes

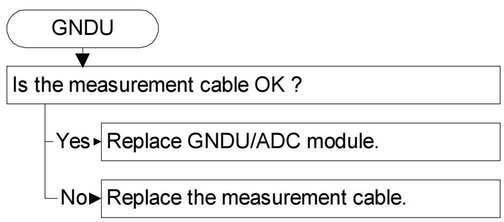


Figure 4-33 If CMU fails

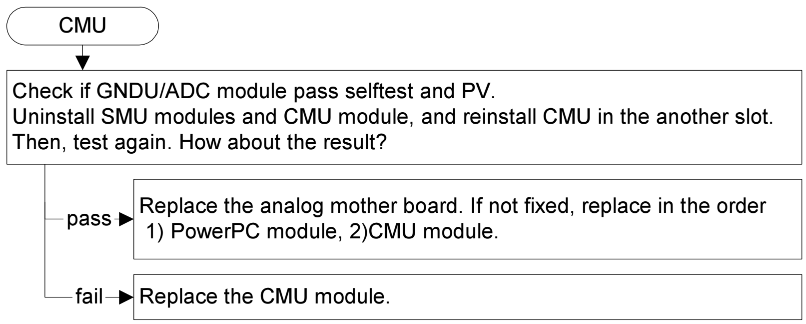
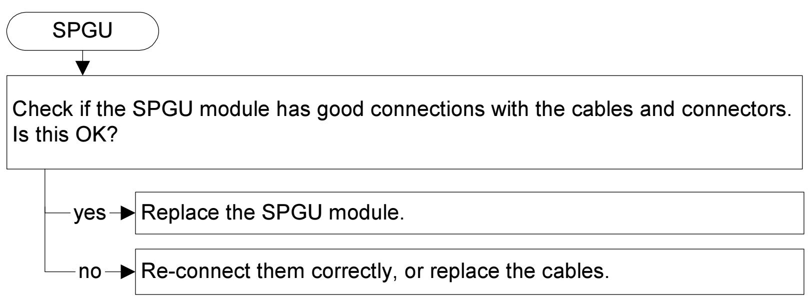


Figure 4-34 If SPGU fails



PV Failure

Figure 4-35 If PV fails

PV

Which PV fails ?

- A. GNDU/ADC fails. All others pass.
- B. One SMU module fails. (Fails on the ranges lower than 10 nA) All the others pass.
  (If only one SMU module is installed and if it fails, it is the situation "D" below.)
- C. One SMU module fails. (Fails for the ranges lower than 10 nA) All the others pass.
- D. Multiple modules fail.
- E. Reference values cannot be written in EEPROM of GNDU/ADC module.(The values are out of limits.)
- F. SMU's reference standard register data cannot be written.
- G. The instrument shuts down during PV execution.
- H. Out of control via GPIB.
- I. CMU fails.
- J. SPGU fails.

A → Replace the GNDU/ADC module.
If not fixed, calibrate and set the reference values to the GNDU/ADC module.

B → Replace the failing SMU module. If not fixed, do the following in order:
1) Calibrate and set the reference values to the GNDU/ADC module.
2) Replace GNDU/ADC module.

C → Calibrate and set the reference values to the SMU module.
If not fixed, do the following in order:
1) Calibrate and set the reference values to the GNDU/ADC module.
2) Replace the SMU module.
3) Replace the GNDU/ADC module.

D → Calibrate and set all the reference values. If not fixed, do the following in the order:
1) Change the SMU module that is used for the adjustment and retry.
2) Replace the GNDU/ADC module.
3) Replace the motherboard.
4) Replace the power supply module.

E → Replace the SMU module that is used for the adjustment and set the calibration data.
Is the calibration data written in the EEPROM of GNDU/ADC module?
- Yes → Replace the SMU module that was used and failed to set the calibration data.
- No → Replace the GNDU/ADC module.

F → Replace the SMU module for which the reference data cannot be set.

G → Replace the power supply module.

H → Go to GPIB.

I → Go to CMU.

J → Go to SPGU.

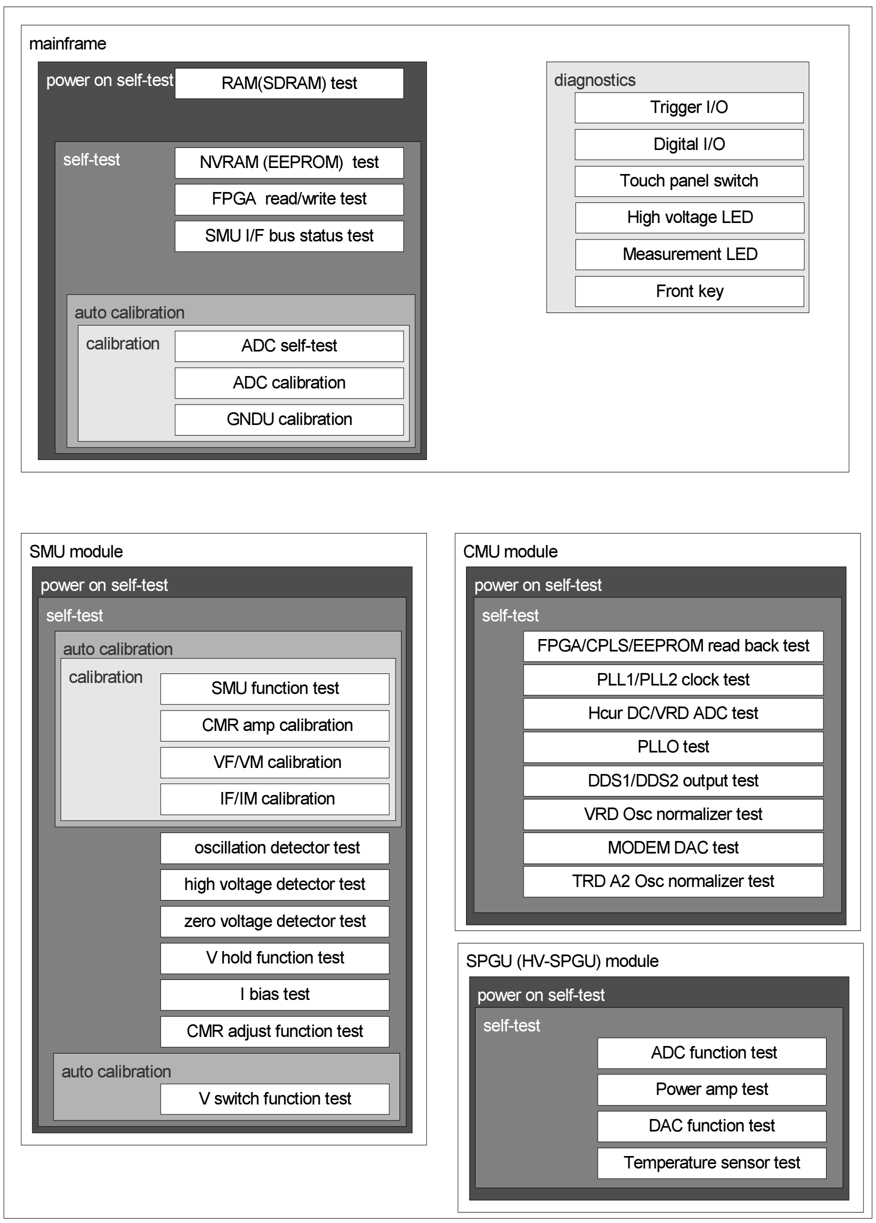
Troubleshooting Reference

This section describes the structure of the built-in self-test and diagnostics.

The Agilent B1500A has calibration, selftest and diagnostics functions. At turn-on, the power-on selftest is performed automatically without your assistance. The diagnostics' interactive test is performed with your assistance, such as cable connection and visual check. The selftest and the diagnostics verifies that the B1500A is operating but may not verify if the output and measurement are performed accurately. If you need to verify the output and measurement accuracy, use calibration and performance verification. See Chapter 3 , "Calibration,".

See *Agilent B1500 User Guide* about how to execute selftest and diagnostics from EasyExpert.

Figure 4-36 Selftest and diagnostics structure



5 Replacement Procedure

This chapter describes the assemblies replacement procedures. Each section explains how to remove the assemblies from Agilent B1500A series.

WARNING **Only personnel with knowledge of electric circuitry and an awareness of the hazards involved should remove and install printed circuit board assemblies.**

CAUTION

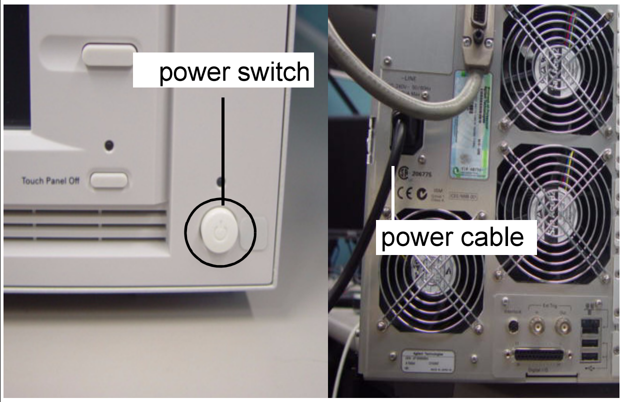
- To avoid electrostatic damage (ESD), use an anti-static mat and wrist strap.
- After removing a module, hold the module so that the printed circuit board of the module does not bend. Bending the board can damage the printed patterns.
- Oil, perspiration, fibrous dust, and dirt degrade the insulation of the circuit, thus lowering measurement accuracy. Wear rubber gloves when handling the print circuit boards.

The chapter contains the following sections:

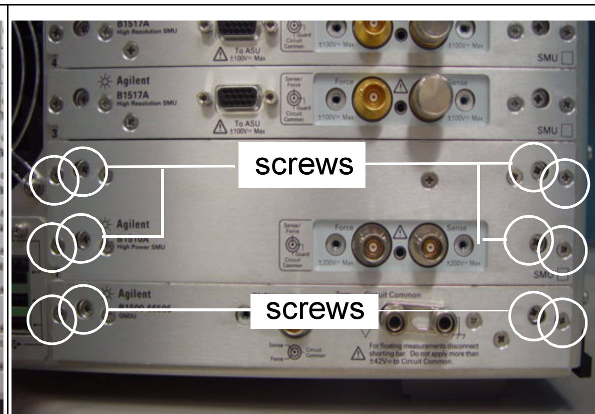
- "Removing SMU, CMU, SPGU, and GNDU/ADC Module"
- "Removing PC Unit"
- "Removing Power PC Board"
- "Removing Front Panel and LCD/Touch Panel Assemblies"
- "Removing Frame Power Supply Module"
- "Removing ATX Power Supply Module"
- "Removing Frame Fan and Rear Connector Board"
- "Removing CD-RW Drive"
- "Removing Modules on PC Unit"
- "Removing Modules on Front Panel Assembly"

Removing SMU, CMU, SPGU, and GNDU/ADC Module

This section describes how to remove the SMU, CMU, SPGU, and GNDU/ADC module.



1. Turn off power, then disconnect the power cable on the rear side.



2. Loosen four screws (eight for High-power SMU) on the module.

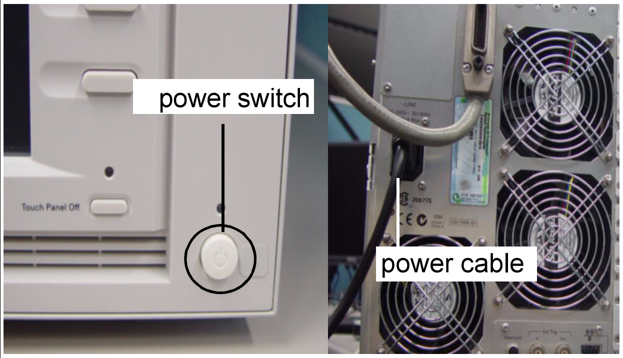
3. Remove the module by using the extractor.

CAUTION When installing the module, the precise position alignment is needed or some screws may not be inserted properly and maybe damaged. So, insert all the screws to the holes and loosely fix. And then fix the screws little by little in diagonal sequence to firmly fix.

NOTE When adding a module, an air hole plate needs to be removed and a dummy board needs to be moved. See “SMU/CMU/SPGU module upgrades” in Chapter 2 , “Software Installation, Updates, and Hardware Upgrades” for more details.

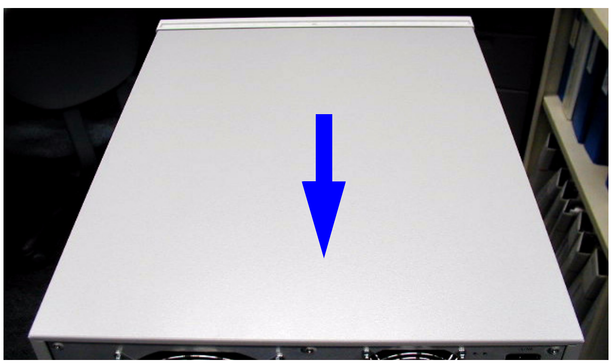
Removing PC Unit

This section describes how to remove the PC unit.

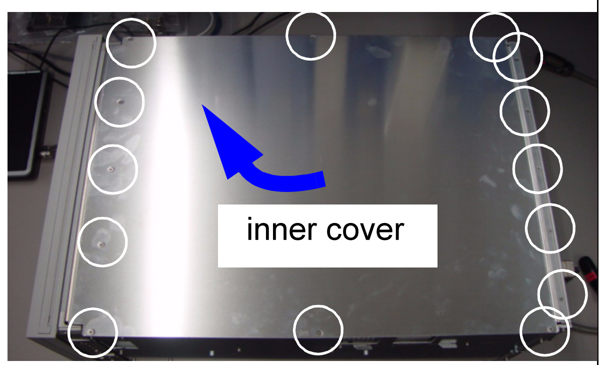


1. Turn off power, then disconnect the power cable on the rear side.

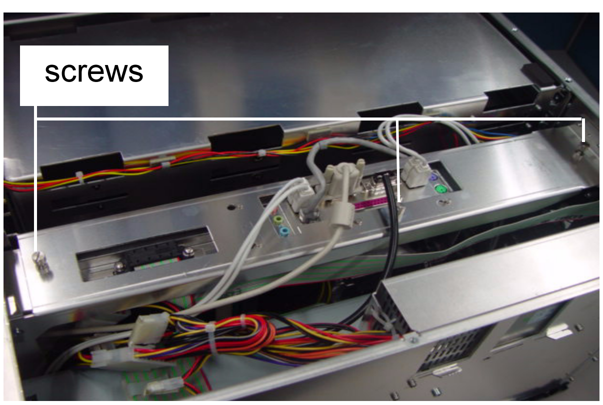
2. Loosen the screws of the strap handles.
3. Remove the strap handles.



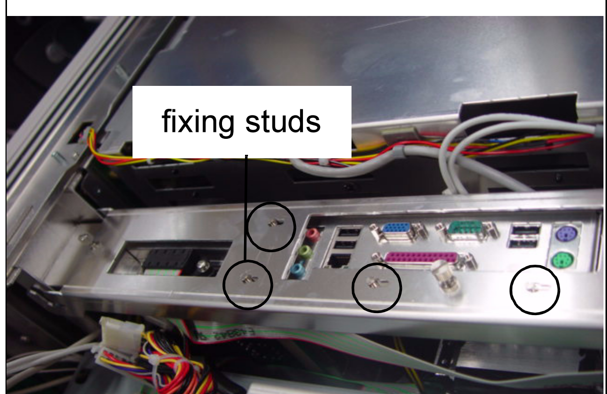
4. To remove the top cover, slide the cover back, splay the side of the cover, and then lift up the cover.



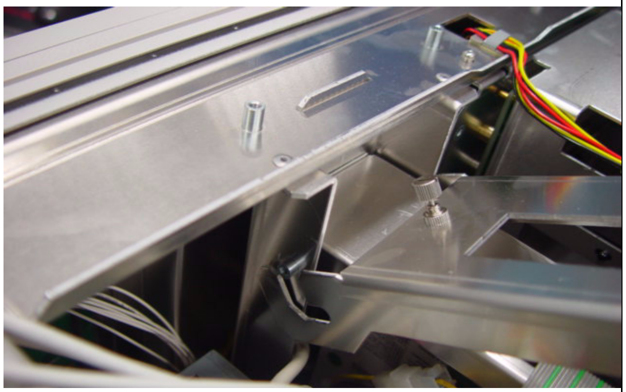
5. Loosen the screws on the inner cover.
6. Slide the inner cover forward and pull up to remove.



7. Disconnect the cables on top of the PC assembly and loosen three screws on the fixing panel.



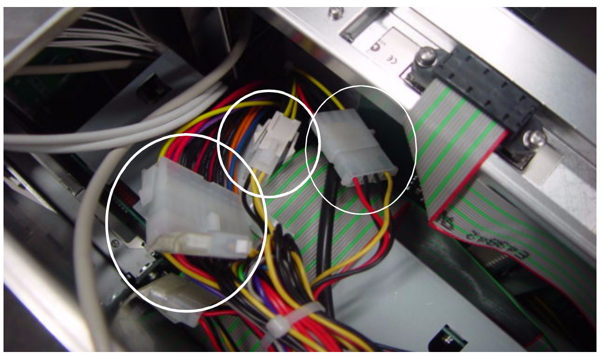
8. Slide the fixing panel backward so that the fixing studs will align to the stud holes.
9. Remove the fixing panel by lifting the back side.



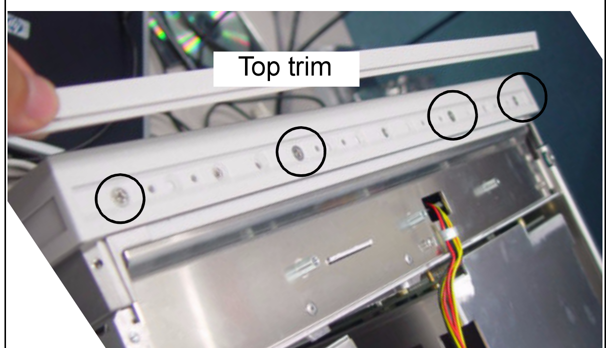
10. Remove the fixing panel by lifting the back side.

    Note that there are hooks at the front side.

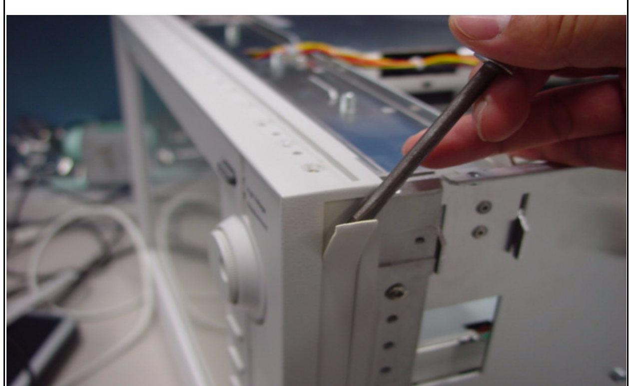
11. Disconnect the GP-IB cable by loosening two screws.



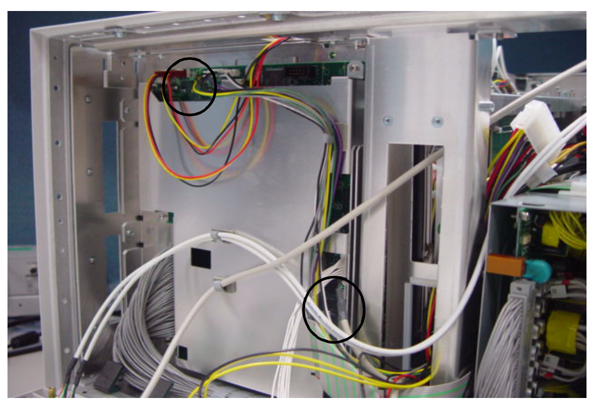
12. Disconnect three connectors to the ATX power supply unit.



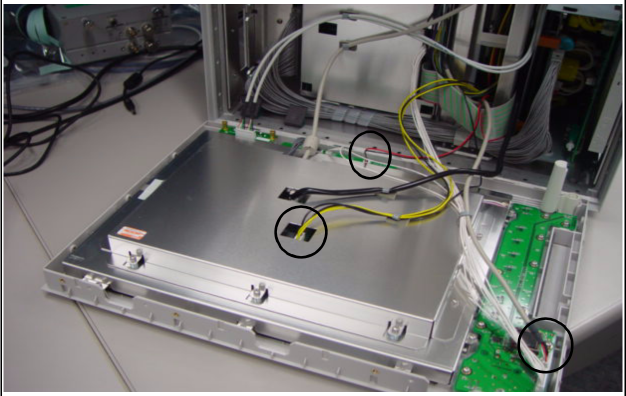
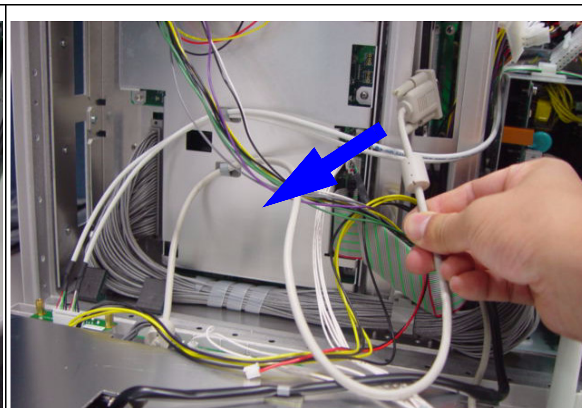
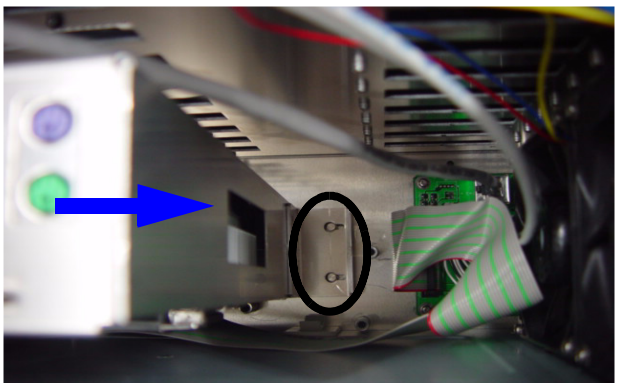
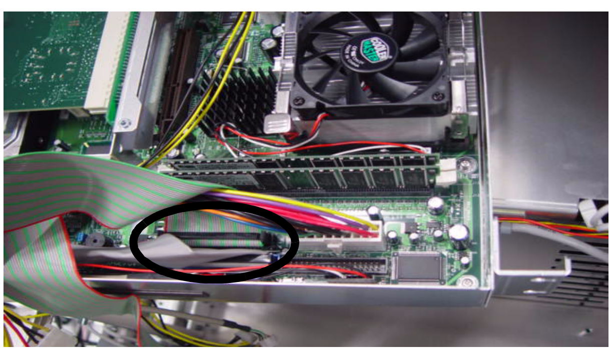
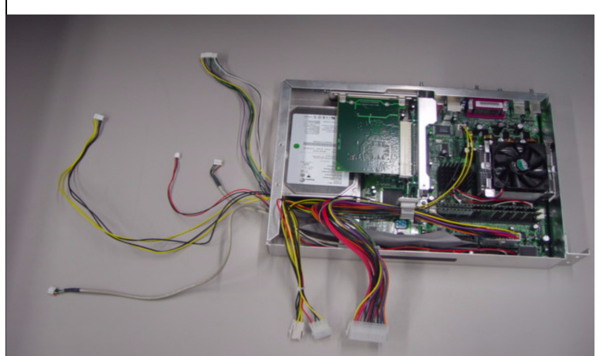
13. Remove the top trim.
14. Loosen four bigger screws at the top of the mainframe. (Three smaller screws do not need to be removed.)



