

Agilent 4349B 4-Channel High Resistance Meter

Service Manual

SERIAL NUMBERS

This manual applies directly to instruments with serial number prefix JP1KD.
For additional important information about serial numbers, read
“Instruments Covered by This Manual” in Chapter 1 of this manual.



Agilent Part No. 04349-90033
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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 protection provided by the equipment. In addition it violates safety standards of design, manufacture, and intended use of the instrument.

The Agilent Technologies assumes no liability for the customer's failure to comply with these requirements.

Note

4349B complies with INSTALLATION CATEGORY II and POLLUTION DEGREE 2 in IEC1010-1. 4349B is INDOOR USE product.



Ground The Instrument

To avoid electric shock hazard, the instrument chassis and cabinet must be connected to a safety earth ground by the supplied power cable with earth blade.

DO NOT Operate In An Explosive Atmosphere

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

Keep Away From Live Circuits

Operating personnel must not remove instrument covers. Component replacement and internal adjustments must be made by qualified maintenance personnel. Do not replace components with the 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 unauthorized modifications to the instrument. Return the instrument to a Agilent Technologies Sales and Service Office for service and repair to ensure that safety features are maintained.

Dangerous Procedure Warnings

Warnings , such as 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 this instrument.



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 United States National Institute of Standards and Technology, to the extent allowed by the Institution's calibration facility, or to the calibration facilities of other International Standards Organization members.

Warranty

This Agilent Technologies instrument product is warranted against defects in material and workmanship for a period of one year from the date of shipment, except that in the case of certain components listed in *General Information* of this manual, the warranty shall be for the specified period. During the warranty period, Agilent Technologies will, at its option, either repair or replace products that prove to be defective.

For warranty service or repair, this product must be returned to a service facility designated by Agilent Technologies. Buyer shall prepay shipping charges to Agilent Technologies and Agilent Technologies shall pay shipping charges to return the product to Buyer. However, Buyer shall pay all shipping charges, duties, and taxes for products returned to Agilent Technologies from another country.

Agilent Technologies warrants that its software and firmware designated by Agilent Technologies for use with an instrument will execute its programming instruction when properly installed on that instrument. Agilent Technologies does not warrant that the operation of the instrument, or software, or firmware will be uninterrupted or error free.

Limitation Of Warranty

The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance by Buyer, Buyer-supplied software or interfacing, unauthorized modification or misuse, operation outside the environmental specifications for the product, or improper site preparation or maintenance.

No other warranty is expressed or implied. Agilent Technologies specifically disclaims the implied warranties of merchantability and fitness for a particular purpose.

Exclusive Remedies

The remedies provided herein are buyer's sole and exclusive remedies. Agilent Technologies shall not be liable for any direct, indirect, special, incidental, or consequential damages, whether based on contract, tort, or any other legal theory.

Assistance

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

For any assistance, contact your nearest Agilent Technologies Sales and Service Office. Addresses are provided at the back of this manual.

Safety Symbols

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



Instruction manual symbol: the product is marked with this symbol when it is necessary for the user to refer to the instruction manual.



Alternating current.



Direct current.



On (Supply).



Off (Supply).



Frame or chassis terminal

Warning



This **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



This **Caution** 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 damage to or destruction of part or all of the product.

Note



Note denotes important information. It calls attention to a procedure, practice, condition or the like, which is essential to highlight.

Documentation Map

Operation Manual

Operation Manual (Agilent Part Number: 04349-90040 for English edition, 04349-97040 for Japanese edition) explains specifications, basic measurement explanations, and how to verify conformance to published specifications.

Service Manual

Service Manual (Agilent Part Number: 04349-90033) explains how to adjust, troubleshoot, and repair the 4349B.

How To Use This Manual

This is the Service Manual for the 4349B 4-Channel High Resistance Meter. This manual contains adjustments and repair information, and consists of the following four chapters.