15. Remove the side trims by using the flat-tip screwdriver on both sides.
16. Loosen three screws on both sides by holding the front panel. Be careful that the front panel assembly including the LCD assembly may fall forward when all the screws are removed.

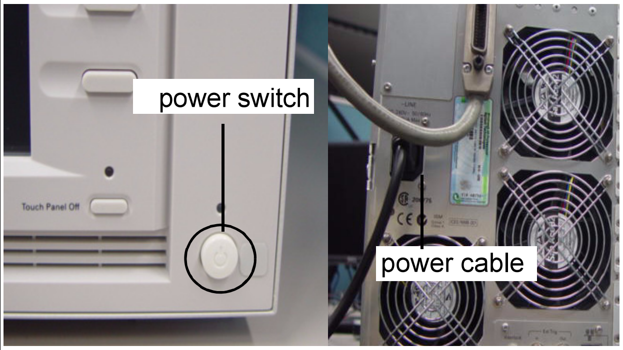


17. Disconnect two connectors at the Power PC board.

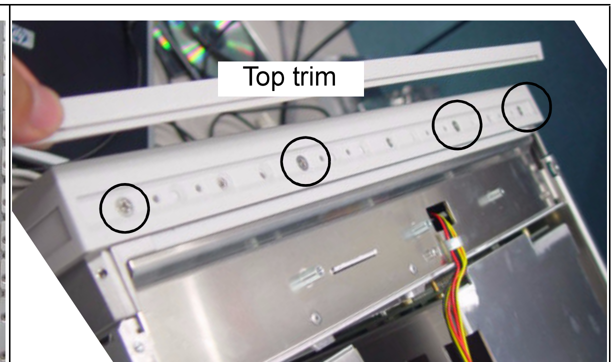
 18. Disconnect three connectors at the LCD assembly and the Front key controller board.	 19. Feed through the monitor cable to the front side as it goes through the hole of the PC unit at the front side.
 20. Note that there are two studs and the stud holes at the rear side bottom. Slide the PC unit backward to to remove the unit.	 21. Paying attention not to damage the cables, slowly and carefully remove the PC unit out from the instrument frame.
 22. Disconnect the cable to the CD-RW drive.	 23. The removed PC unit is shown above. Refer to Figure 5-1 for removing an assembly in the PC unit.

Removing Front Panel and LCD/Touch Panel Assemblies

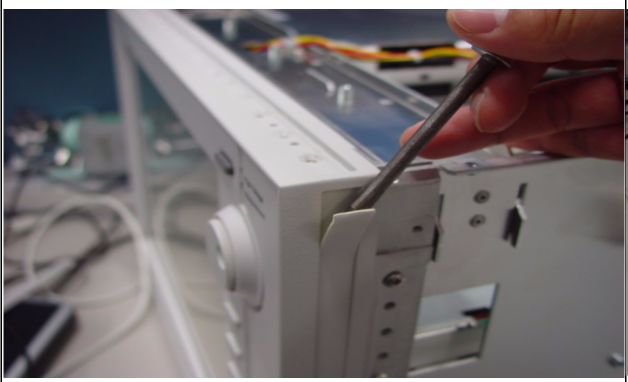
This section describes how to remove the LCD/Touch Panel Assemblies.



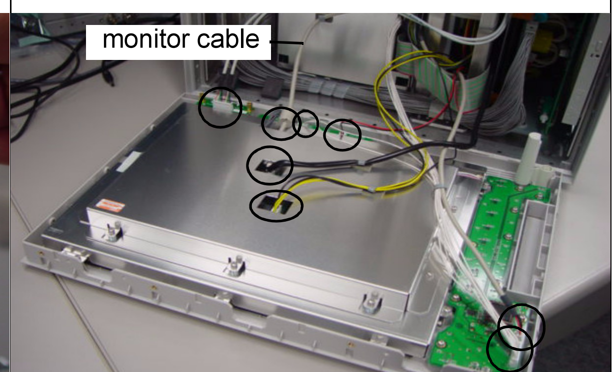
1. Turn off power, then disconnect the power cable on the rear side.



2. Remove the top trim.
3. Loosen four bigger screws at the top of the mainframe. (Three smaller screws do not need to be removed.)

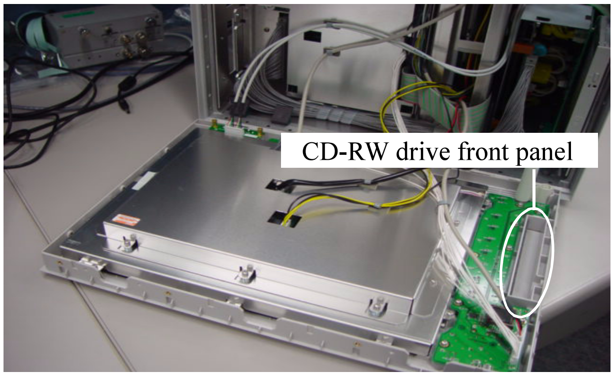


4. Remove the side trims by using the flat-tip screwdriver on both sides.
5. Loosen three screws on both sides by holding the front panel. Be careful that the front panel assembly including the LCD assembly may fall forward when all the screws are removed.

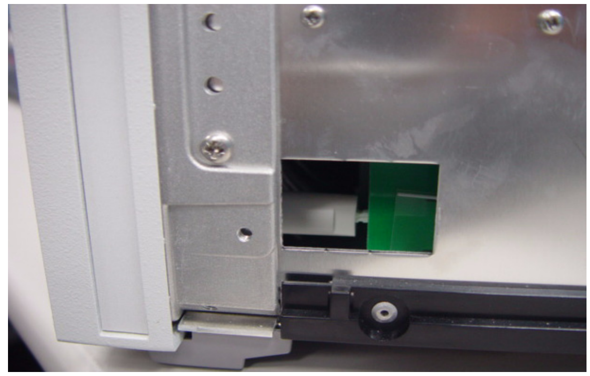


6. Disconnect eight cables to remove the front panel assembly including the LCD assembly.
7. To disconnect the monitor cable, it is possible to reach the connector by using the flat-tip screwdriver or remove the cover and disconnect the cable.
8. Refer to Figure 5-2, Figure 5-3, and Figure 5-4 for removing the units of the front panel assembly.

Here is a note for the re-installation.



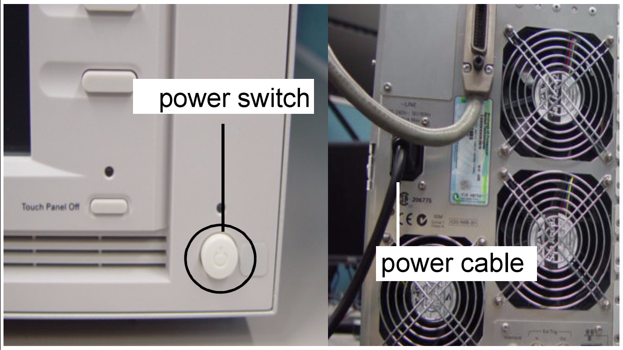
CAUTION When re-connecting the cables and re-assemble the front panel, pay attention so that the cables do not be on the CD-RW drive front panel. It may damage the cable and also it may make CD-RW drive do not work.



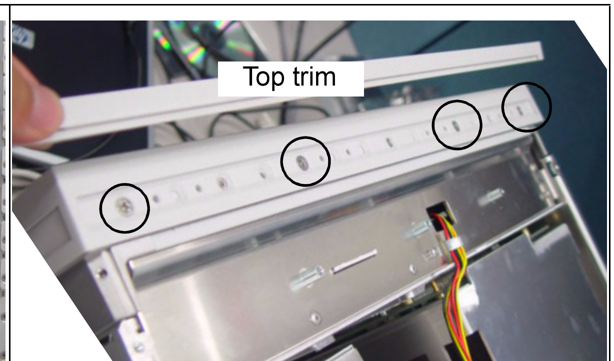
- When re-installing the front panel, make sure that the power switch assembly on the front panel correctly touches to the power switch on the Frame power supply module and they do not pinch cables. The power switch alignment can be confirmed through the hole on the side panel.

Removing Power PC Board

This section describes how to remove the Power PC board.

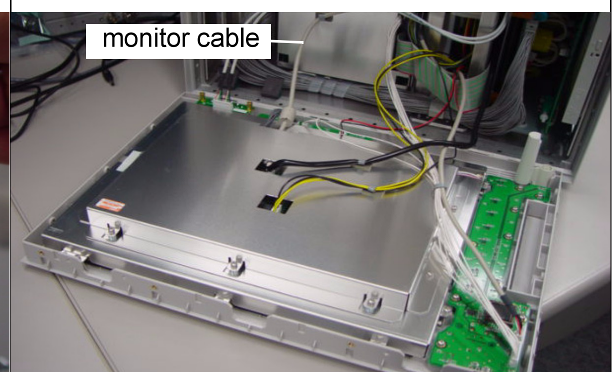


1. Turn off power, then disconnect the power cable on the rear side.

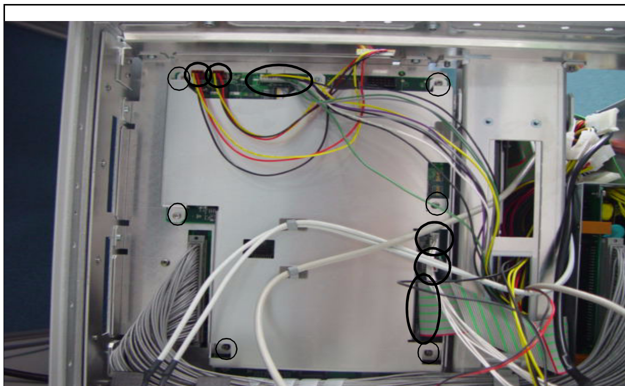


2. Remove the top trim.
3. Loosen four bigger screws at the top of the mainframe. (Three smaller screws do not need to be removed.)

4. Remove the side trims by using the flat-tip screwdriver on both sides.
5. Loosen three screws on both sides by holding the front panel. Be careful that the front panel assembly including the LCD assembly may fall forward when all the screws are removed.



6. Carefully lay the front panel on a soft material such as sponge sheet so the LCD assembly will not be damaged.



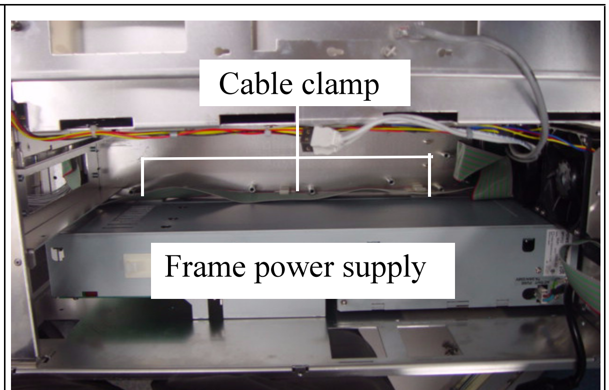
7. Disconnect six cables and six screws to remove the Power PC board (P/N: B1500-66502).

   For B1500-65111 (Power PC board 2), disconnect seven cables and six screws to remove it.

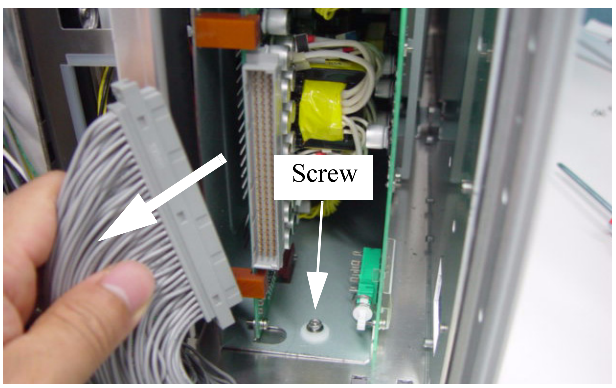
Removing Frame Power Supply Module

This section describes how to remove the power supply module.

1. Refer to “Removing PC Unit” and follow the procedure to remove PC unit.
2. Refer to “Removing CD-RW Drive” and follow the steps 12-13 to remove CD-RW drive.
3. Refer to “Removing ATX Power Supply Module” and follow the steps 7-13 to remove ATX power supply.



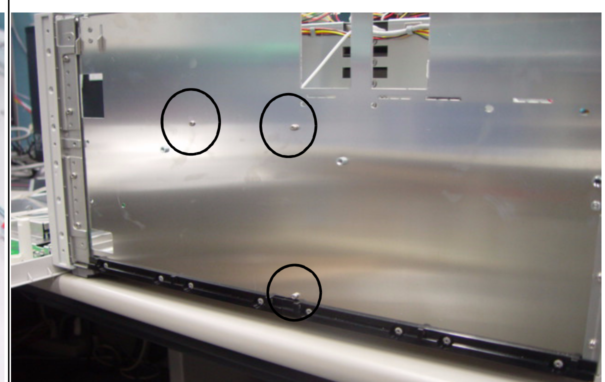
4. Put the cable out from the three cable clamps at the inner side of the Frame power supply unit. (The cable is from the rear connector panel to the front side.)



5. For B1500-60010, disconnect the cable connected to the analog mother board and loosen the screw at the bottom front side.

   For B1500-64110 (Frame Power Supply 2), disconnect the cables connected to the analog mother board and Power PC board and loosen the screw at the bottom front side.

CAUTION When loosening the screw, pay attention not to touch and damage the power switch right next to it.

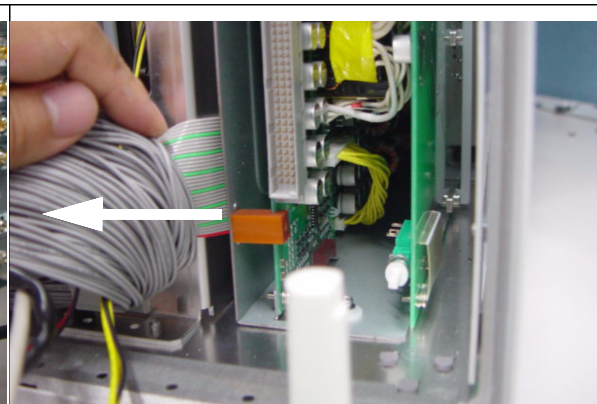


6. Loosen three screws on the side.

CAUTION These are burring screws. When installing the module, make sure to use the torque driver and set the torque to 8kgf.cm.

7. Loosen four screws on the rear panel. Note that the two screws on top are 8mm long and the two at the bottom are 6mm long.

CAUTION These are burring screws. When installing the module, make sure to use the torque driver and set the torque to 8kgf.cm.



8. Lift up the front side as there is a stud at the bottom. Then carefully move the unit to the front side to remove.

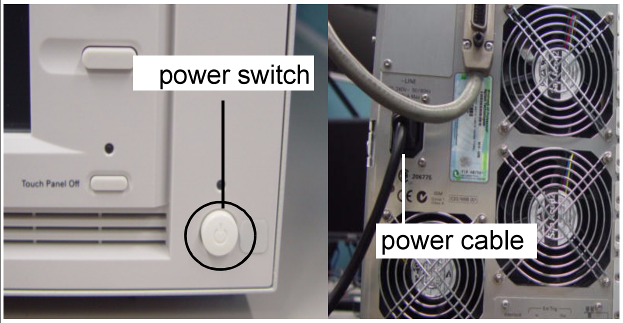
CAUTION Put aside the cables so that the cables are not pinched and damaged.

NOTE When re-installing the Frame power supply module, make sure on the following.

- The cable to the Rear connector panel is firmly held by the three cable clamps on the side panel of the Frame power supply.
- All the cables are re-connected correctly.
- Cables are not pinched.

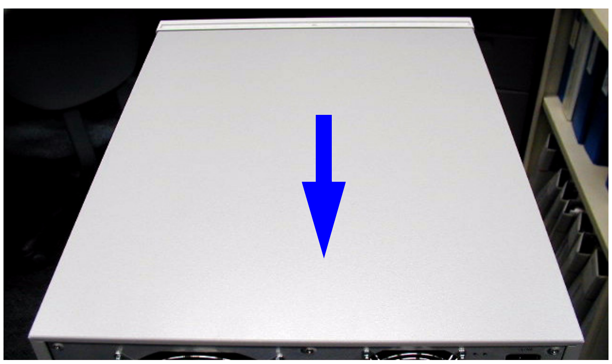
Removing ATX Power Supply Module

This section describes how to remove the ATX Power Supply module.

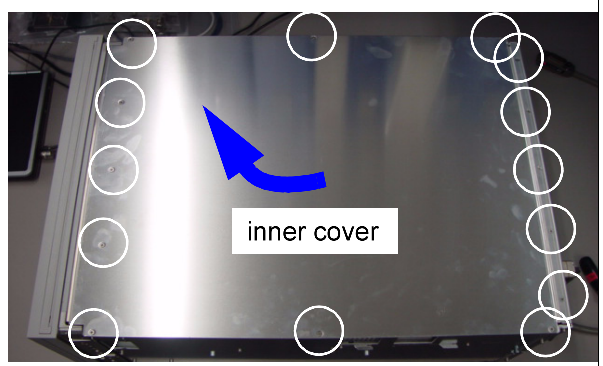


1. Turn off power, then disconnect the power cable on the rear side.

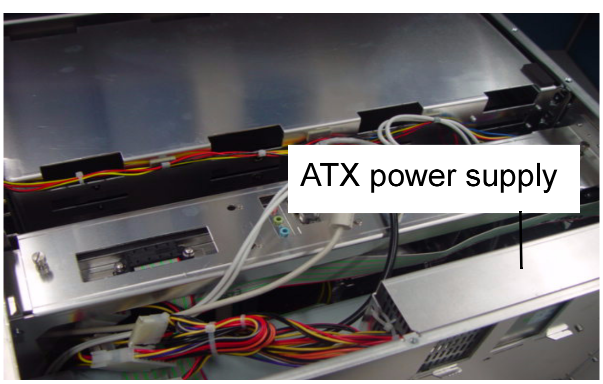
2. Loosen the screws of the strap handles.
3. Remove the strap handles.



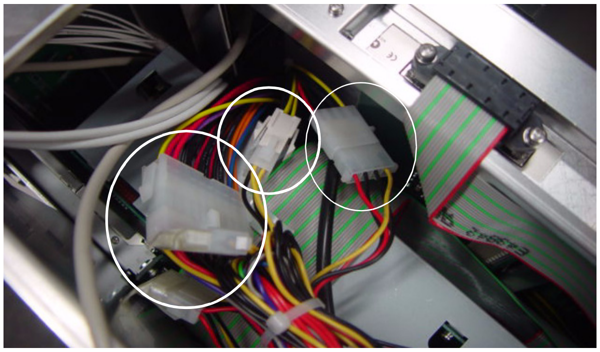
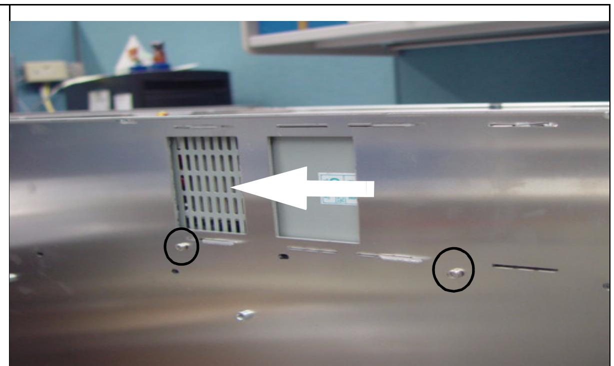
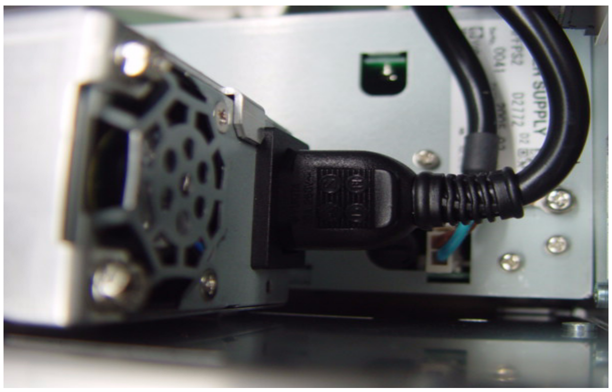
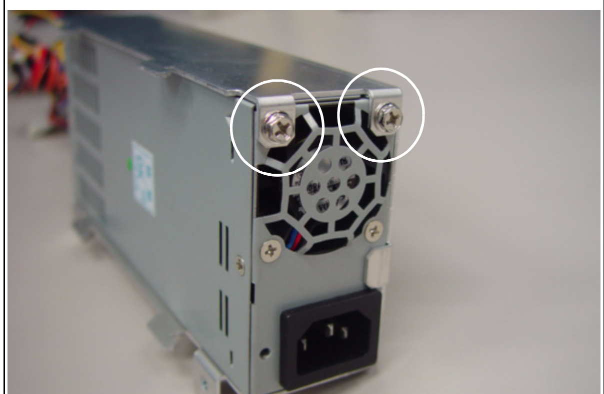
4. To remove the top cover, slide the cover back, splay the side of the cover, and then lift up the cover.



5. Loosen the screws on the inner cover.
6. Slide the inner cover forward and pull up to remove.

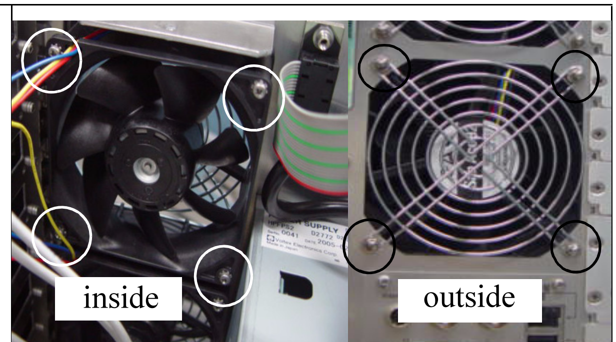
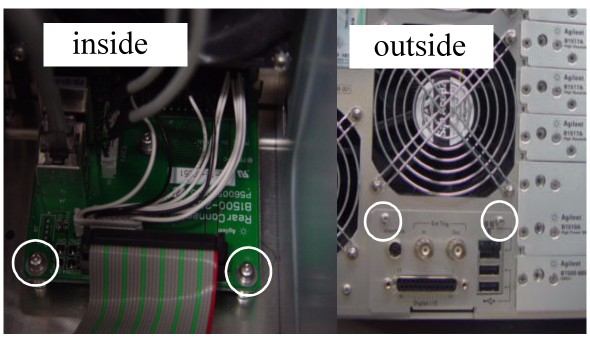


7. Locate the ATX power supply module. To disconnect the power cables at the front side, CD-RW drive needs to be removed.
8. Refer to the procedure, “Removing CD-RW Drive” and follow the steps 7-13 to remove CD-RW drive.