Chapter 1 General Information

Chapter 1 gives general information for servicing the 4349B. This chapter lists the recommended equipment for adjustments and troubleshooting.

Chapter 2 Adjustments

Chapter 2 describes the adjustments, required to ensure that the 4349B is within its published specifications after it has been repaired, or it fails the performance tests.

Chapter 3 Assembly Replacement

Chapter 3 provides the information on replacing the 4349B assemblies. The information includes replaceable assembly lists, and removal and installation procedures.

Chapter 4 Troubleshooting

Chapter 4 provides the information on troubleshooting the 4349B. The information includes theory of operation and information on faulty assembly isolation.

Appendix A Manual Changes

Appendix A contains manual changes and provides information for using this manual with 4349Bs manufactured before the printing date of the manual.

Appendix B Default Jumper and Switch Settings

Appendix B describes the settings of the jumpers and switches on the 4349B A2 CPU Board Assembly. The information is required when the A2 assembly is replaced.

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General Information

Introduction

This chapter provides information on instruments covered by this manual and required equipment for adjustments and troubleshooting.

Instruments Covered by This Manual

Agilent Technologies uses a two-section, nine character serial number which is printed on the serial number label (Figure 1-1) attached to the instrument's rear panel. The first five characters are the serial prefix, and the last five digits are the suffix.



Figure 1-1. Serial Number Label

An instrument manufactured after the printing date of this manual may have a serial number prefix that is not listed on the title page. This unlisted serial number prefix indicates the instrument is different from those described in this manual. The manual for this new instrument may be accompanied by a yellow Manual Changes supplement or have a different manual part number. This sheet contains “change information” that explains how to adapt the manual to the newer instrument.

In addition to change information, the supplement may contain information for correcting errors (Errata) in the manual. To keep this manual as current and accurate as possible, Agilent Technologies recommends that you periodically request the latest Manual Changes supplement. The supplement for this manual is identified by this manual's printing date and its part number, both of which appear on the manual's title page. Complimentary copies of the supplement are available from Agilent Technologies. If the serial prefix or number of an instrument is lower than that on the title page of this manual, see *Appendix A, Manual Changes*. For information concerning, a serial number prefix that is not listed on the title page or in the Manual Change supplement, contact the nearest Agilent Technologies office.

Required Equipment

Table 1-1 lists the required equipment for adjusting and troubleshooting the 4349B. Table 1-2 lists the required language extensions to be used with the adjustment program. Table 1-3 lists the substitutions for the Multimeter and DC Voltage Source.

Table 1-1. Required Equipment

Equipment	Requirements	Recommended Model	Qty.	Use
Multimeter	DCV Accuracy: $< \pm 0.1 \%$	3458A	1	A ¹ , T ²
DC Voltage Source	Voltage Range: 1 to 10 Vdc	6634A	1	A
RC Box	No Substitute	16340A	1	A
Computer	No Substitute	HP 9000 series 200 or 300 ³	1	A
		RAM \geq 4 Mbytes		
Operating System	BASIC 5.1 or higher	HP 98616A	1	A
Adjustment Program	No substitute	Agilent PN 04349-65005	1	A
Cable	Dual Banana-BNC(m) Cable	Agilent PN 11001-60001	1	A
Adapter	Triaxial Tee (m)(f)(f) Adapter	Agilent PN 1250-1551	1	A

1 Adjustment

2 Troubleshooting

3 Excluding the HP 9826A

Table 1-2. Required Language Extensions

Name	Ver.	Name	Ver.	Name	Ver.	Name	Ver.
CLOCK	5.0	EDIT	5.1	GRAPHX	5.2	MAT	5.1
CRTA	5.1	ERR	5.1	GPIB	5.0	MS	5.1
CRTX	5.1	FGPIB	5.0	IO	5.1	PDEV	5.0
CSS0	5.0 ¹	GRAPH	5.2	KBD	5.1		

1 This language extension depends on the mass storage type used.

Table 1-3. Substitute Equipment

Equipment	Substitution
Multimeter	3455A 3456A 3478A
DC Voltage Source ¹	3245A DATRON 4000 DATRON 4000A DATRON 4700 DATRON 4707 DATRON 4708 FLUKE 5700A

1 Substituting the DC Voltage Source involves an adjustment procedure change, refer to "DC Voltage Source (DC Power Supply or DCV Calibrator)" in Chapter 2 for more details.