	
9. Disconnect three connectors from the ATX power supply unit.	10. Loosen two screws on the side panel. 11. Slide the ATX power supply module forward.
	
12. At the rear side, disconnect the power cable to remove the ATX power supply unit.	13. Loosen two screws on the rear side to remove the bracket.

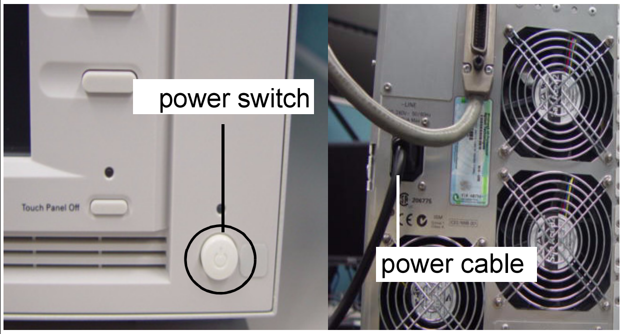
Removing Frame Fan and Rear Connector Board

This section describes how to remove the Rear Connector board.

1. Refer to “Removing PC Unit” and follow the procedure to remove the PC unit from the instrument frame.	 2. A frame fan is fixed by four studs from inside and four nuts from outside. Loosen them to remove the fan.
 3. To remove the Rear connector board, loosen two screws inside and two screws from outside.	

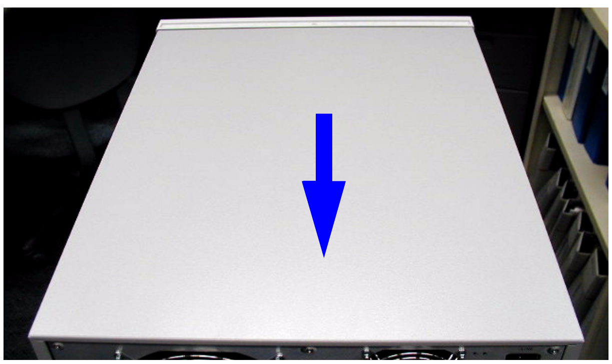
Removing CD-RW Drive

This section describes how to remove the CD-RW drive.

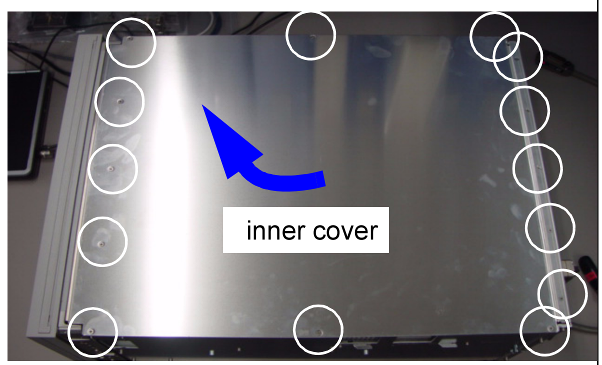


1. Turn off power, then disconnect the power cable on the rear side.

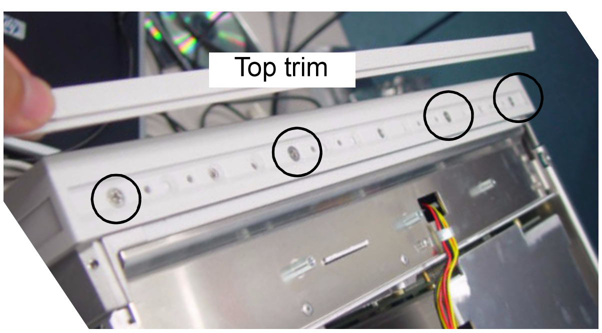
2. Loosen the screws of the strap handles.
3. Remove the strap handles.



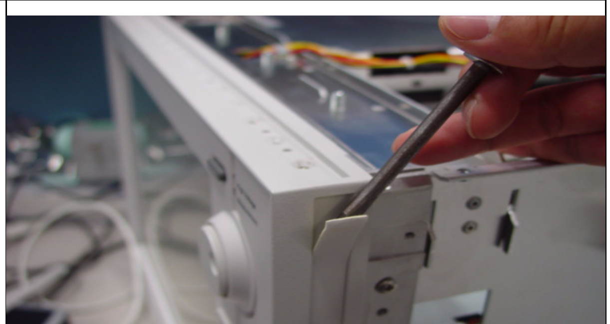
4. To remove the top cover, slide the cover back, splay the side of the cover, and then lift up the cover.



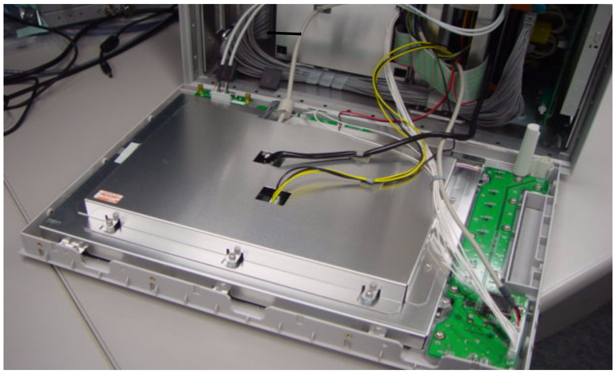
5. Loosen the screws on the inner cover.
6. Slide the inner cover forward and pull up to remove.



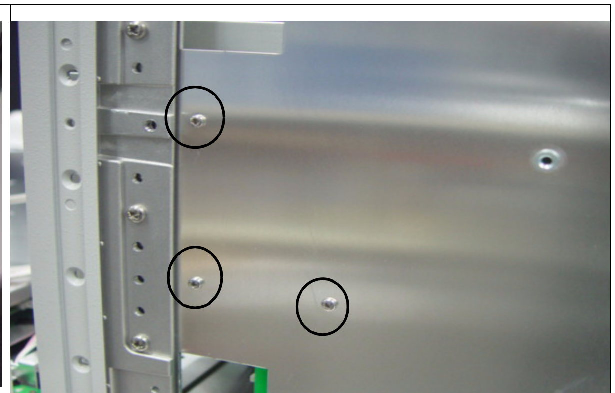
7. Remove the top trim.
8. Loosen four bigger screws at the top of the mainframe. (Three smaller screws do not need to be removed.)



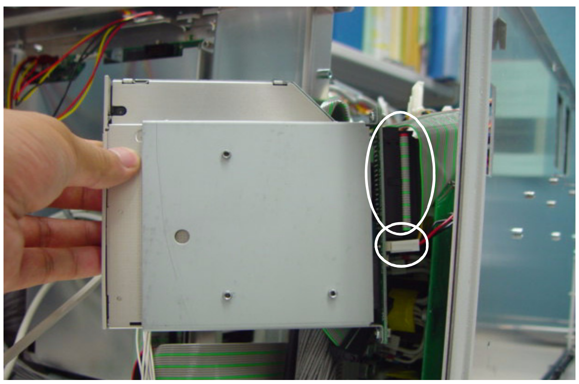
9. Remove the side trims by using the flat-tip screwdriver on both sides.
10. Loosen three screws on both sides by holding the front panel. Be careful that the front panel assembly including the LCD assembly may fall forward when all the screws are removed.



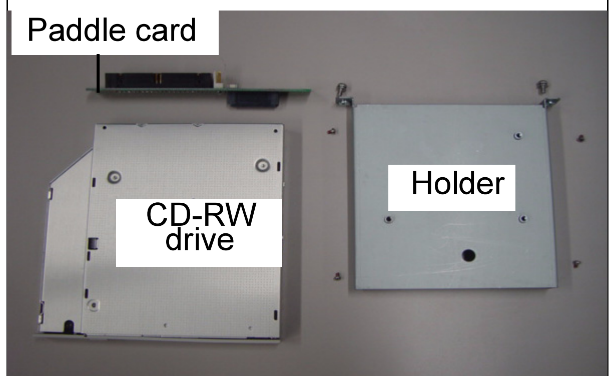
11. Carefully lay the front panel on a soft material such as sponge sheet so the LCD assembly will not be damaged.



12. Loosen three screws on the side panel.



13. Carefully take out the CD-RW module from the front side and disconnect two cables.

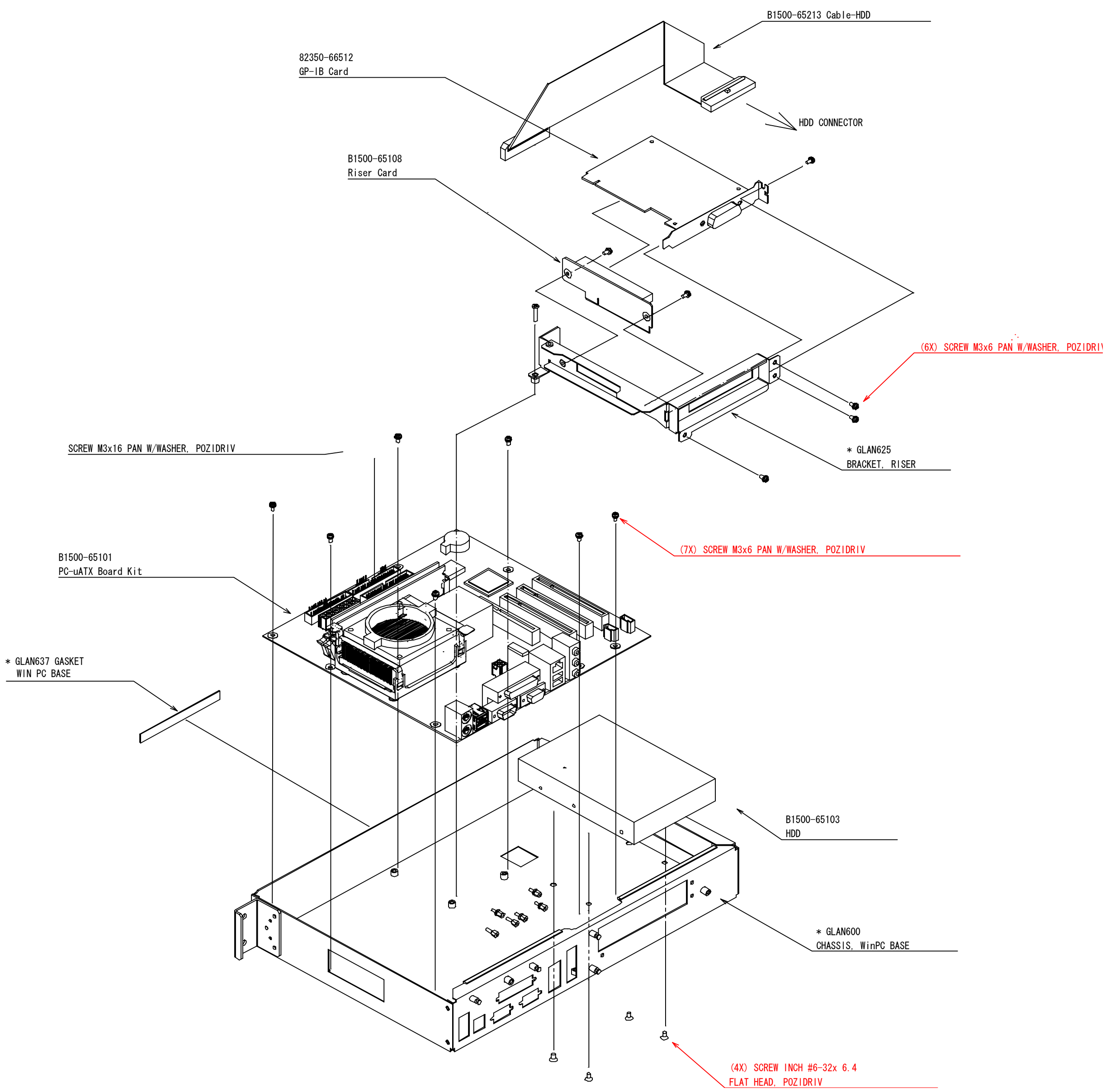


14. Remove the CD-RW drive from the holder and the paddle card.

Removing Modules on PC Unit

This section describes how to remove the modules on PC unit. See below for how to remove the module on PC unit.

Figure 5-1 Modules on PC unit



NOTE When installing the Micro ATX board, make sure that the memory cards are firmly seated.

Removing Modules on Front Panel Assembly

This section describes how to remove the modules on Front Panel. See below drawings for how to remove each module on the front panel assembly.

Figure 5-2 Screws on front panel assembly

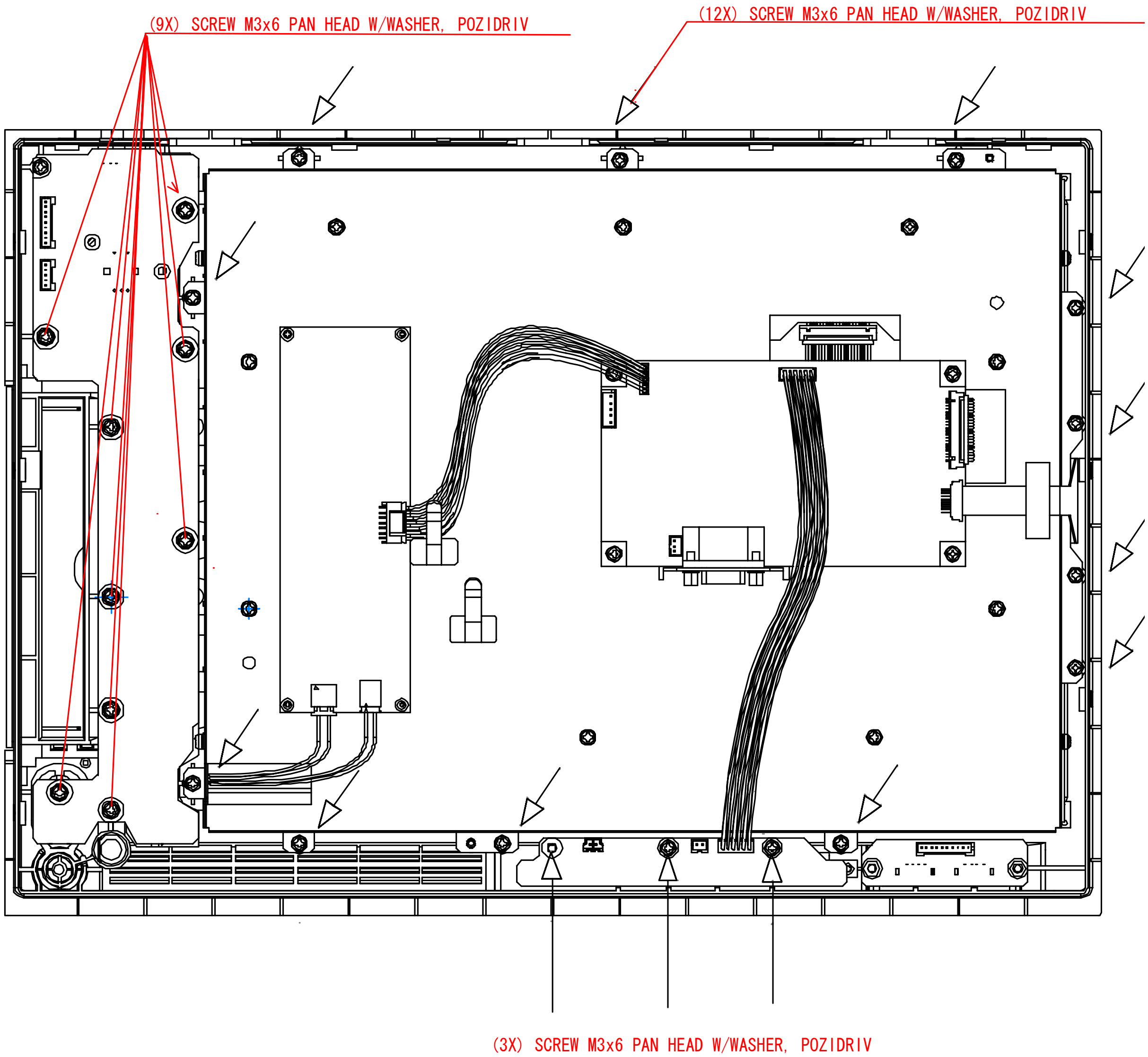


Figure 5-3 Front panel assembly parts -1

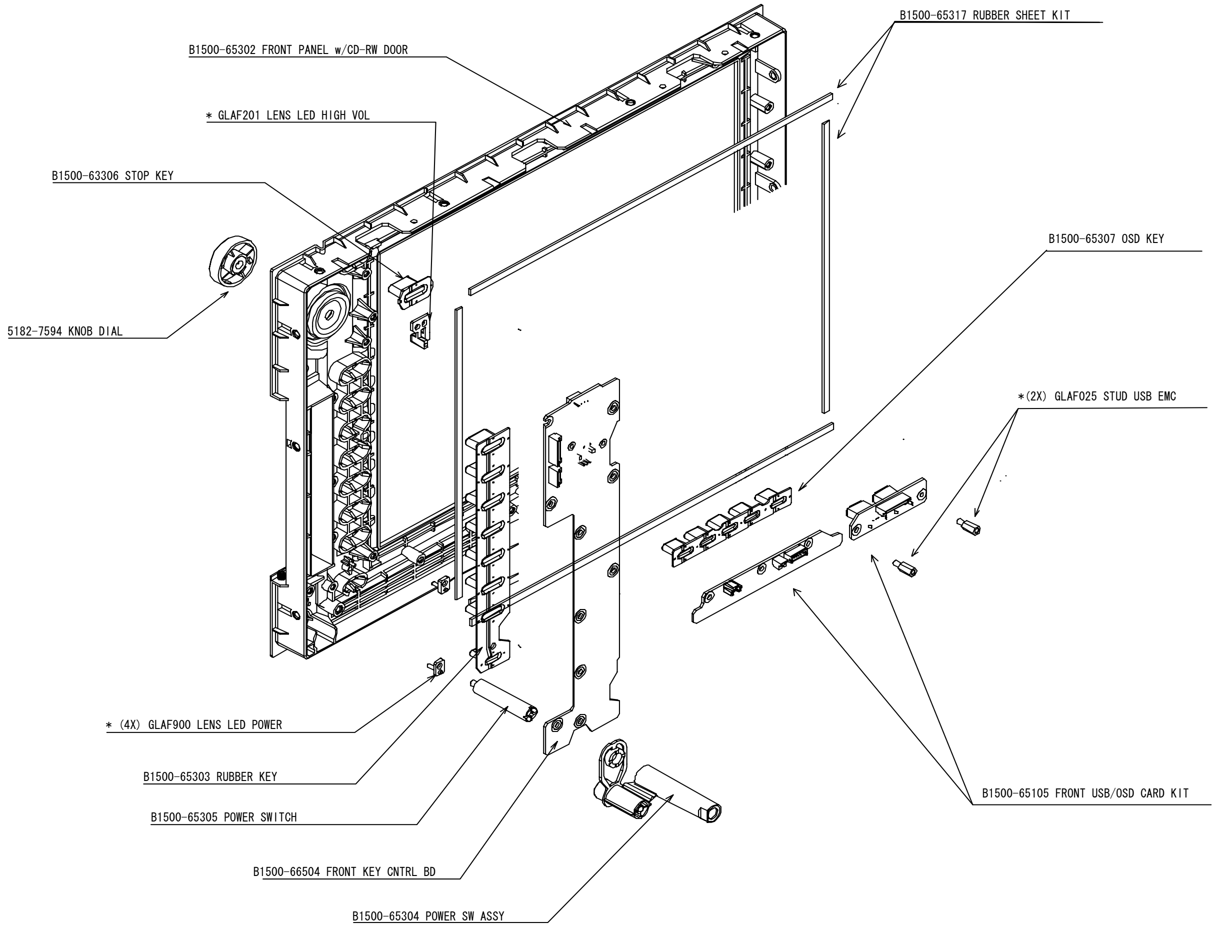
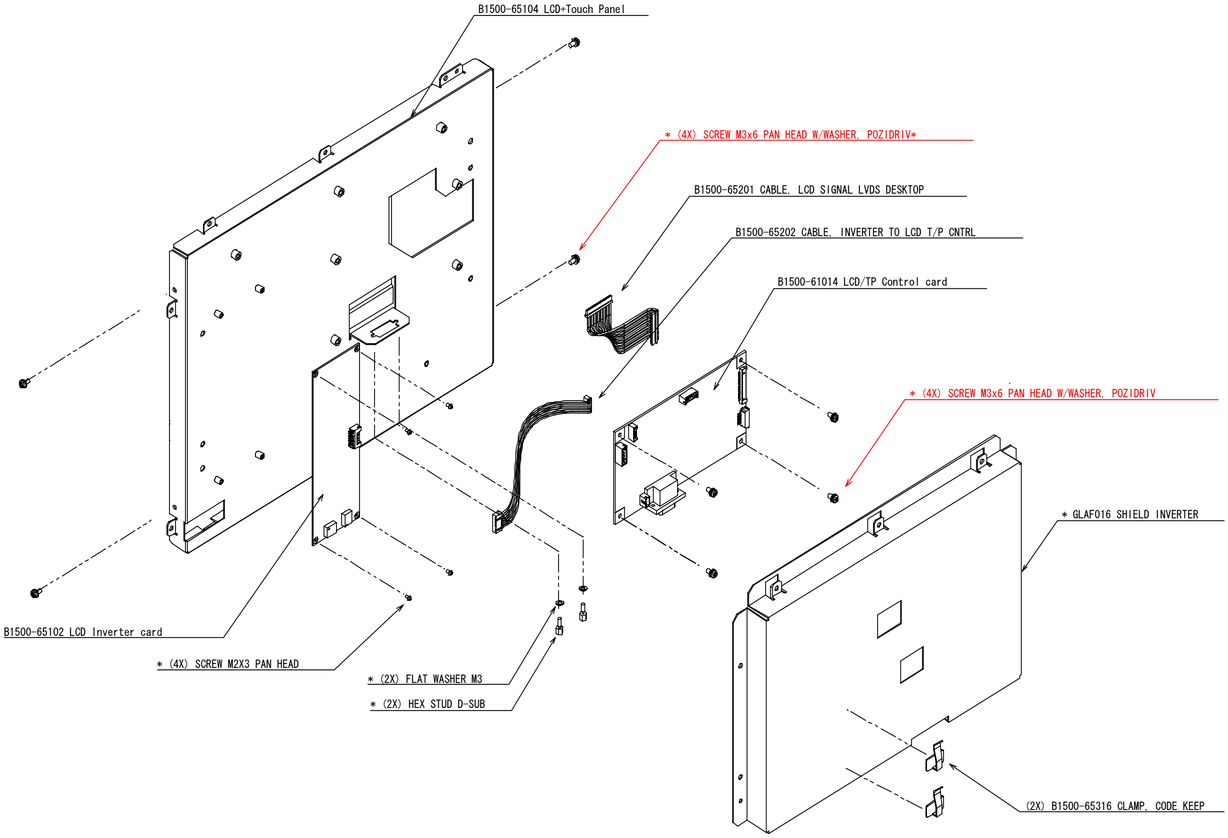


Figure 5-4 Front panel assembly parts -2



6 Replaceable Parts

This chapter describes the replaceable parts for the Agilent B1500A and its accessories. The tables in this section also contain the post repair action that must be performed when a part is replaced.