Adjustments

Introduction

This chapter describes the adjustments required to ensure the 4349B is within its published specifications after it has been repaired, or when it fails the performance tests. The adjustments should be performed along with periodic maintenance to keep the 4349B in optimum operating condition. If proper performance cannot be achieved after adjustments, proceed to Chapter 4.

Note

To ensure proper results and correct instrument operation, a 60 minute warm-up (stabilization) is required before performing the adjustments.

Safety Consideration

This chapter contains *NOTES*, *CAUTIONS*, and *WARNINGS* which must be followed to ensure operator safety and to maintain the instrument in a safe and serviceable condition. The adjustments covered in this chapter should be performed only by a qualified person who is aware of the hazards.

Warning

Any interruption of the protective ground conductor (inside or outside the instrument) or disconnection of the protective ground terminal can make the instrument dangerous. Intentional interruption of the protective ground system for any reason is prohibited.

Required Equipment

Table 1-1 lists the equipment required to perform the adjustments. Table 1-3 lists the substitute equipment. Use only calibrated equipment when adjusting the 4349B.

Adjustment Tools

No hand tools are required for the adjustments.

Adjustable Components

There are no adjustable components, such as variable capacitors or variable resistors, in the 4349B. All adjustments are performed by updating the adjustment data stored in the internal EEPROM.

Factory-Selected Components

No factory-selected components are used in the 4349B

EEPROM Write Protect Switch

There are no EEPROM write protect switches in the 4349B.

Related Adjustments

There are four adjustments for the standard 4349B, and two adjustments for the 4349B with Option 001. Table 2-1 lists the adjustments that must be performed if an assembly has been replaced.

Table 2-1. Related Adjustments

Assembly Replaced	Required Adjustment
A1 Main Board Assembly	All adjustments
A2 CPU Board Assy without ROM	None ¹
A5 AC Inlet Board Assembly	None
LCD Assembly	None
DC-DC Converter Unit	None
Keyboard Assembly	None

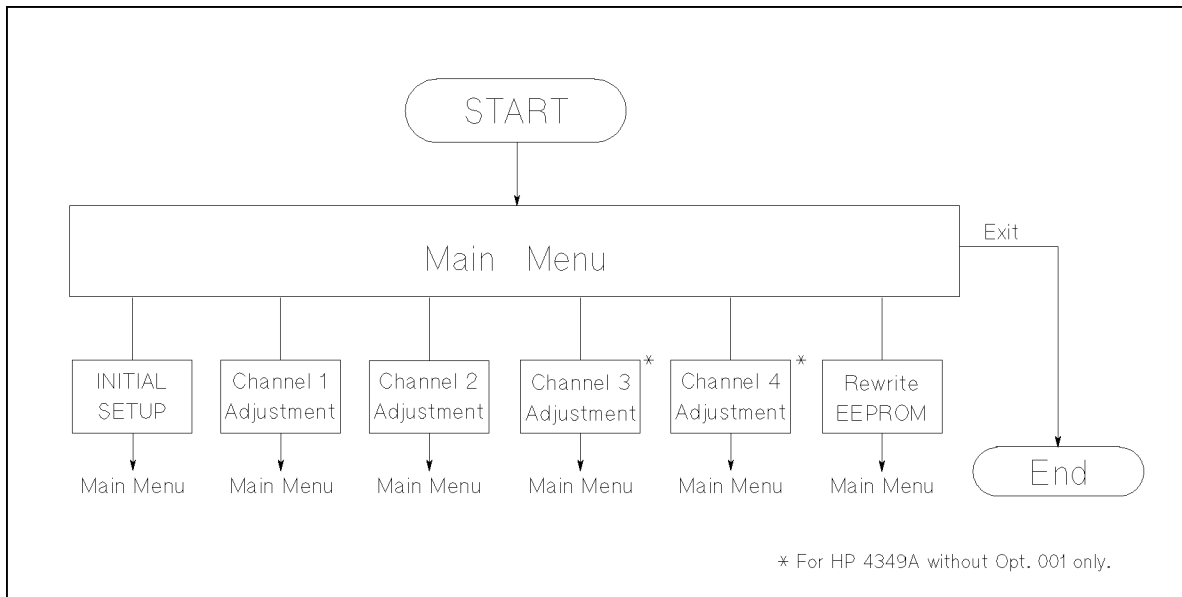
¹ If the EEPROM, A2U1, is replaced, all adjustments are required.