This chapter consists of the following sections:

- "Post Repair Action"
- "Setting up GP-IB card"
- "Calibrating Touch Panel"
- "Replaceable Parts for B1500A"

NOTE The part number information in the drawings are not yet finalized and may not have the Agilent part number yet. They will be complete in the next revision. Please contact HSTD marketing if you need the information that is missing in this revision.

Post Repair Action

Refer below for which calibration and PV tests need to be done when a module is exchanged.

NOTE When a repair is done, turn on the power and run the self test. The Table below shows the calibration and the performance verification tests that need to be run in addition to the self test.

NOTE The parts not listed in the below table do not need any calibration and the performance verification tests after repair.

Table 6-1 Post repair action

Part number	Qty	Description	Post repair action
B1500-61001	1	GNDU/ADC module	Ref V calibration Ref R calibration GNDU test SMU V test SMU I test SMU CMR test
B1510-61011 (B1510-69011)	Up to 4	Precision High Power SMU	SMU calibration SMU V test SMU I test SMU CMR test
B1511-61001 (B1511-69001)	Up to 10	Precision Medium Power SMU	
B1517-61001 (B1517-69001)	Up to 10	Precision High Resolution SMU	
E5288-66501	Up to 10	Atto Sense and Switch Unit (ASU)	SMU calibration SMU V test SMU I test Serial Interchange
B1520-61001 (B1520-69001)	Up to 1	Multi Frequency Capacitance Measurement Unit (MFCMU)	CMU calibration CMU test
B1525-61001 (B1525-69001)	Up to 5	High Voltage Semiconductor Pulse Generator Unit (HV-SPGU)	SPGU 50 ohm calibration SPGU ADC calibration SPGU skew calibration[a] SPGU pulse level test SPGU pulse shape test
N1301-61001 (N1301-69001)	Up to 1	SMU CMU Unify Unit	None

Table 6-1 Post repair action

Part number	Qty	Description	Post repair action
B1500-66501	1	Analog mother board	GNDU test SMU V test SMU I test SMU CMR test
B1500-64110[b] (B1500-69110)	1	Frame Power Supply 2	None
B1500-61011	1	CD-RW Module	Revision matching[c]
B1500-65101	1	Micro ATX Board	Revision matching[c]
B1500-61013	1	ATX Power Supply	Revision matching[c]
B1500-61014	1	LCD/TP Control Card	Revision matching[c] Touch panel calibration[d]
B1500-65113[e]	1	Harddisk Drive 80 GB	Revision matching[c] Software installation[f]
B1500-65111[g]	1	Power PC Board 2	Revision matching[c]
B1500-65104	1	LCD Kit	Revision matching[c]
B1500-65102	1	LCD Inverter Card	Revision matching[c]
82350-66512	1	GP-IB Card	Re-defining GP-IB card[h]
B1500-66504	1	Front Key Control Card	None
B1500-65105	1	Front USB/OSD Card Kit	None
B1500-65106	1	Frame Fan	None

a. This is required under the following conditions.
- Multiple HV-SPGU modules are installed.
- An HV-SPGU module is swapped with other HV-SPGU module.
- Any in multiple HV-SPGU modules is repaired.
- The SPGU pulse shape test failed.

b. These are the replacements for the discontinued part B1500-61010.
To replace the Frame Power Supply (P/N: B1500-61010) with the Frame Power Supply 2, the following items are required:
- Frame Power Supply 2 (P/N: B1500-64110 or Exchange P/N: B1500-69110)
- Frame Power Supply Cable 2 (P/N: B1500-65218)
- Cable clamp (P/N: 5188-4540), 4 each

c. See Chapter 2 , “Software Installation, Updates, and Hardware Upgrades,” for the revision matching and check if there is a need to update the software, etc. Please note that in some cases, it may be necessary to replace hardware also when the software update is needed.

d. See “Calibrating Touch Panel” for the touch panel calibration.

e. This is the replacement for the discontinued part B1500-65103.

f. See Chapter 2 , “Software Installation, Updates, and Hardware Upgrades.”
g. This is the replacement for the discontinued part B1500-66502.
   To replace the Power PC board (P/N: B1500-66502) with the Power PC board 2, the following items are required:
   - Power PC Board 2 (P/N: B1500-65111)
   - Power PC Board Bracket 2 (P/N: B1500-65320)
   - Cable clamp (P/N: 1400-1334), 4 each
   - Remote On/Off Cable (P/N: B1500-65219)
h. See “Setting up GP-IB card” for re-defining the GP-IB card entry.

Setting up GP-IB card

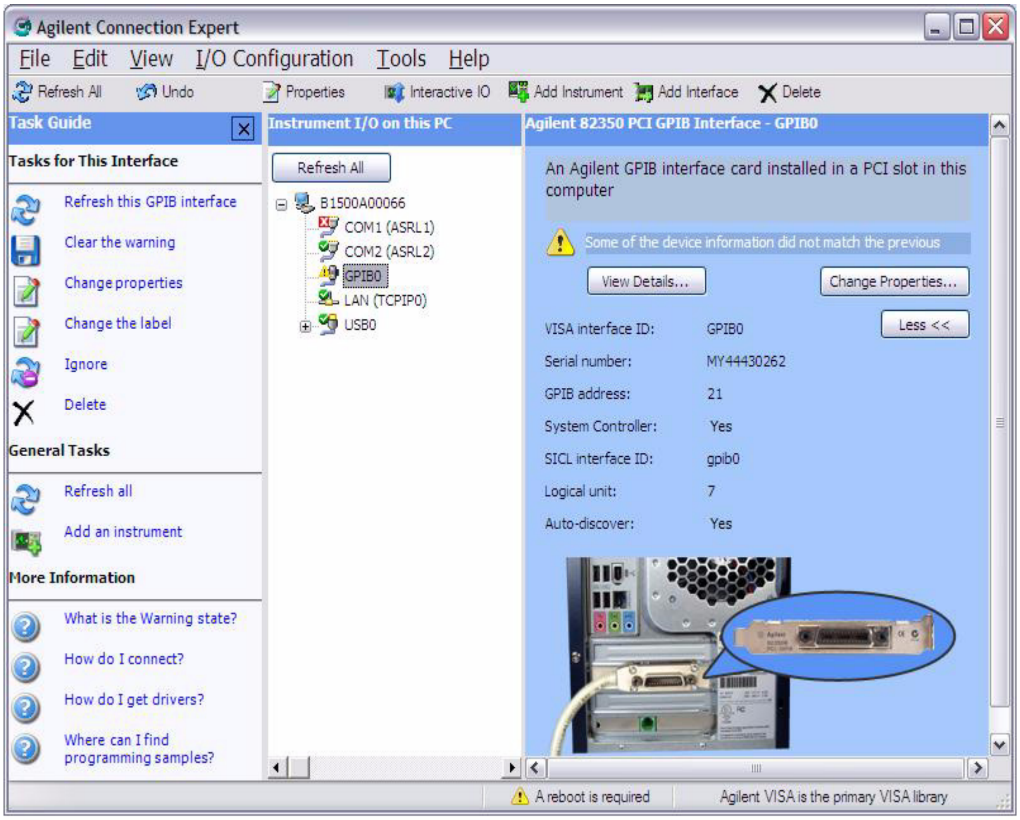
When GP-IB card is replaced, follow the procedure below to re-configure.

1. Click the right button of the mouse on the **Agilent IO Control** icon on the task bar.
2. Select **Agilent Connection Expert** on the top of the menu.

Figure 6-1 Selecting Agilent Connection Expert

3. In the Agilent Connection Expert window, locate **GPIB0 and GPIB1 at the center.**

Figure 6-2 Agilent Connection Expert window



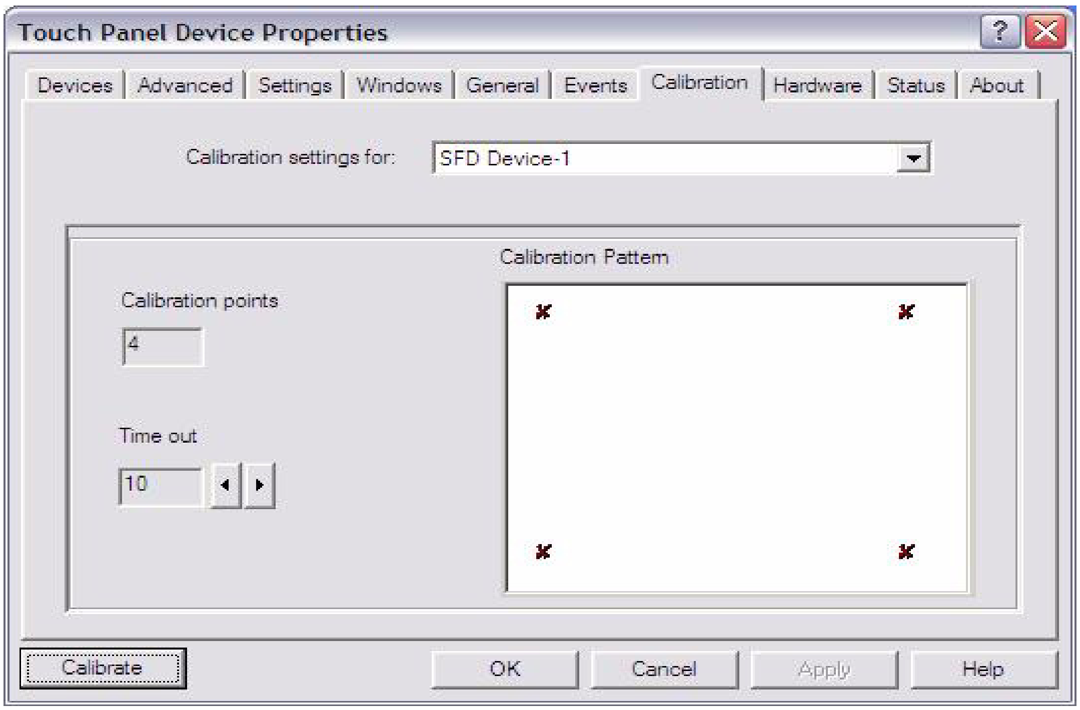
4. Click **GPIB0** and then click **delete** icon on the left to delete it.
5. Click **GPIB1** and then click **delete** icon on the left to delete it.
6. Click **Refresh all** icon. This will make the newly installed GPIB card to become GPIB0 that B1500A will use.
7. Click **OK** to close the dialogue.
8. Click **Reboot now** in the dialogue window to reboot and enable the change.

Calibrating Touch Panel

This section describes how to calibrate the touch panel.

1. Click **Start > Control Panel > TPDD Devices** to get the Touch Panel Device Properties window.

Figure 6-3 TPDD Devices window



2. Select the **Calibration** tab.
3. Click the **Calibration** button at the left bottom corner of the window.
4. Follow the instructions shown on the screen and use the touch pen to touch the center of "X" four times.
5. Close the windows.

Replaceable Parts for B1500A

This section contains the figures that show the detailed parts information.

Top cover, handle, and other frame parts

This section shows the parts that configure the instrument frame.

Figure 6-4 Covers, handles, and foots

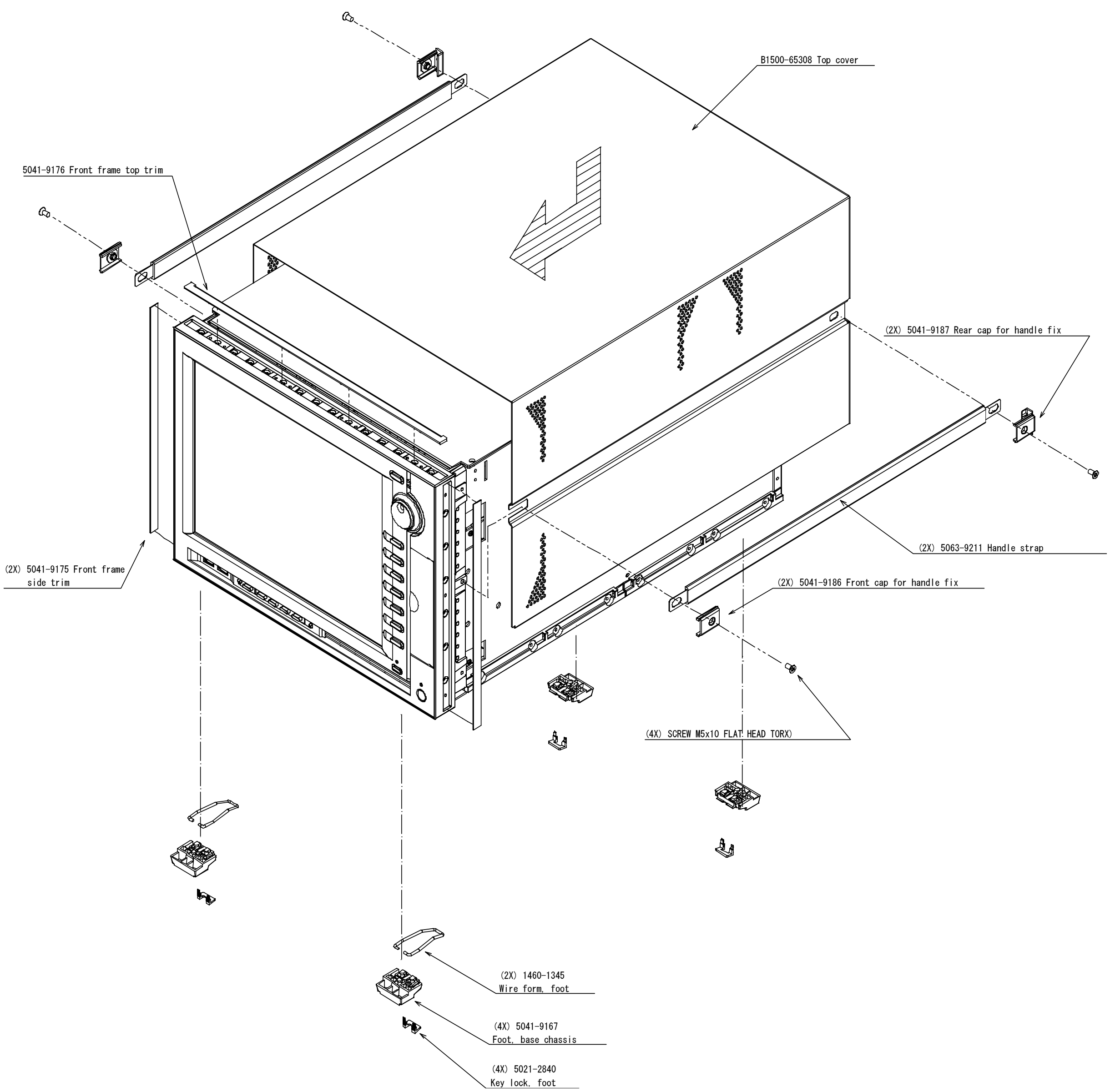
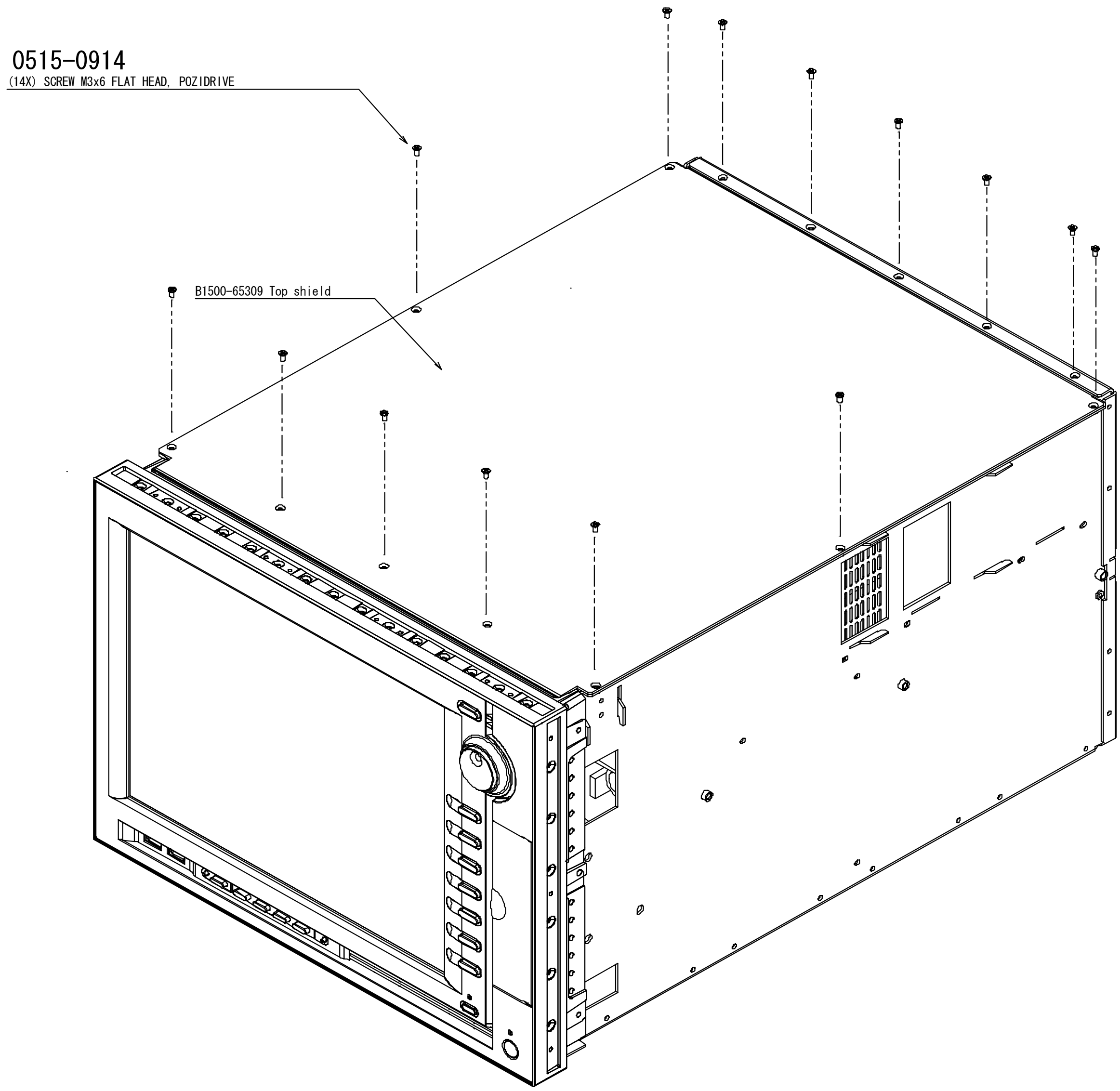


Figure 6-5 Top shield



Front Panel Parts

This section shows the parts on the front panel.