Adjustment Program

The adjustment program listed in Table 1-1 is required for the adjustments. Using the program, the computer controls the 4349B and the other pieces of equipment to obtain the adjustment data, and stores the data in the 4349B's internal EEPROM, A2U1.

The adjustment program runs on the computer listed in Table 1-1. The program should be installed into your computer according to the procedure described in "Program Installation". To start the program after it has been installed, refer to "Program Execution".

Figure 2-1 shows the adjustment program flow. The following lists the brief explanation for each menu item. At the end of each adjustment, the program writes the obtained adjustment data both to the 4349B internal EEPROM and to the unit-serial-number dependent file on the disk.



L6502001

Figure 2-1. Adjustment Program Flow

INITIAL SETUP	defines the standards' calibration values. Update the calibration values as necessary.
Channel 1 Adjustment	obtains all the channel 1 related data such as input resistance and scaling. This item should be performed if the performance test fails on this channel.
Channel 2 Adjustment	performs the same as the "Channel 1 Adjustment" for the channel 2.
Channel 3 Adjustment	performs the same as the "Channel 1 Adjustment" for the channel 3.
Channel 4 Adjustment	performs the same as the "Channel 1 Adjustment" for the channel 4.
Rewrite EEPROM	writes the adjustment data, which is stored in a unit-serial-number dependent file, to the EEPROM. Only the adjustment data of previously adjusted channel(s) will be written.

Note

Make sure that the correct line frequency (50 or 60Hz) has been selected in the “UUT: 4349B” window preceding the Main Menu. This selection will improve the adjustment data accuracy.

Program Installation

The adjustment program must be installed in the computer using the following procedures. The installation can be divided into two stages, “Making a Working Copy” and “Defining the Configuration”.

Making a Working Copy

Copy the contents of the adjustment program disk to a working disk or to the harddisk to prevent accidental deletion or destruction of the program files. Use the working disk or the harddisk and store the original disk in a safe place.

Defining the Configuration

Define the configuration of the adjustment equipment. The configuration includes the types and the GPIB addresses of the multimeter and dc voltage source to be used. Because the program depends on equipment configuration, it must be redefined if the equipment configuration has changed.

Note

DC Voltage Source selection involves the adjustment procedure change. Refer to “DC Voltage Source (DC Power Supply or DCV Calibrator)” for more details.

Refer to the following procedure to define the configuration.

1. Turn on the computer and bring up the BASIC system.
2. Set the Mass Storage Unit Specifier to the drive/directory where the adjustment program exists using the MSI command.
3. Load the “TE_A4349B” file from the adjustment program disk by pressing
LOAD "TE_A4349B" **(Return)** (or **(Enter)**).
4. Run the loaded program by pressing RUN.
5. As the program instructs, select the type of the Multimeter to be used and enter its GPIB address.
6. As the program instructs, select the type of the DC Voltage Source to be used and enter its GPIB address.