Figure 6-6 Front panel fixing screws

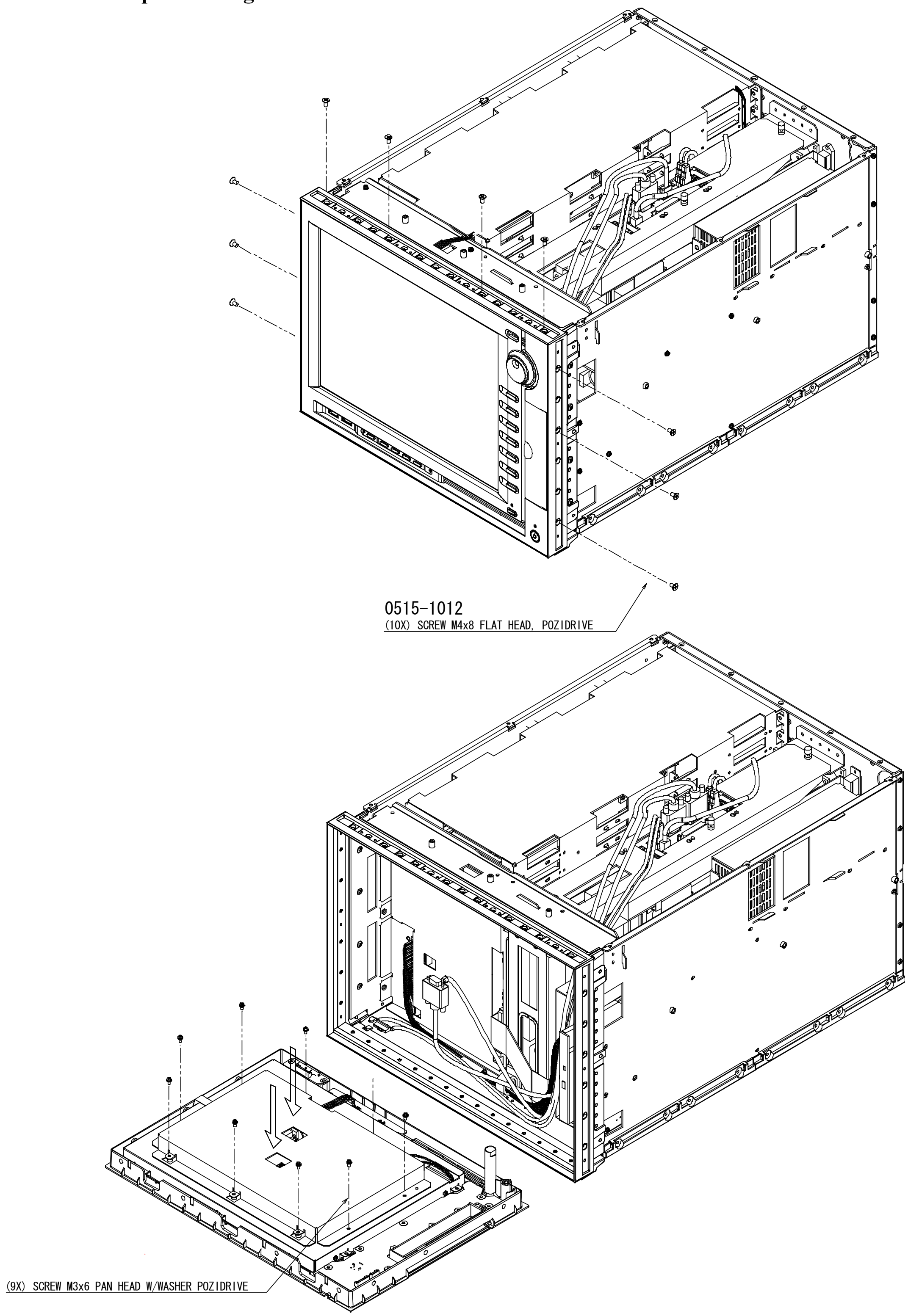


Figure 6-7 Front panel cables

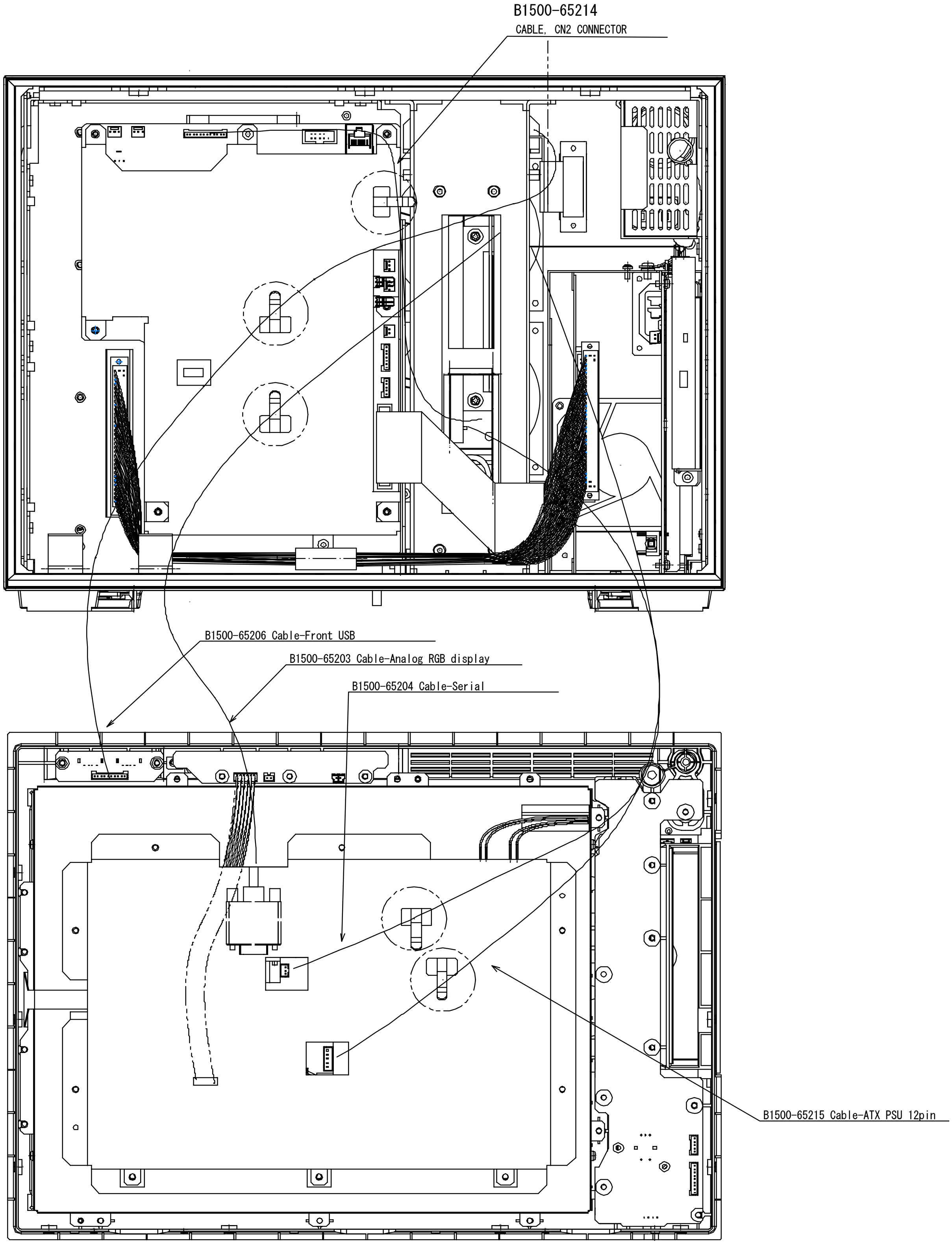


Figure 6-8 CD-RW drive door

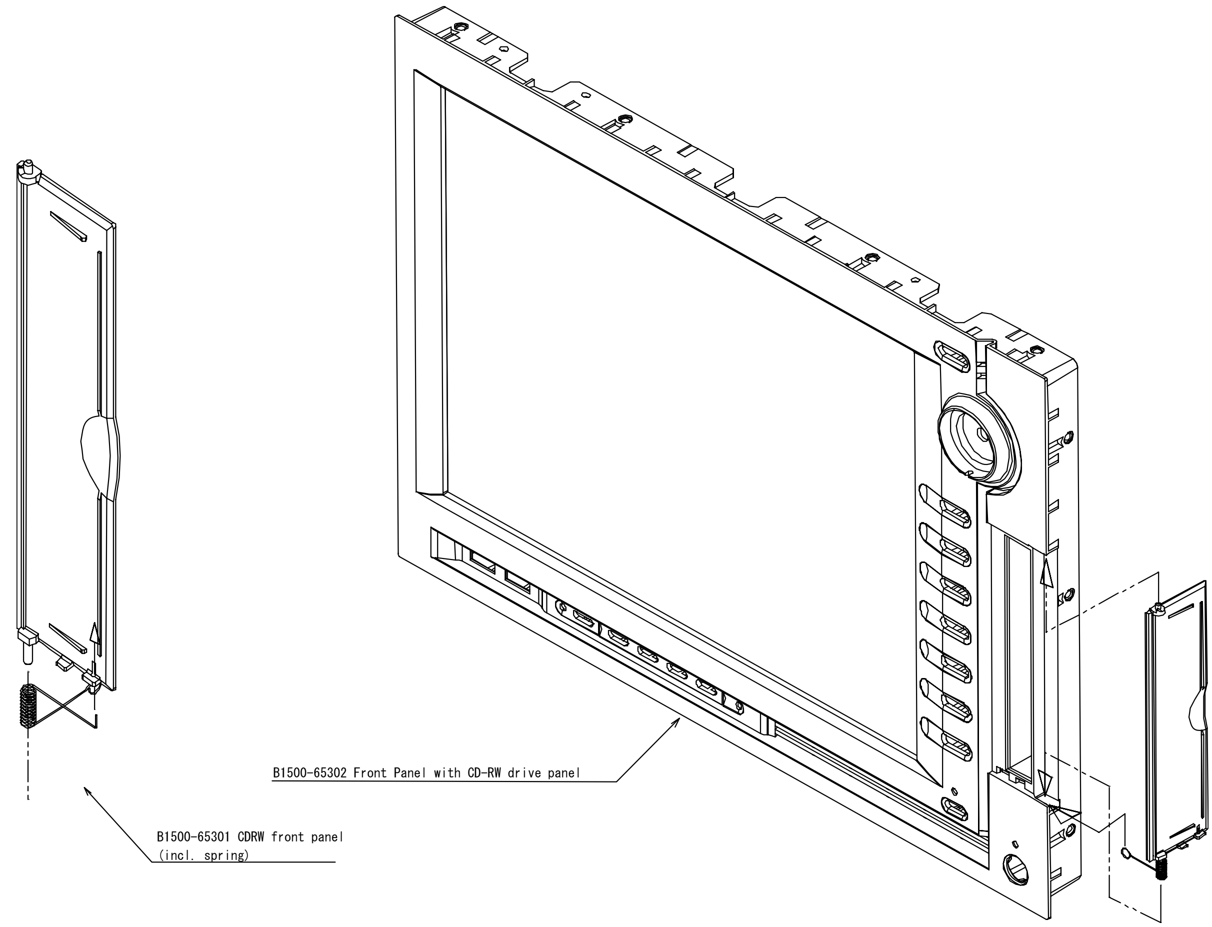


Figure 6-9 Front panel assembly screws

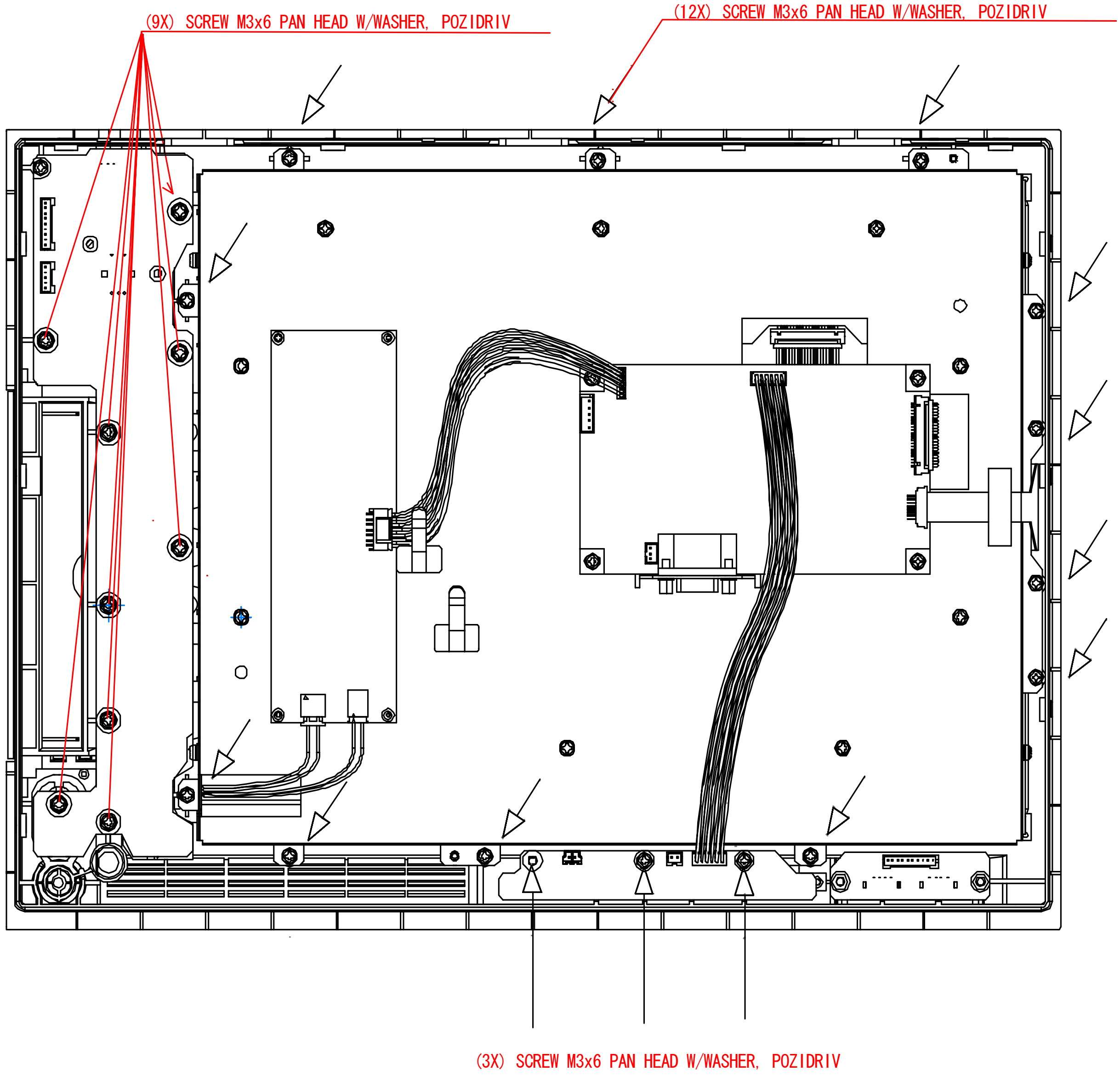


Figure 6-10 Front panel assemblies-1

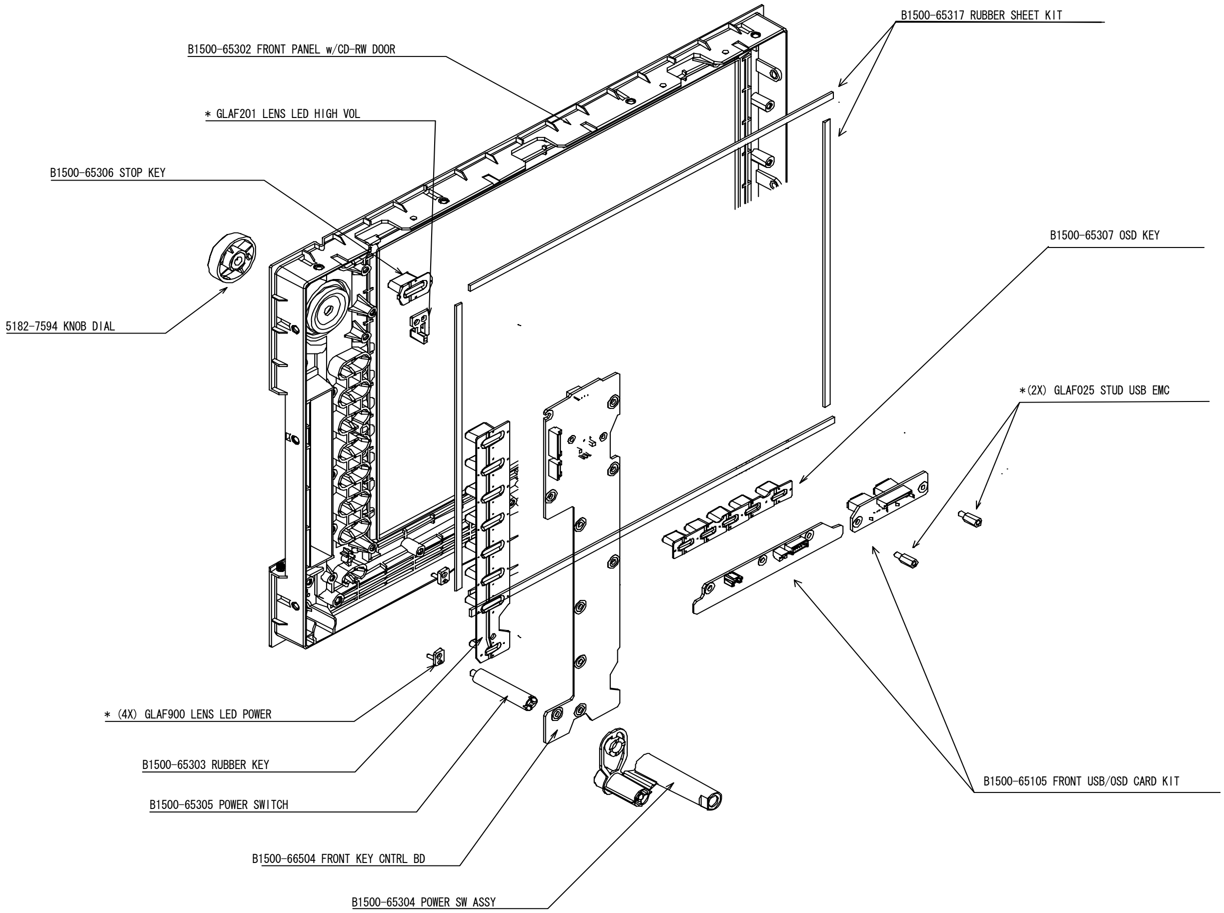
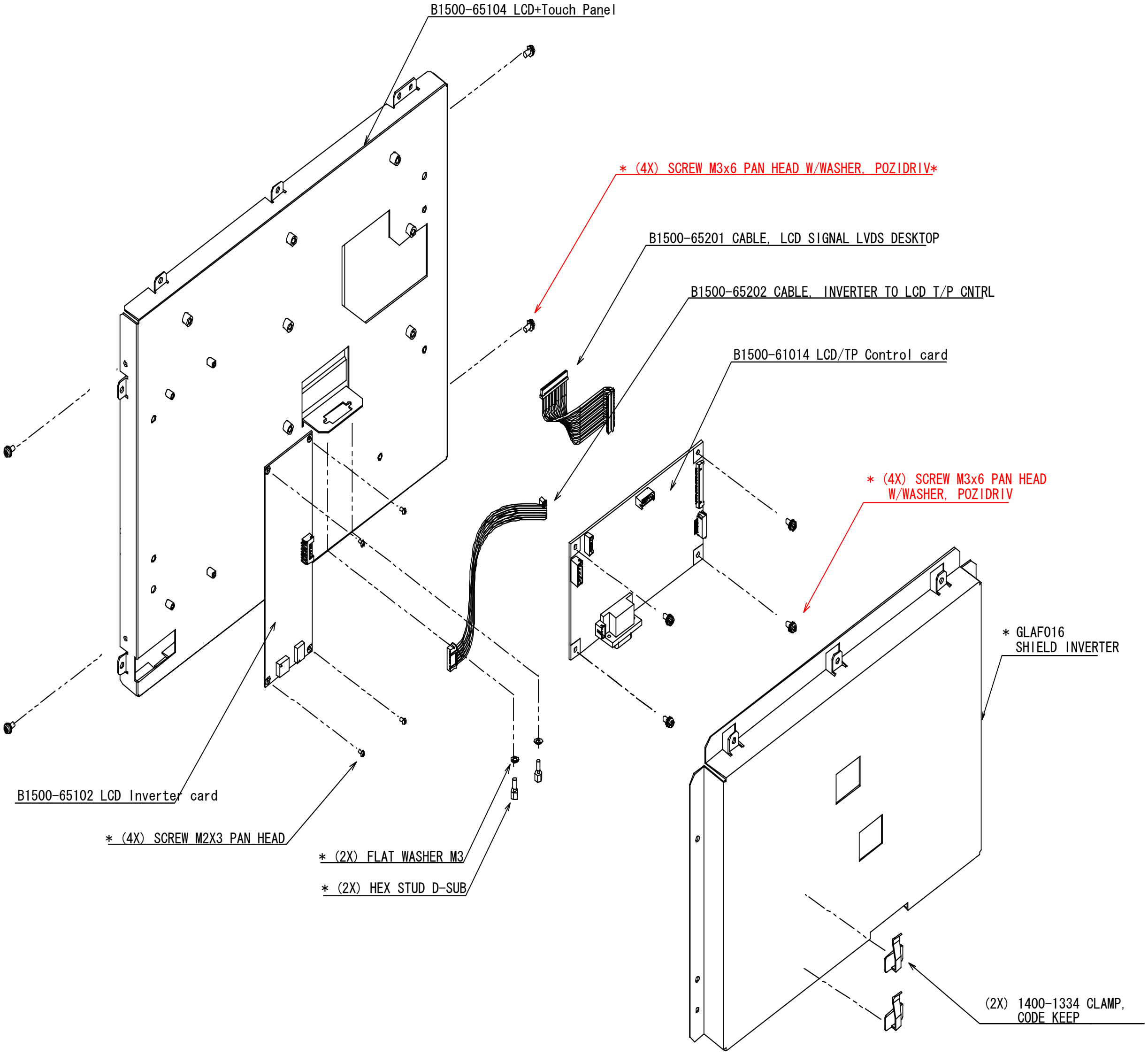


Figure 6-11 Front panel assemblies-2



Instrument Inside Parts

This section shows the parts inside the instrument frame.