Note

Once the types and GPIB addresses of both the Multimeter and DC Voltage Source are set, they cannot be changed unless the configuration is redefined.

Program Execution

Perform the following steps to start the adjustment program.

Note Install the program prior to execution. Refer to “Program Installation”.



-
1. Turn on the computer and bring up the BASIC system. Refer to the Table 1-2 for the required language extensions.
 2. Set the Mass Storage Unit Specifier to the drive/directory where the adjustment program exists using the MSI command.
 3. Load the program, “ADJ4349B” by pressing LOAD “ADJ4349B” (or .
 4. Execute the loaded program by pressing RUN.

Note In the program, the 4349B is referred as “UUT”.



Note If the adjustments being performed follow right after EEPROM replacement, change switch A2SW1-1 to “CLOSE”, so that the 4349B will ignore the self test errors at power-on. (Return the switch to the “OPEN” position when the adjustments have been completed.) Refer to Figure B-1 for the switch location.

Adjustments Procedure References


This section provides supplemental information for the adjustments which are performed by the program. Connection instructions and some additional explanations are provided. Use this chapter as a reference when you perform the adjustments.

The adjustments of the 4349B without Option 001 consist of the following four adjustments.

- Channel 1 Adjustment
- Channel 2 Adjustment
- Channel 3 Adjustment
- Channel 4 Adjustment


The adjustments of the 4349B with Option 001 consist of the following two adjustments.

- Channel 1 Adjustment
- Channel 2 Adjustment


Note  To identify if the 4349B is equipped with Option 001, check the label on the instrument rear panel. If the Option 001 is installed, a label `OPTION 001` will be attached on the rear panel.

DC Voltage Source (DC Power Supply or DCV Calibrator)

The following adjustments are divided into two procedures, “Using DC Power Supply” or “Using DCV Calibrator”, according to the type of the dc voltage source selected in the “Defining the Configuration”. Follow only the appropriate procedure.

Note  The 4349B adjustment requires reference current to scale the internal current-voltage converter. To obtain the reference current, an external dc voltage source with the standard resistor, 16340A, connected in series is required. The adjustment program allows two types of dc voltage sources, a DC Power Supply and a DCV Calibrator.

The DC Power Supply requires a multimeter to monitor the power supply output voltage, because the voltage accuracy of the power supply is insufficient for the 4349B adjustments. On the other hand, the DCV Calibrator requires no multimeter, because its accuracy is sufficient.

Note  Because the adjustment program doesn't control the DC Power Supply via the GPIB and allows manual operation, a power supply without GPIB capability may be used if it satisfies the specification listed in Table 1-1.

Channel 1 Adjustment

This adjustment updates the channel 1 adjustment data stored in the EEPROM. This adjustment consists of two setups.

Channel 1 Adjustment Using DC Power Supply

Note

This section provides adjustment procedure using a DC Power Supply. If a DC Calibrator is used, refer to “Channel 1 Adjustment Using DCV Calibrator”.

Equipment

Multimeter	3458A
System DC Power Supply	6634A
RC Box	16340A
Dual Banana-BNC(m) Cable	PN 11001-60001
Triaxial Tee (m)(f)(f) Adapter	PN 1250-1551

Setup 1/2

This setup obtains the I-V Converter scaling factors.