Figure 6-12 PC cables to the front side

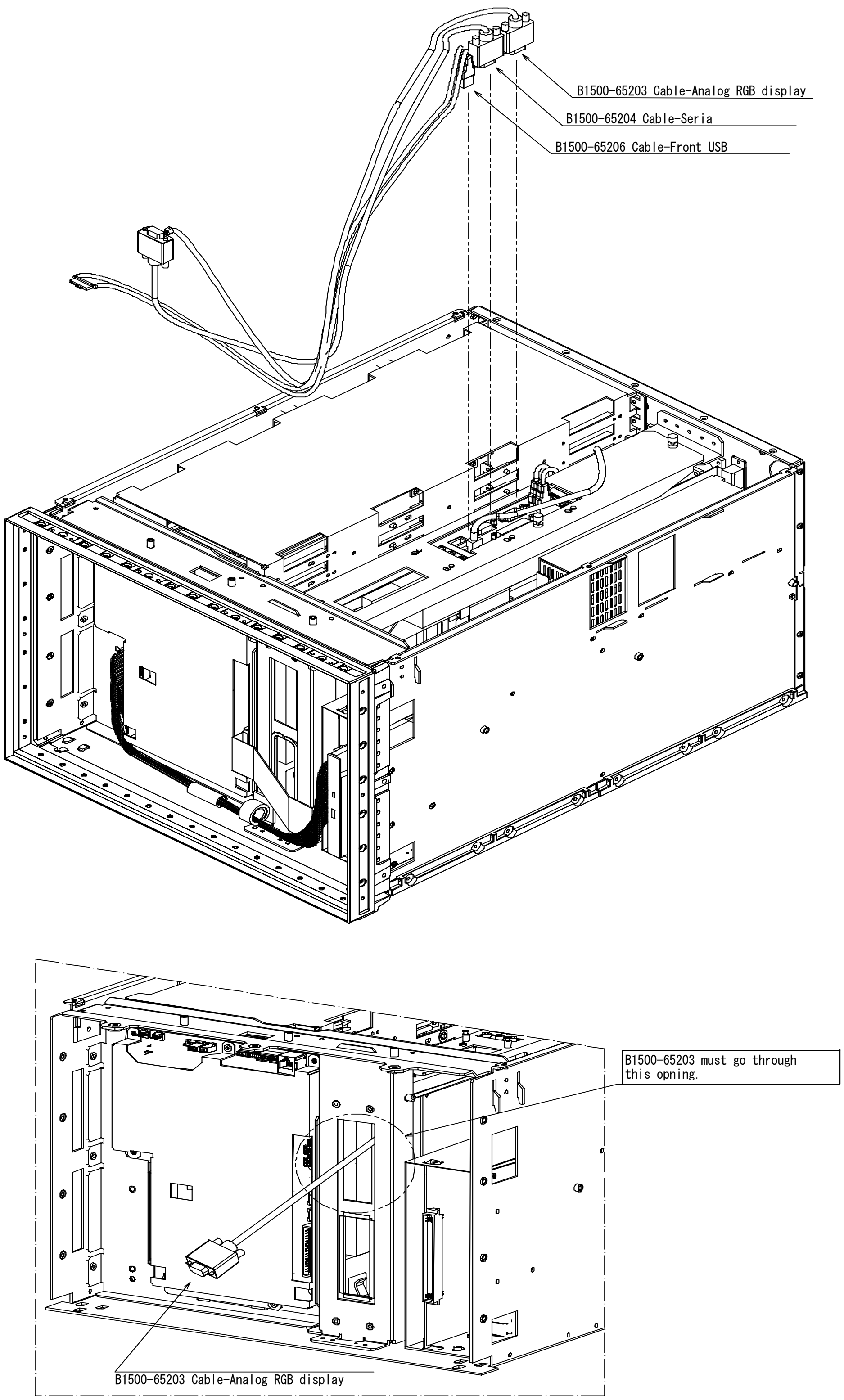


Figure 6-13 PC fixing bar

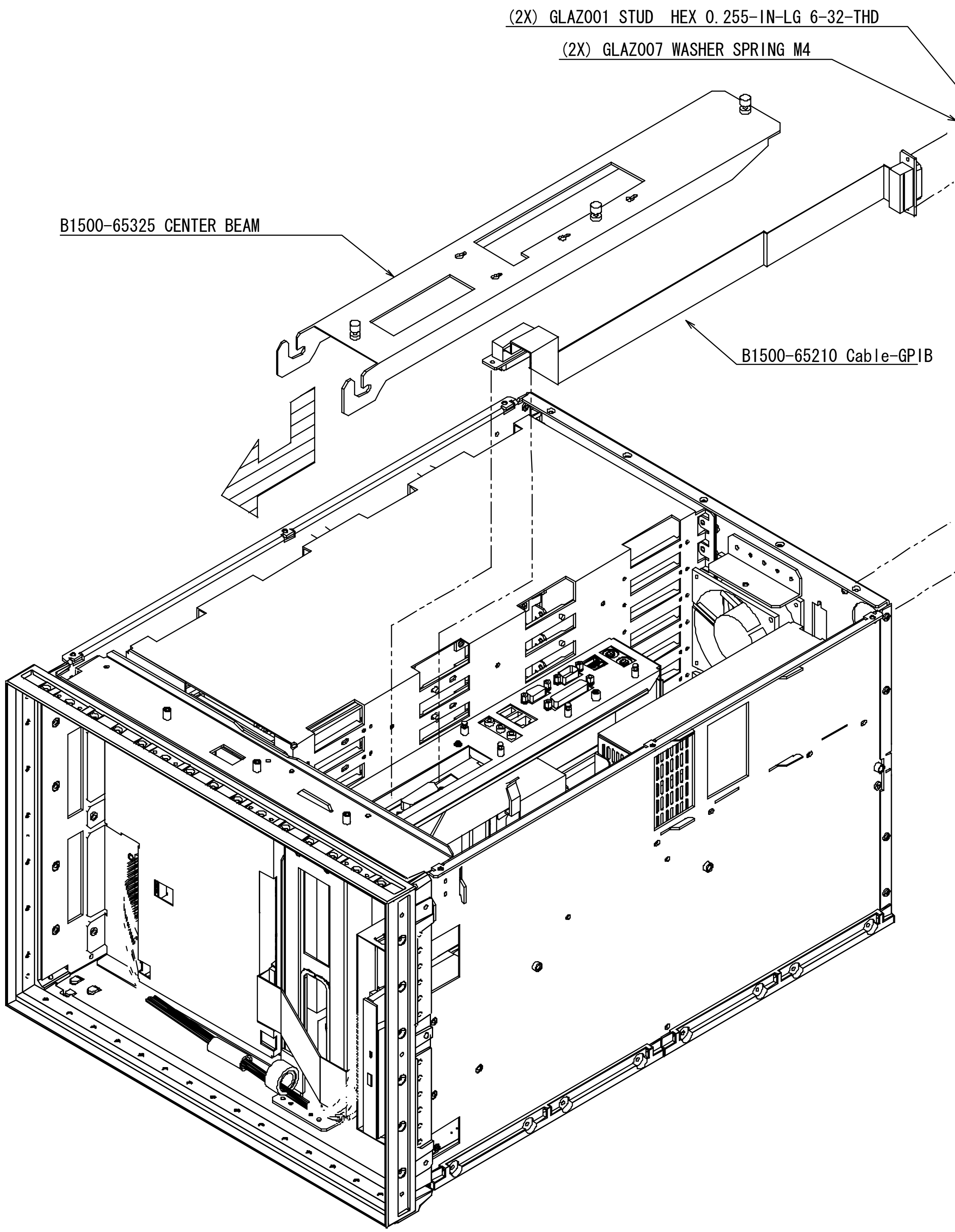


Figure 6-14 PC cables on the top

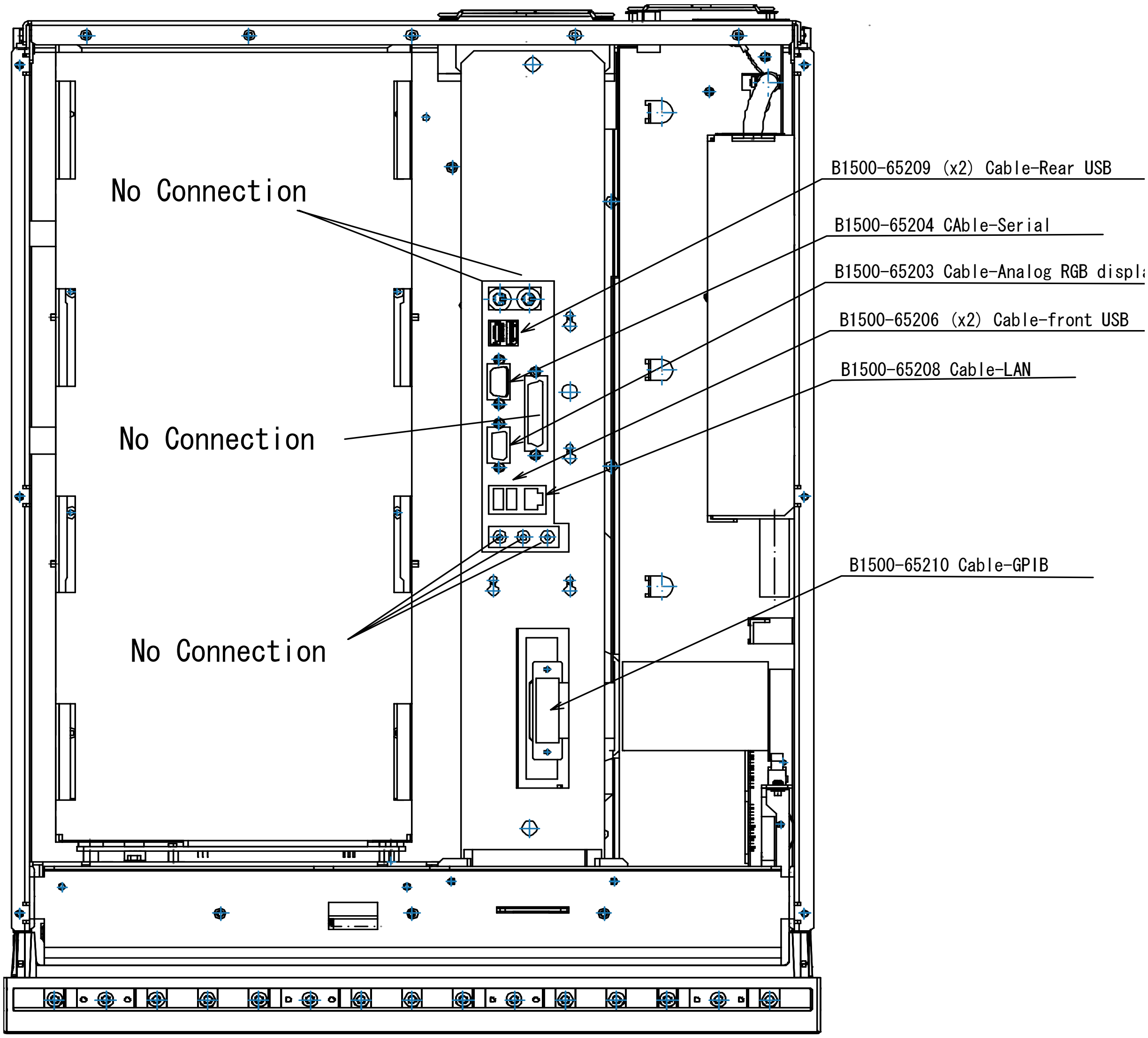


Figure 6-15 PC unit and power supply cable

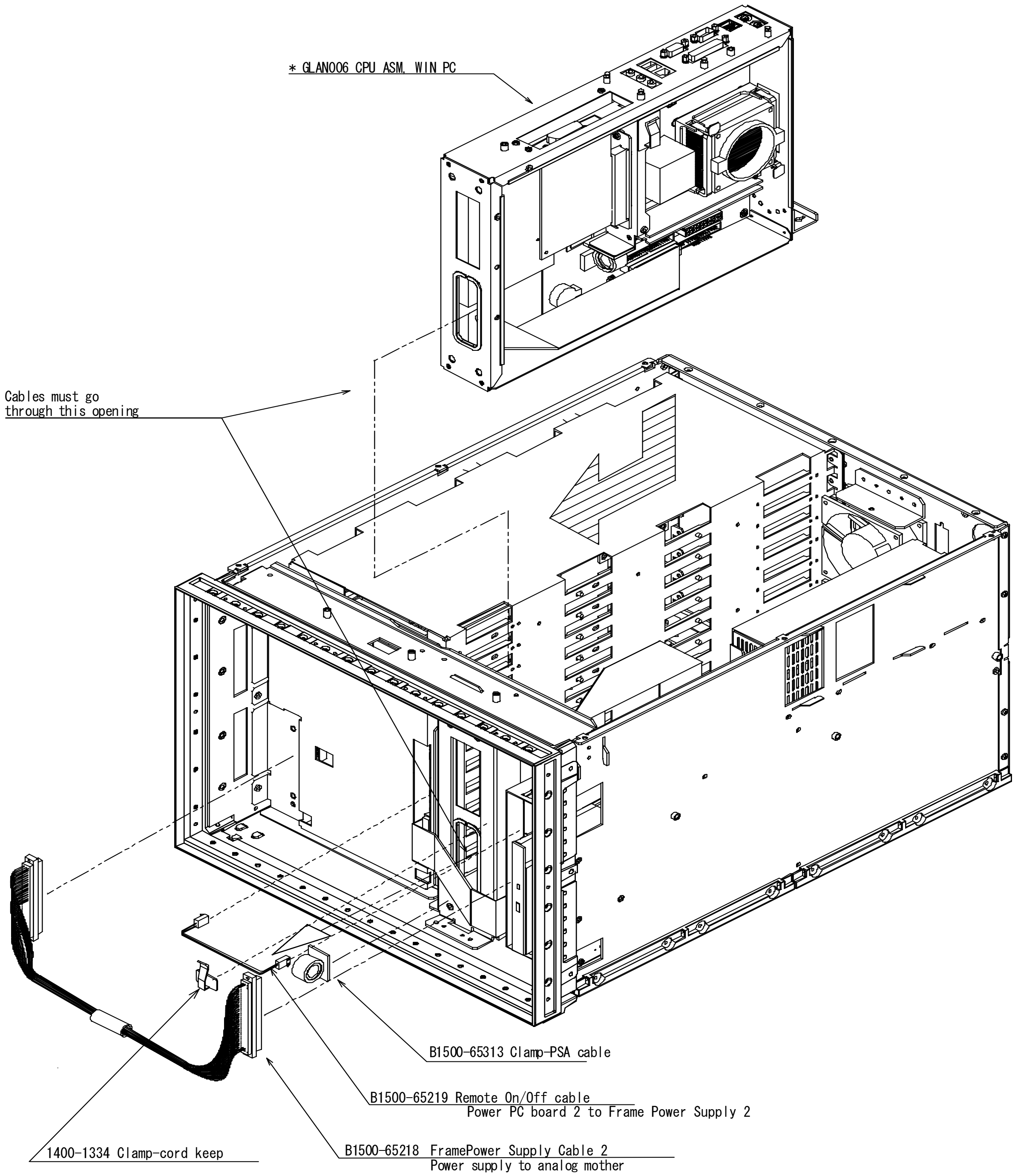
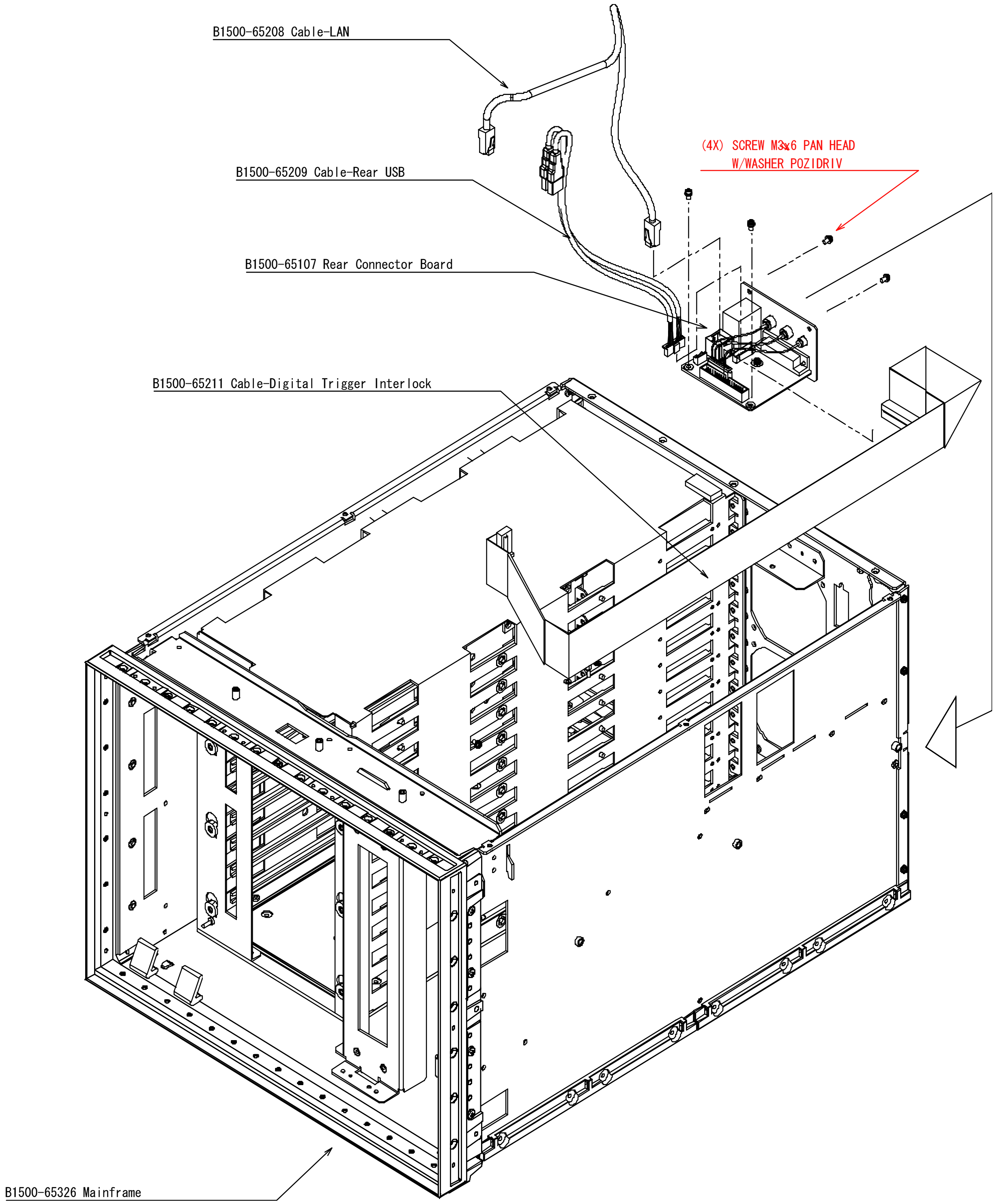


Figure 6-16 Rear connector board



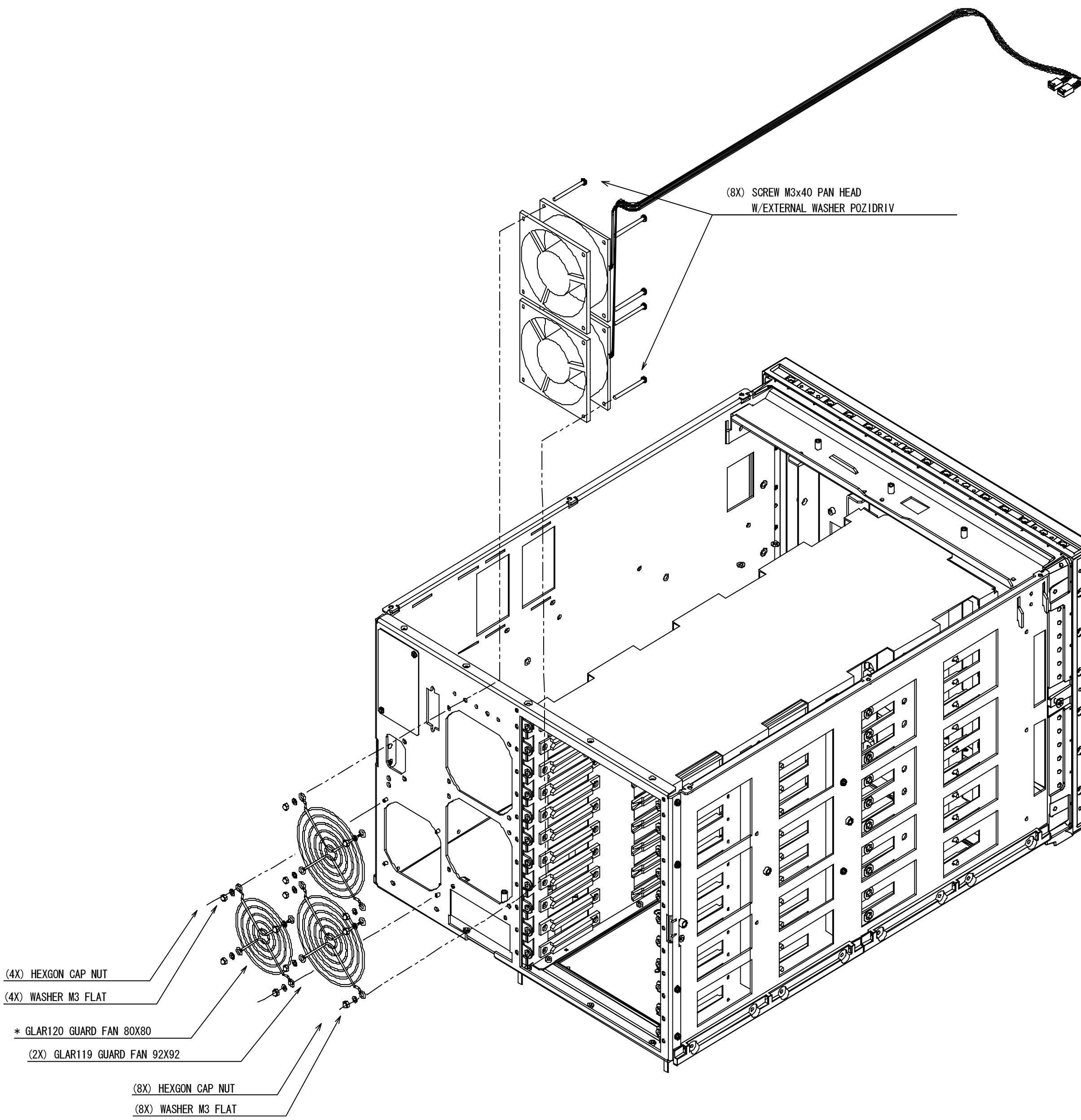


Figure 6-17 Rear fans

Figure 6-18 Power supply modules

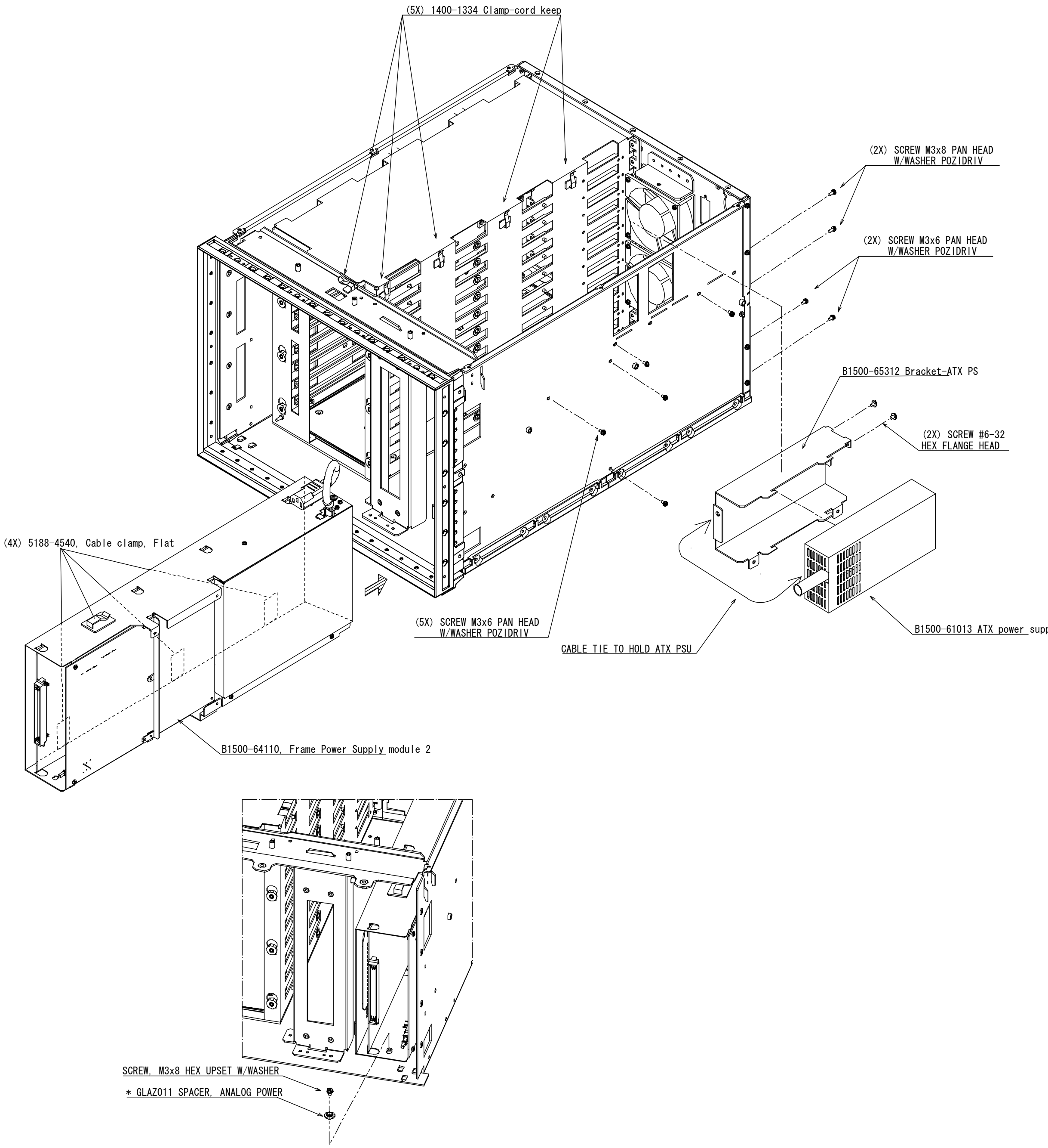
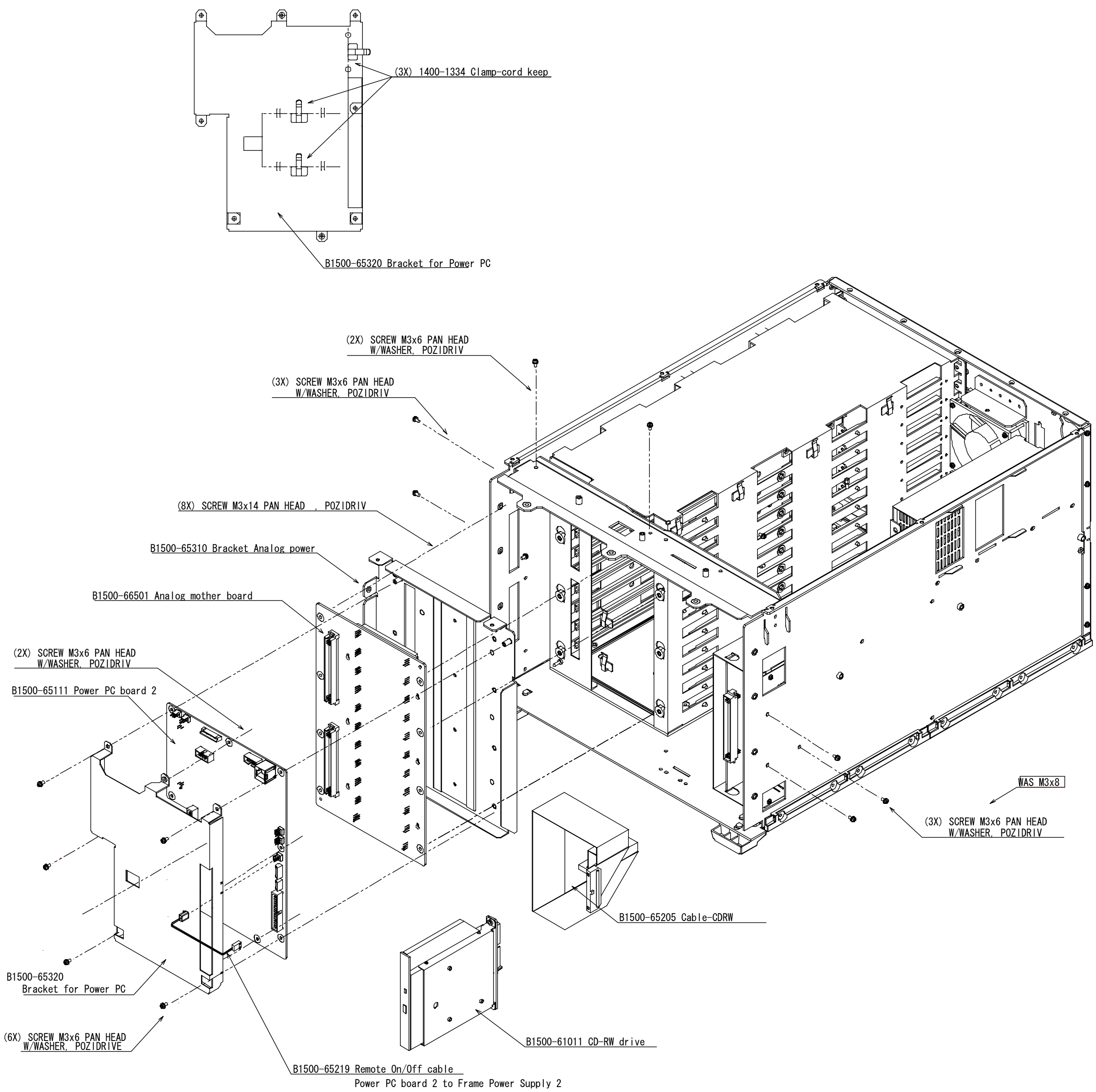