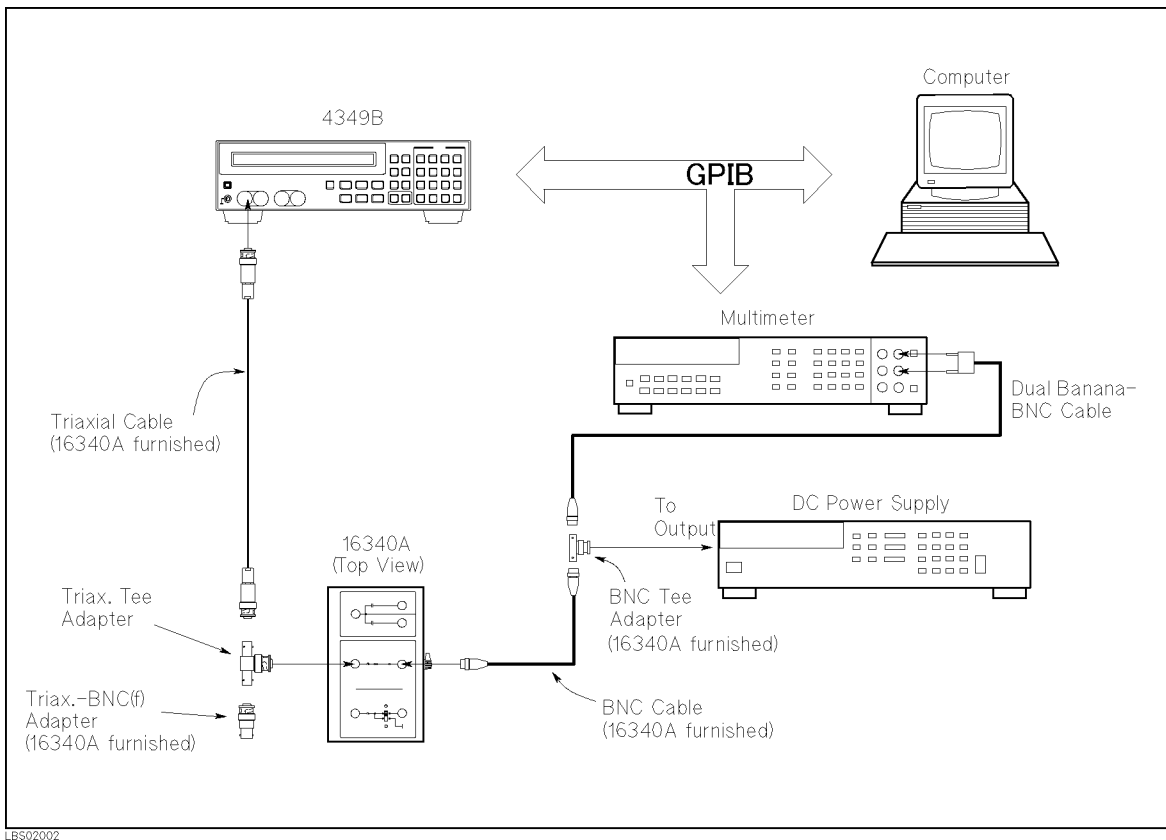


Figure 2-2. Channel 1 Adjustment, Setup 1/2 (using DC Power Supply)

Perform the following steps as the program instructs.

1. Connect the 16340A furnished Triaxial Cable to the 4349B "Ch 1" connector.
2. Connect the other end of the Triaxial Cable to the Triaxial Tee Adapter (f).
3. Connect the 16340A furnished Triaxial-BNC(f) Adapter to the Triaxial Tee Adapter (f).
4. Connect the Triaxial Tee Adapter (m) directly to the 16340A's " $10^{10} - 10^2$ " triaxial connector.
5. Connect the 16340A's " $10^{10} - 10^2$ " BNC connector to the 16340A furnished BNC Tee Adapter (f) using the 16340A furnished BNC cable.
6. Connect the BNC Tee Adapter (m) to the DC Power Supply voltage output using appropriate adapter and cable.
7. Connect the BNC Tee Adapter (f) to the Multimeter input using the Dual Banana-BNC Cable.

Setup 2/2

This setup obtains the I-V Converter input resistance data and the I-V Converter scaling factors.

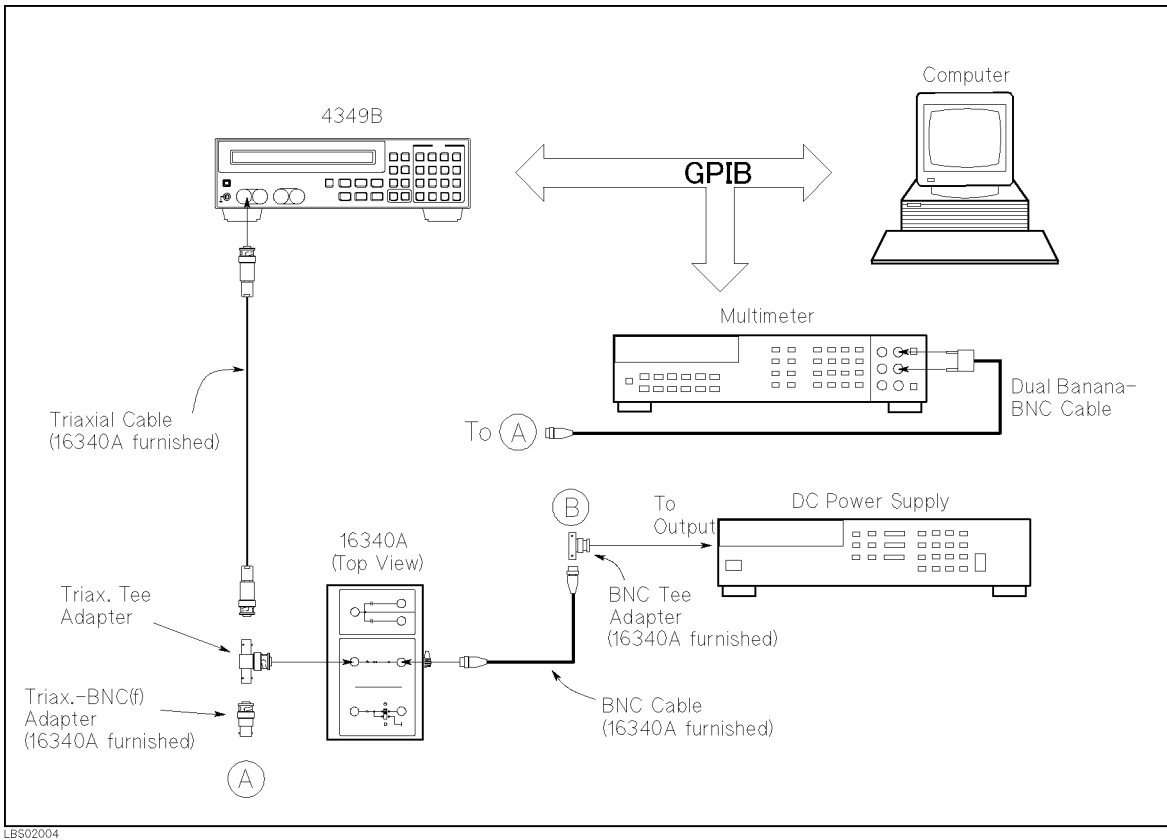


Figure 2-3. Channel 1 Adjustment, Setup 2/2 (using DC Power Supply)

Upon the program instructions, perform the following changes.

1. Disconnect the Dual Banana-BNC Cable from the BNC Tee Adapter (Ⓑ in the figure).
2. Connect the Dual Banana-BNC Cable to the Triaxial-BNC(f) Adapter (Ⓐ in the figure).

Channel 1 Adjustment Using DCV Calibrator

Note



This section provides adjustment procedure using a DCV Calibrator. If a DC Power Supply is used, refer to “Channel 1 Adjustment Using DC Power Supply”.

Equipment

DCV Calibrator	3245A
Multimeter	3458A
RC Box	16340A
Dual Banana-BNC(m) Cable	PN 11001-60001
Triaxial Tee (m)(f)(f) Adapter	PN 1250-1551

Setup 1/2

This setup obtains the I-V Converter scaling factors.