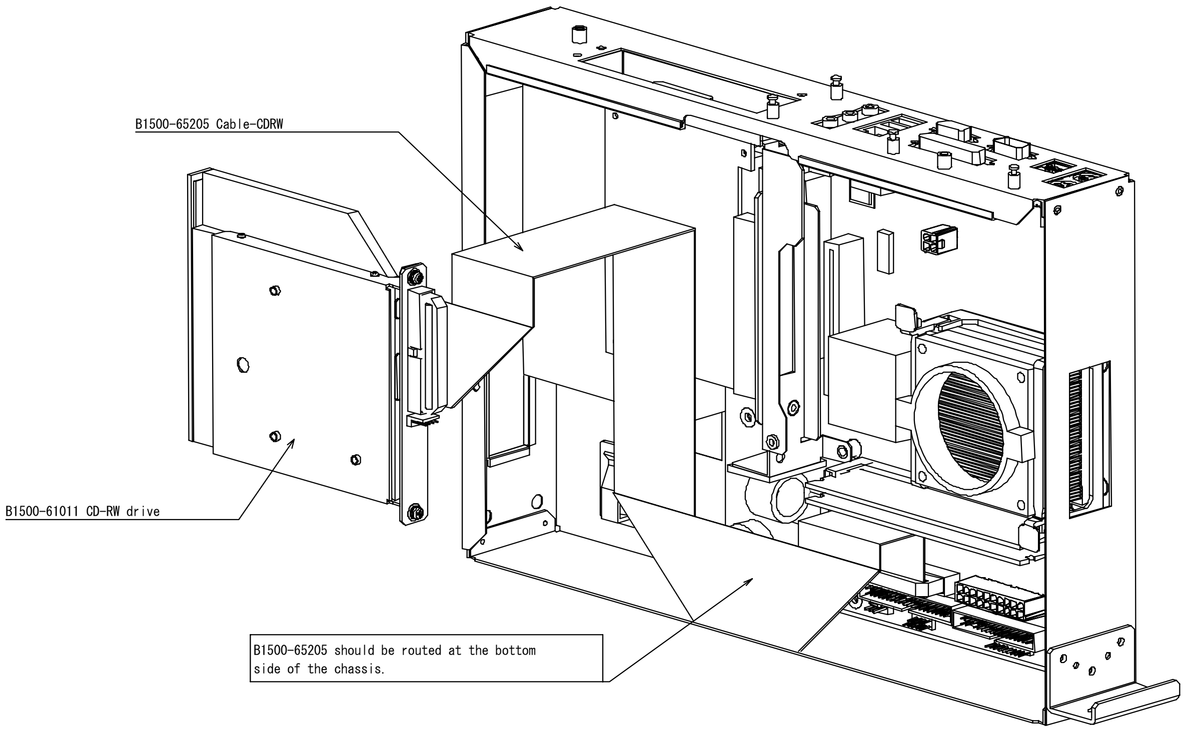
Figure 6-19 Analog mother board and Power PC board



PC unit parts

This section shows the parts in the PC unit.

Figure 6-20 PC module and CD-RW module



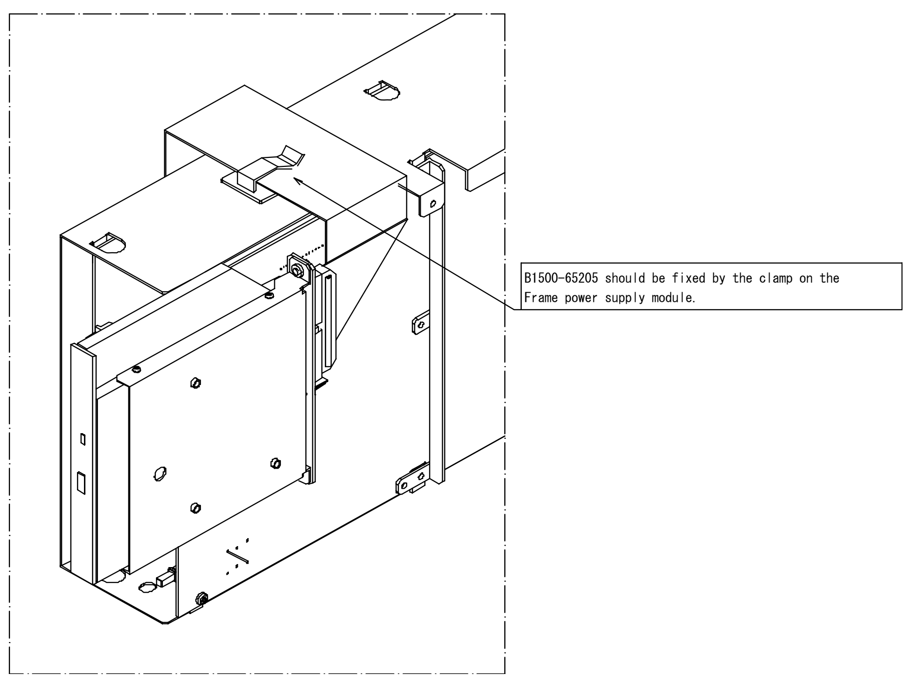


Figure 6-21 PC unit -whole

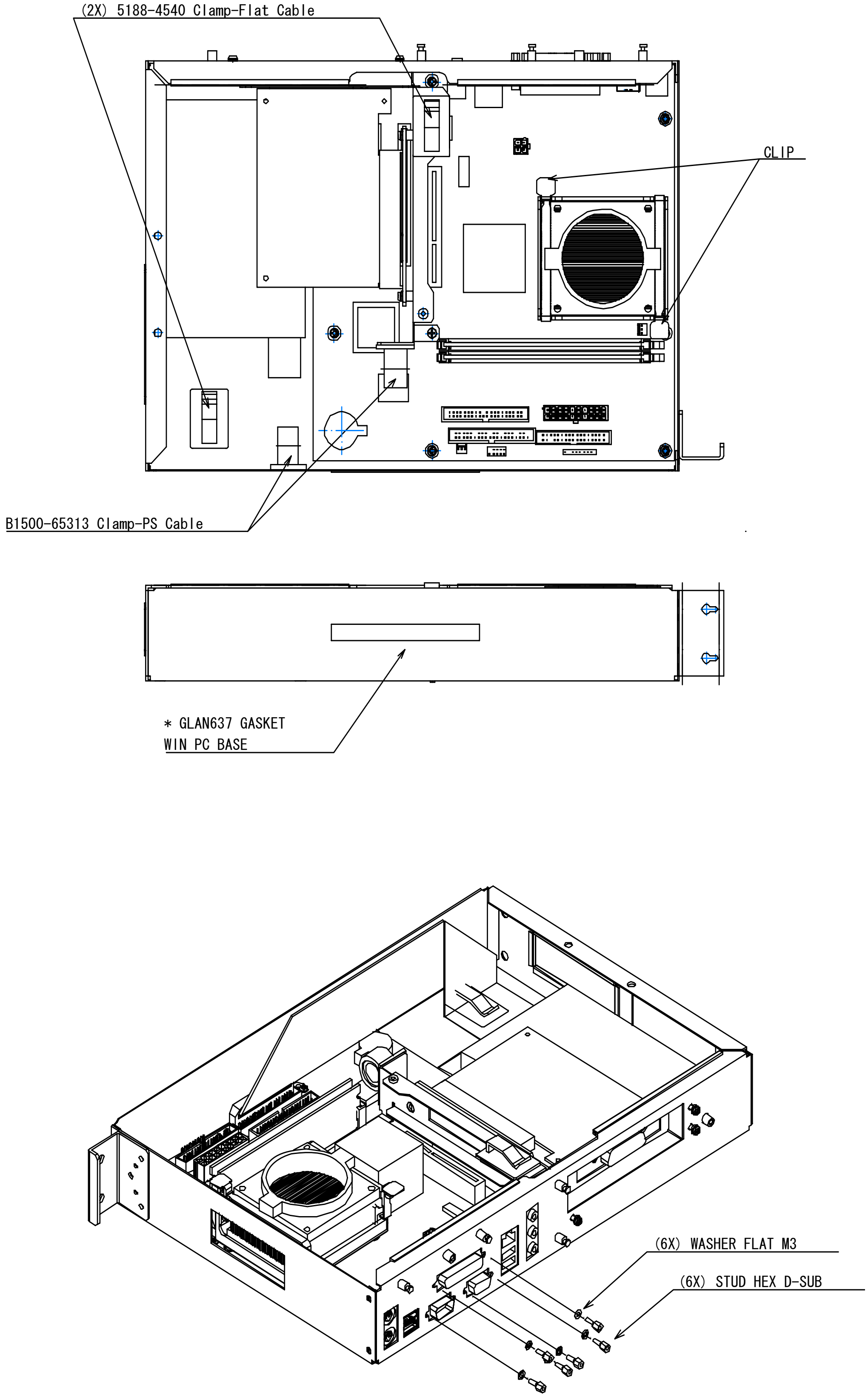


Figure 6-22 PC unit -detail

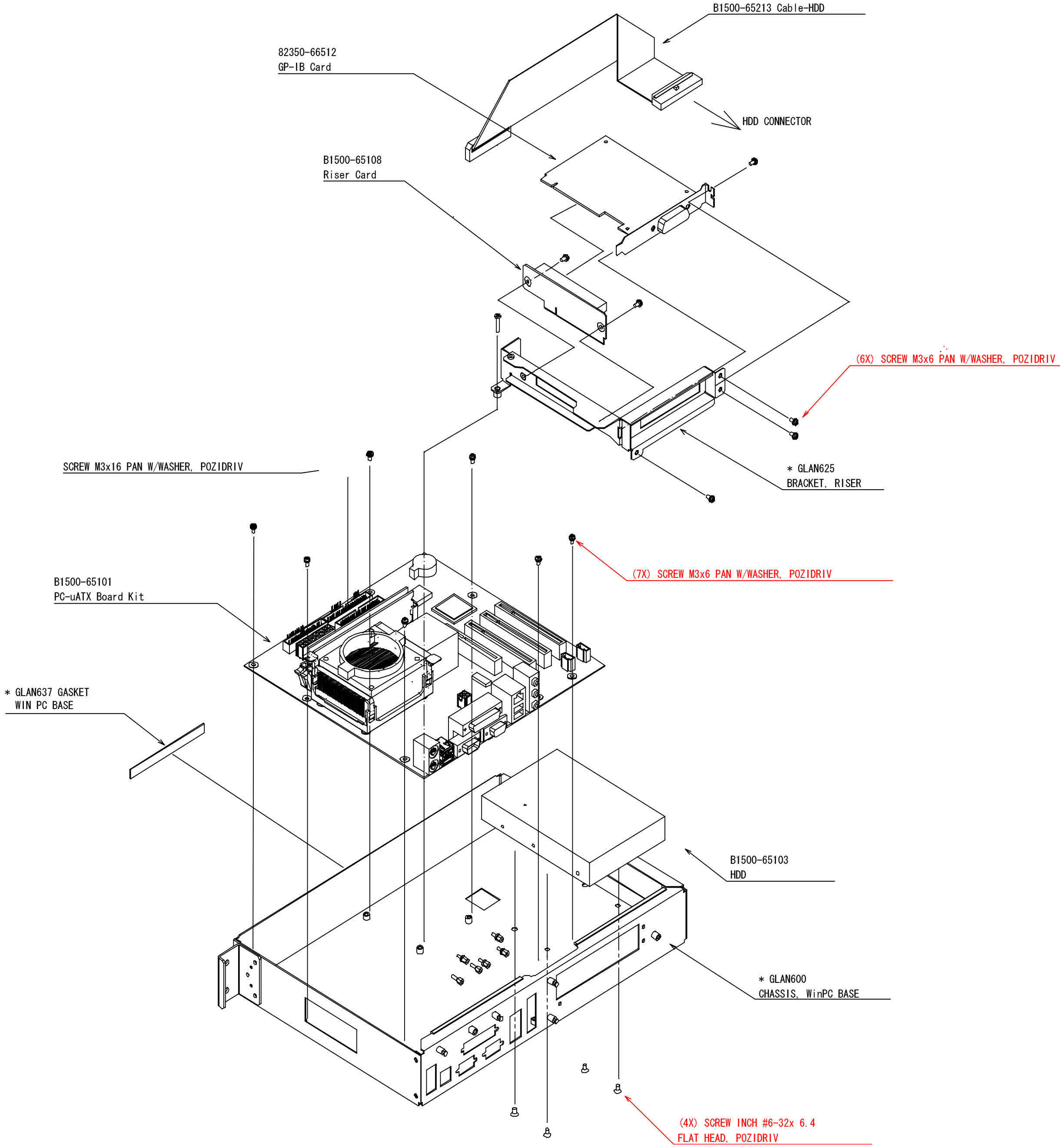
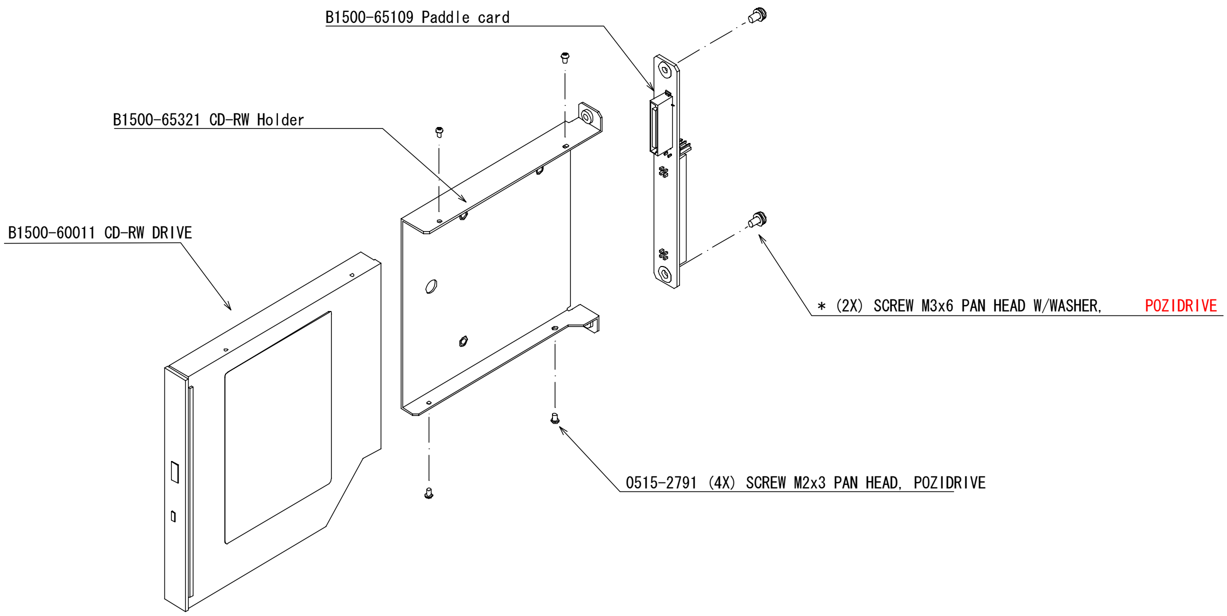


Figure 6-23 CD-RW module



A Error Codes

Error Codes

This section lists the Agilent B1500 error codes and messages.

- "Agilent EasyEXPERT Operation Error"
- "Agilent FLEX Execution Error"
- "Agilent B1500A Self-test/Calibration Error"

Agilent EasyEXPERT Operation Error

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

101001	Log repository operation failed.
101002	Log file operation failed.
101003	Log record operation failed.
102001	Service started successfully.
102002	Service stopped successfully.
102003	Service starting process failed. Contact your nearest Agilent Technologies Service Center.
102004	Service stopping process failed. Contact your nearest Agilent Technologies Service Center.
103001	USB488 error occurred. Alias: *A*, Reason: *B*
103002	USB488 device was not found. Alias: *A*, Reason: *B*
103003	USB488 timeout occurred. Alias: *A*, Timeout: *B* [ms]
103004	GPIB error occurred. Interface: *A*, Address: *B*, Reason: *C*
103005	GPIB address must be between 0 and 31. Interface: *A*, Address: *B*
103006	Duplicate GPIB address was found. GPIB address must be unique. Interface: *A*, Address: *B*
103007	GPIB device was not found. Interface: *A*, Address: *B*, Reason: *C*
103008	GPIB timeout occurred. Interface: *A*, Address: *B*, Timeout: *C* [ms]
104001	Module (*A*) is not available.
105001	Generic setup error occurred. Code: *A*, Reason: *B*
105002	Duplicate data name was found. Data name must be unique. Data name: *A*
105003	Operation is not supported in offline mode.
105004	Interlock circuit is open. Interlock circuit must be closed for setting voltage source/compliance absolute value exceeding 42V.
105005	Output series resistor cannot be used for HRSMU with ASU.
105006	Source wait time coefficient must be between *A* and *B*.
105008	Monitor wait time coefficient must be between *A* and *B*.
105010	Series resistor is not available for HPSMU using the 1 A range.
105011	I/V Staircase Sweep needs at least one monitoring channel.

105012	I/V Pulse Sweep needs exactly one monitoring channel.
105013	I/V Pulse Biased Sweep needs exactly one monitoring channel.
105014	I/V-t Sampling needs at least one monitoring channel.
105015	C-V Sweep needs at least one monitoring channel.
105016	At least one measurement channel is required for Multi Channel I/V Sweep measurement.
105017	Only one measurement channel can be used for I/V-t linear sampling measurement of interval < 2 ms.
105018	Base hold time is not available for 4155B/C and 4156B/C. The value must be 0.
105020	Interlock circuit is open. Interlock circuit must be closed to set an output or compliance value greater than ±40 V.
105021	Current source value of *A* must be between *B* A and *C* A.
105022	Voltage compliance value of *A* must be between *B* V and *C* V.
105023	Voltage source value of *A* must be between *B* V and *C* V.
105024	Current compliance value of *A* must be between *B* A and *C* A.
105025	Power compliance value of *A* must be between *B* W and *C* W.
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.
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.
105033	The polarity of peak value(s) and the base value of SMU current pulse must be the same.
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).
105035	Invalid value (*A*) was specified for SMU I/V Sweep stop condition. Valid option(s): *B* *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.
105037	The delay time for SMU I/V Sweep must be between *A* s and *B* s.
105041	Invalid value (*B*) was specified for current monitor ranging mode of *A*. Valid option(s): *C*
105042	Invalid value (*B*) was specified for current monitor range of *A*. Valid option(s): *C*
105043	Invalid value (*B*) was specified for current monitor ranging rule of *A*. Valid option(s): *C*
105044	Invalid value (*B*) was specified for voltage monitor ranging mode of *A*. Valid option(s): *C*
105045	Invalid value (*B*) was specified for voltage monitor range of *A*. Valid option(s): *C*
105046	Invalid value (*A*) was specified for the integral mode of High-Resolution ADC. Valid option(s): *B*
105047	The coefficient for High Resolution ADC *A* integral mode must be between *B* and *C*.
105048	Invalid value (*A*) was specified for the averaging mode of High-Speed ADC. Valid option(s): *B*
105049	The coefficient for High Speed ADC *A* averaging mode must be between *B* and *C*.

105050	Invalid value (*A*) was specified for the integral mode of ADC. Valid option(s): *B*
105051	Invalid value (*A*) was specified for the sweep direction. Valid option(s): *B*
105052	Invalid value (*A*) was specified for the sweep stop condition. Valid option(s): *B*
105053	Invalid value (*A*) was specified for the impedance measurement model. Valid option(s): *B*
105054	Hold time value must be between *A* s and *B* s.
105055	Delay time value must be between *A* s and *B* s.
105056	Voltage source value of *A* must be between *B* V and *C* V.
105057	Frequency value of *A* must be between *B* Hz and *C* Hz.
105058	Coefficient value of *A* integral mode must be between *B* and *C*.
105059	AC Level value of *A* must be between *B* mV and *C* mV.
105060	Invalid value (*B*) was specified for monitor ranging mode of *A*. Valid option(s): *C*
105061	SMU pulse period must be *A* s longer than the pulse width.
105062	Primary sweep source step value must be greater than the setup resolution.
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.
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.
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 μA.
105071	Sampling interval for I/V-t sampling must be between *A* s and *B* s.
105072	Number of samples for I/V-t *A* sampling must be between *B* and *C*.
105073	Hold time for I/V-t sampling must be between *A* s and *B* s.
105074	Multiplying the number of monitor channels by No of Samples must be between *A* and *B*.
105075	Invalid value *A* specified for I/V-t sampling Lin/Log setting. Valid option(s): *B*
105076	Base hold time for I/V-t sampling must be between *A* s and *B* s.
105077	Invalid value *A* specified for I/V-t sampling output sequence. Valid option(s): *B*
105078	Sampling interval for I/V-t *A* sampling must be between *B* s and *C* s.
105079	Hold time for I/V-t *A* sampling must be 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.
105081	Hold time for I/V-t *A* sampling with interval shorter than *B* s must be between *C* s and *D* s.
105091	List length of VAR1 sweep must be between *A* and *B* for the I/V List Sweep measurement. Length *C* is not applicable.
105092	List length of VAR2 sweep must be between *A* and *B* for the I/V List Sweep measurement. Length *C* is not applicable.
105093	List length of delay time must be between *A* and *B* for the I/V List Sweep measurement. Length *C* is not applicable.
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.

105801	Invalid value *A* specified for *Output Value after Measurement* in the Advanced Setup dialog box. Valid option(s): *B*
105802	Invalid value *A* specified for *Bias Hold after Measurement* in the Advanced Setup dialog box. Valid option(s): *B*
105803	Bias hold function execution error. All channel outputs or voltage compliance must be at ±42 V or less to control the output switch or the series resistor.
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.
105811	Invalid value *A* was specified for Semiconductor Relays (*B*) of Advanced Setup. Valid option(s): *C*
105821	Invalid value *A* was specified for Type of SPGU Pulse Setup. Valid option(s): *B*, VName: *C*
105822	Invalid value *A* was specified for SW Sync of Pulse Switch Setup. Valid option(s): *B*, VName: *C*
105823	Invalid value *A* was specified for Normal of Pulse Switch Setup. Valid option(s): *B*, VName: *C*
105824	Width value of Pulse Switch Setup must be between *A* s and *B* s. VName: *C*
105825	Width for pulse switch must be between *A* s and *B* s. VName: *C*
105826	Sum of Delay and Width of Pulse Switch Setup must be within Period value. VName: *A*
105830	Load Z value must be between *A* ohm and *B* ohm. VName: *C*
105831	Period value of SPGU Pulse Setup must be between *A* s and *B* s.
105832	PULSE COUNT value of SPGU Pulse Setup must be between *A* and *B*.
105833	DURATION value of SPGU Pulse Setup must be between *A* s and *B* s.
105834	Base value of SPGU Pulse Setup must be between *A* V and *B* V. VName: *C*
105835	Peak value of SPGU Pulse Setup must be between *A* V and *B* V. VName: *C*
105836	Delay value of SPGU Pulse Setup must be between *A* s and *B* s. VName: *C*
105837	Width value of SPGU Pulse Setup must be between *A* s and *B* s. VName: *C*
105838	Leading value of SPGU Pulse Setup must be between *A* s and *B* s. VName: *C*
105839	Trailing value of SPGU Pulse Setup must be between *A* s and *B* s. VName: *C*
105840	Leading × 1.25 must be within Width value. VName: *A*
105841	Sum of Delay, Width, and Trailing × 1.25 must be within Period value. VName: *A*
105842	Invalid value *A* was specified for PGU output impedance. Valid option(s): *B*, VName: *C*
105843	SPGU cannot be used for bias source of I/V-t linear sampling measurement of interval < 2 ms.
105844	|Peak-Base| value of PGU pulse must be between *A* V and *B* V. VName: *C*
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.
105846	SPGU cannot output the specified voltage. Change Load Z value or output voltage.
105901	Over voltage was applied to SMU measurement terminal.
105902	Over current was applied to SMU measurement terminal.
105903	Cannot use the specified module that failed self-test.

105904	*A* cannot be set to Additional Data Variables. Only the channels defined in Channel Definition can be set.
105905	Entry is already defined in Additional Data Variables. It is not necessary to redefine the entry. Unit: *A*, Type: *B*
105906	Variable name specified in Additional Data Variables is used for another variable. Specify a different name. Variable name: *A*
105907	FMT command's first argument must be 13.
105908	Invalid Type value was found in the Additional Data Variables area. A test setup cannot contain both the type Re(Z) or Im(Z) and the type Re(Y) or Im(Y).
105909	Program memory number is out of range. Valid value: *A* to *B* Entered value: *C*
105910	Program memory variable number is out of range. Valid value: *A* to *B* Entered value: *C*
105911	Empty Command field was found in the Command Setup. A command must be entered in the Command field.
105912	Test execution error was detected. Check the parameter values of the command, and set the Arguments field again. Setup Name=*A*, Line Number=*B,* Command=*C*
105913	Incorrect usage of ST and END commands. Use them as a pair to store a command group into the program memory.
105914	Improper number of Arguments for the *A* command. Enter the Arguments correctly.
106001	Logon request was rejected. The number of Logons already reaches the limit of the software regulation. Restart EasyEXPERT. If this does not solve the problem, restart the B1500.
107001	Workspace management error was occurred.
107002	Workspace was not found. Restart Agilent B1500A. If the problem still occurs, contact your nearest Agilent Technologies Service Center.
107003	Workspace could not be loaded. Restart Agilent B1500A. If the problem still occurs, contact your nearest Agilent Technologies Service Center.
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. Close the present Workspace and open the Workspace again.
107006	The workspace name is conflicting. It must be unique in system. Specify the correct Workspace name.
108001	Function Library management error occurred.
108002	Function Library function has not been configured correctly or is not running. Restart Agilent B1500A. If the problem still occurs, contact your nearest Agilent Technologies Service Center.
108003	Invalid Function Module assembly file. Restart Agilent B1500A. If the problem still occurs, contact your nearest Agilent Technologies Service Center.
108004	Invalid Function Module. Restart Agilent B1500A. If the problem still occurs, contact your nearest Agilent Technologies Service Center.
108005	Function Module was not found. Restart Agilent B1500A. If the problem still occurs, contact your nearest Agilent Technologies Service Center.
108006	Function Module is inaccessible because it has been removed. Restart Agilent B1500A. If the problem still occurs, contact your nearest Agilent Technologies Service Center.

108007	The same process is running now. Restart Agilent B1500A. If the problem still occurs, contact your nearest Agilent Technologies Service Center.
108008	Profile was not found. Restart Agilent B1500A. If the problem still occurs, contact your nearest Agilent Technologies Service Center.
108009	Profile could not be loaded. Restart Agilent B1500A. If the problem still occurs, contact your nearest Agilent Technologies Service Center.
108010	The request to load or create Profile was rejected. Profile is already active. Restart Agilent B1500A. If the problem still occurs, contact your nearest Agilent Technologies Service Center.
108011	Invalid Function Module for this EasyEXPERT revision. Module ID: *A*, Path: *B* Restart Agilent B1500A. If the problem still occurs, contact your nearest Agilent Technologies Service Center.
108020	An I/O error occurred during Function Library operation. Path: *A* Restart Agilent B1500A. If the problem still occurs, contact your nearest Agilent Technologies Service Center.
108021	Function Module read error. Path: *A* Restart Agilent B1500A. If the problem still occurs, contact your nearest Agilent Technologies Service Center.
108022	Function Module save error. Path: *A* Restart Agilent B1500A. If the problem still occurs, contact your nearest Agilent Technologies Service Center.
109001	Auto calibration is in progress.
109002	CMU phase compensation failed.
109011	CMU open correction failed.
109012	The value of standard for CMU open correction must be finite as admittance.
109021	CMU short correction failed.
109022	The value of standard for CMU short correction must be finite as impedance.
109031	CMU load correction failed.
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.
111002	Function name (*A*) is invalid.
111003	Function name (*A*) duplicates other data/function name.
111004	Definition expression of function (*A*) is invalid. expression: *B*
111005	The data (*A*) assigned with the data (*B*) is not defined.
111006	The data (*A*) assigned to the data (*B*) is not defined.
111007	The data (*A*) cannot be assigned to the data (*B*) for the mismatch of their types.
111008	Recursive definition is not allowed for function (*A*). Expression: *B*
111011	Vector data expression is expected. Expression: *A*
111012	Numeric expression is expected. Expression: *A*
111013	String expression is expected. Expression: *A*
111014	Descriptor expression is expected. Expression: *A*
111015	Module descriptor expression is expected. Expression: *A*
111016	ALWaveform type expression must be entered. Expression: *A*
111021	Test setup name cannot be an empty string.
111022	Test setup name must be *A* characters or less.
111031	Assign module parameter for ALWaveform type parameter.
111032	ALWG Pattern Name must be entered.
111033	Invalid character is included in Name of module parameter assigned for ALWaveform type parameter. Module name: *A*, Invalid character: *B*
111034	Invalid character is included in ALWG Pattern Name. ALWG pattern name: *A*, Invalid character: *B*
112001	Output function must be constant for the unit (*A*) in common mode.
112002	Output function (*A*) must be assigned to any unit.
112003	Output function (*A*) cannot be assigned to multiple units (*B* and *C*).
112004	Pulse mode cannot be assigned to multiple SMUs (*A* and *B*).
112005	I/V mode of the primary sweep source and synchronous sweep source must be the same.
112006	Duplicate channel data name was found. Channel data name must be unique. Channel data name: *A*
112007	Duplicate channel unit assignment was found. Channel unit assignment must be unique. Channel unit: *A*
112008	No channel unit was assigned. At least one channel unit must be assigned.
112009	Function (*A*) can be used for a maximum of *B* channel(s) in the *C* mode.
112010	All SPGU channels must be set to the same output mode, VPULSE or ALWG.
112011	SMU descriptor expression is expected. Expression: *A*
112012	CMU descriptor expression is expected. Expression: *A*
112013	SPGU descriptor expression must be entered. Expression: *A*

112021	Numeric expression is expected for power compliance. Expression: *A*
112022	No CMU was assigned. At least one CMU must be assigned.
112023	No SMU was assigned. At least one SMU must be assigned.
112024	At least one SPGU must be used for SPGU Control.
112051	Auto analysis operation failed.
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.
112053	Enter a value for numeric variable *A*, used to specify the switching matrix output channel.
112054	A switch setup named *A* is already in the preset group *B*. The switch setup name must be unique in a preset group.
112055	A preset group named *A* already exists. The preset group name must be unique.
112056	Enter a name for the switching matrix setup.
112057	Maximum length for a switching matrix setup name is *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.
112060	Specified connection pattern is not available for the couple port *A*, *B*.
112061	Input port *A* uses a shared path. The path is currently connected to the other input port. The specified connection is not available.
112071	Invalid Unit value was entered in the Channel Definition area. A test setup cannot use multiple units connected to the SCUU. Invalid entry: Unit=SMU *A*
112072	Invalid value *A* was specified for Enable/Disable of I/V-t Sampling Stop Condition. Valid option(s): *B*
112073	Invalid value *A* was specified for Name of I/V-t Sampling Stop Condition. Valid option(s): *B*
112074	Invalid value *A* was specified for Event of I/V-t Sampling Stop Condition. Valid option(s): *B*
112075	Invalid function was used in the definition of variable specified by Name of I/V-t Sampling Stop Condition.
112100	ALWG waveform data for *A* was not found. Set data of the ALWaveform type parameter properly.
112101	Multiple ALWG waveform data are specified for *A*. Set Properties of the ALWaveform type parameter properly.
113001	Category name length must be in range of *A* to *B* characters.
113002	Application test definition name cannot be an empty string.
113003	Application test definition of the same name is already existing. Test definition: *A* Test categories: *B*
113011	Duplicate parameter name was found. Parameter name must be unique. Parameter name: *A*
113012	Duplicate typical value *A* is assigned. Each typical value must be unique for a numeric parameter.
113013	Symbol must not be an empty string.
113014	Symbol *A* is duplicated. Symbol must be unique for a numeric parameter.

113015	Same value *A* is assigned to symbols *B* and *C*. Each symbol must have unique value for a numeric parameter.
113016	Duplicate typical value *A* is assigned. Each typical value must be unique for a string parameter.
113017	Empty string is not allowed for the symbol.
113018	Symbol *A* is used for another vector parameter. Specify a different symbol.
113021	The type of evaluated value does not match the type of parameter *A*.
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*
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*
113024	Value for module parameter is invalid or is not compliant to the resource type of the parameter. Parameter name: *A*, Parameter value: *B*
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*
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.
114002	Unnamed preset group cannot be exported. Please name the preset group in advance.
114011	A test setup named *A* is already in the preset group *B*. The test setup name must be unique in a preset group.
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. {0} Setup Name {1} Date (Time stamp) {2} Count {3} Device ID
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*
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 Results Data Auto Export dialog box.
114103	Change the folder path in the Test Results 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 Results Data Auto Export dialog box.
114105	Change the file extension in the Test Results Data Auto Export dialog box. Specified value contains an invalid character. Specified file extension: *A*

114106	Data file creation failed during automatic data export. Refer to the detail message, and retry after taking necessary measures.
114107	Index file creation failed during 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 Results Data Auto Export dialog box.
114152	Change the XML Style Sheet File Path in the Test Results 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.
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*.
115031	Failed to invoke *A*.
115032	Repeat execution was aborted.
115041	Standby state was changed to OFF due to high voltage related error.
116001	Connected model not supported by Desktop EasyEXPERT. Only model *A* is supported. Connected model: *B* (address: *C*)
116002	B1500 firmware revision *A* is not supported by Desktop EasyEXPERT. Only revisions *B* and later are supported.
116003	Invalid argument specified for /gpib. Specified argument: /gpib:*A* Example argument (valid): /gpib:gpib0::17
116004	Desktop 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*.
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.
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.
117010	Switching matrix command execution error. B2200 error code: *A* B2200 error message: *B*
117011	Connected model not supported by EasyEXPERT. Only model *A* is supported. Connected

	model: *B*
117012	Capacitance compensation data file read error. Specified file is either corrupt, or is not a compensation data file.
117014	Cannot control the switching matrix. It is controlled by the other tool.
120000	Script program execution error.
120001	Duplicated variable name used. Change the name of the variable. In a script program, the local variable name must be unique.
120002	Script program execution is aborted. Program execution paused by clicking the Pause button. This is the status message in normal operation.
120003	Script program execution ended abnormally. Program execution stopped by an illegal operation or statement. For more information, click the Detail button.
120004	An error forced by ERROR statement. Program execution 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 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 paused by clicking the Pause button. This is the status message in normal operation.
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 for the argument *B* of the function *A*. Click the Detail button for more information.
122005	Invalid type of data is specified as function argument. Correct the data type of the variable used for the argument. Or change the variable that is the same data type as the argument.
122006	Incorrect data is specified as function argument.

122007	Specified argument is out of range. 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.
123000	Only literal value can be specified here. Invalid character is entered in the Variable Inspector. Enter the correct variable name.
130001	Transport function error occurred.
130002	A target package was not found. Cannot import data because of invalid file format or corrupted file. Specify correct file.
130003	The package is unusable because it includes incorrect data. Cannot import data because of invalid file format or corrupted file. Specify correct file.
130004	Package data is insufficient for this process. Cannot import data because of invalid file format or corrupted file. Specify correct file.
130005	File I/O error. Cannot find or access the package file.
130011	Data import failed. Data may be incompatible or corrupt. Data: *A*
131001	Conversion function error occurred.
131002	Invalid style sheet. Cannot export data (to CSV or XMLSS) because of invalid file format or corrupted file. Specify correct file.
131003	Invalid XML document. Restart Agilent B1500A. If the problem still occurs, contact your nearest Agilent Technologies Service Center.
131004	Conversion process failed. Cannot export data (to CSV or XMLSS) because of invalid file format or corrupted file. Specify correct file.
131005	File I/O error. Cannot access the target file.
132001	Command interface error occurred.
132002	The process failed to execute the specified external command. Confirm that the file is in the system path, and specify the correct file name. Otherwise the file might have a problem.

133001	GPIB interface error occurred.
133002	Internal error occurred during GPIB operation. GPIB interface might be defective.
133003	The GPIB operation failed to complete within the specified timeout period. Set the correct timeout value. GPIB interface might be defective.
133004	The specified expression does not match any device, or the GPIB resource was not found. Set GPIB address properly. GPIB interface might be defective.
133005	The specified GPIB resources are invalid. Set GPIB address properly.
133006	The specified GPIB address value is invalid. Set the correct GPIB address of the GPIB device.
133007	The specified GPIB interface number value is invalid. Set the correct GPIB interface number of the GPIB device.
133008	The specified timeout value is invalid. Set the proper timeout value.
133009	The specified delimiter characters are invalid. Set the proper delimiter value.
133010	Install Agilent IO Library.
133011	The specified GPIB address *A* is assigned to the B1500A. Specify the value assigned to the other equipment. Cannot control the B1500A.
134001	Dialog box interface error occurred.
134002	The process failed to activate the message-box window. Restart Agilent B1500A. If the problem still occurs, contact your nearest Agilent Technologies Service Center.
134003	Message-box is already registered in the system. Restart Agilent B1500A. If the problem still occurs, contact your nearest Agilent Technologies Service Center.
134004	Message-box function is not available because it is unregistered. Restart Agilent B1500A. If the problem still occurs, contact your nearest Agilent Technologies Service Center.
134005	The message-box configuration with no button information is invalid. Define the message box 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 out of the range for the “*C*” axis. Enter the available 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. 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. Internal error.
140005	Invalid operation for the stream occurred. Internal error.
140006	Duplicate data name was found. Data name must be unique. data name: *A*
140007	No printers installed.
140008	Operation for printing failed. Perform printer setup properly.
140009	Failed to evaluate the read out function “*A*”.
140010	Enable the X-Y Graph to use this read out function.
140011	Define the axis *A* to use this read out function.

140012	There is no data for this read out function.
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 *A* is not found. Calculation failed. Scalar data *A* does not exist. Change the test definition so that the data is set before it is called.
140102	Vector data *A* is not found. Calculation failed. Vector data *A* does not exist. Change the test definition so that the data is set before it is called.
141001	Maximum *A* Data Display windows can be opened other than the base window. Cannot open additional Data Display window because the number of opened windows reaches the limit. Close an unnecessary window to open a new window.
141002	Maximum *A* Base Data Display windows can be opened.
151001	Maximum *A* Data Display windows can be opened other than the base window.
151002	Test execution mode cannot be changed during the test.
151003	Up to *A* data traces can be displayed in the Data Display window.
151004	Repeat Measurement Setup is not available when Data Record is OFF.
161001	Number of test definition windows must be *A* or less.
170001	Archive process failed. Reason: *A*
171001	Data compression failed. Program error. Contact Agilent Technologies.
171002	Specify a correct file for the import. Specified file is either unsupported or corrupt.
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.
200004	Data paste failed. Data format is unsupported or incorrect.
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 $E \times F$.
201001	Failed to load image data. File *A* may not be an image file.
202001	The name *A* already exists.
300001	SDA daemon is already running.
300002	SDA daemon configuration file is corrupt. Check the file C:\Program Files\Agilent\B1500\EasyEXPERT\Daemon\StaDaemon.exe.config.
300003	Specify a correct folder for the EasyEXPERT database. Specified folder not found.

300004	Moving of EasyEXPERT database failed. Refer to the detail message, and retry after taking necessary measures.
300011	SDA daemon failed to start FLEX command service. path: *A*, arguments: *B*, reason: *C*
300012	FLEX command service was stopped by SDA daemon. After closing Agilent Connection Expert, launch Start EasyEXPERT or restart B1500A.
300021	SDA daemon failed to start SDA service. path: *A*, arguments: *B*, reason: *C*
300031	SDA daemon failed to start SDA shell. path: *A*, arguments: *B*, reason: *C*
300041	SDA daemon failed to start model name inspection process. Path: *A*, Arguments: *B*, Reason: *C*
300042	Model name inspection failed. Set VISA interface ID and GPIB address correctly, or connect the GPIB cable properly. Reason: *A*
300101	Error occurred during inspection for the specified EasyEXPERT database. Path: *A* See the log file C:\Documents and Settings\All Users\ Application Data\Agilent Technologies, inc\EasyEXPERT\StaDaemon.log if needed.
300102	The specified EasyEXPERT database is broken. Initialize the database or restore the normal database backup. Path: *A,* Reason: *B*
300103	EasyEXPERT database backup file (.xdb) is broken. Cannot restore this backup. Path: *A*
300104	Insufficient free space of HDD. Drive: *A* Present Free Space: *B* bytes Required Free Space: *C* bytes Retry the operation after increasing free space. Free space can be increased by deleting unnecessary files, compressing folders, and so on.
300105	EasyEXPERT database is not in the specified drive *A*. Specify a folder on the drive *B* where the EasyEXPERT database exists.
300106	The specified backup contains the EasyEXPERT database contents for another revision. Specify the other backup. Contents: *A*
300107	The specified backup does not contain the file or folder needed to restore the database. Specify the other backup. Contents: *A*
300108	The specified backup contains the database that is created by the EasyEXPERT revision *A*. It cannot be supported by the present revision. Specify the other backup.
300109	EasyEXPERT database backup extraction error. See the log file C:\Documents and Settings\All Users\Application Data\Agilent Technologies, inc\EasyEXPERT\StaDaemon.log if needed. Backup restoration is canceled, and the present EasyEXPERT database remains the same.
300110	Folder delete error. Delete the folder in the following path manually. Path: *A*
300111	EasyEXPERT database backup restoration error. Database could not be replaced with the backup. See the log file C:\Documents and Settings\All Users\Application Data\Agilent Technologies, inc\EasyEXPERT\StaDaemon.log if needed. Source: *A*, Destination: *B* If Source shows the EasyEXPERT database folder name, the database remains the same. If Destination shows the EasyEXPERT database folder name, the database is broken. Restore the previous database by renaming the temporary database folder named 1.tmp1A and such.

300112	Application Library update error. Information: *A*
300113	The specified backup is not complete. Evidence of deletion was detected. Specify the other backup.
300114	The specified folder is not empty. Specify an empty folder.
300115	Folder deletion was canceled. The folder is left to the following path. Path: *A*
300116	EasyEXPERT database backup extraction was canceled. The extracted files were deleted.
300117	Folder copy was canceled. The copied files were deleted.
400001	Failed to load inf.dat file. Path: *A*, Description: *B*
400002	Cannot access EasyEXPERT database. Path: *A*, Description: *B*
400003	The specified EasyEXPERT database contains the contents for another revision. Path: *A*, Description: *B*
400004	The specified EasyEXPERT database has the incorrect structure. Path: *A*, Description: *B*
400005	Failed to load dir file. Path: *A*, Description: *B*
400006	Cannot access EasyEXPERT database library 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*
500023	Unknown license information for this feature. The software revision may be too old. Feature: *A*
500031	License authentication error. Feature: *A*, Reason: *B*
500032	License authentication failed. Feature: *A*, Reason: *B*

Agilent FLEX Execution Error

When the Agilent B1500 causes errors in the Agilent 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 Agilent 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.
150	Command input buffer is full.
	Agilent 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.
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.
	Specified command cannot be stored in the program memory. For the incorrect commands, see Programming Guide.
170	Incorrect usage of internal variable.
	The internal variable must be %I*n* for integer data, or %R*n* for real data. where *n* is an integer, 0 to 99. Use %I*n* for the integer type command parameters; and use %R*n* for the real type command parameters. For the internal variables, see the VAR command of Programming Guide.

171	Internal variable is not allowed.
	The internal variables %I*n* and %R*n* 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 ±42 V (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 ±42 V 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 ±42 V 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 ±42 V 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.
220	Send WV or WI to set primary sweep source.
	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 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.
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 Programming Guide.
239	Pulse width must be 0.5 ms or more.
	Set the pulse width to 0.5 ms or more. See the PT command of 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.
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 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).
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 Agilent B1500 with this module removed.
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.

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 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 Programming Guide to set trigger port.

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 ±42 V 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.
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.
2000	SPGU module does not exist.
	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.
	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.

Agilent B1500A Self-test/Calibration Error

When the Agilent 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.
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 slave 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.
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.
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.
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_HPF_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.
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.