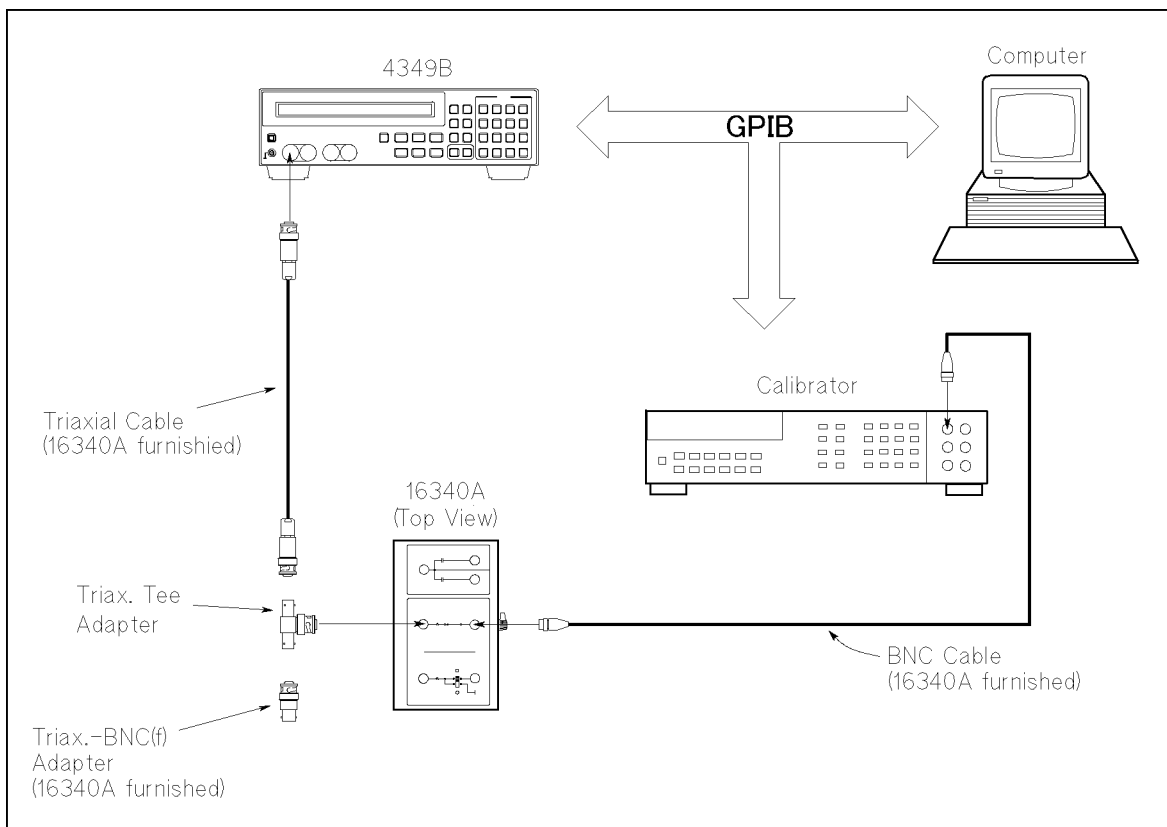


Figure 2-4. Channel 1 Adjustment, Setup 1/2 (using DCV Calibrator)

Perform the following steps as the program instructs.

1. Connect the 16340A furnished Triaxial Cable to the 4349B “Ch 1” connector.
2. Connect the other end of the Triaxial Cable to the Triaxial Tee Adapter (f).

2.10 Adjustments

3. Connect the 16340A furnished Triaxial-BNC(f) Adapter with to the Triaxial Tee Adapter (f).
4. Connect the Triaxial Tee Adapter (m) directly to the 16340A's "10¹⁰ - 10²" triaxial connector.
5. Connect the 16340A's "10¹⁰ - 10²" BNC connector to the calibrator dc voltage output using the 16340A furnished BNC cable and appropriate adapter.

Setup 2/2

This setup obtains the I-V Converter input resistance data and the I-V Converter scaling factors.

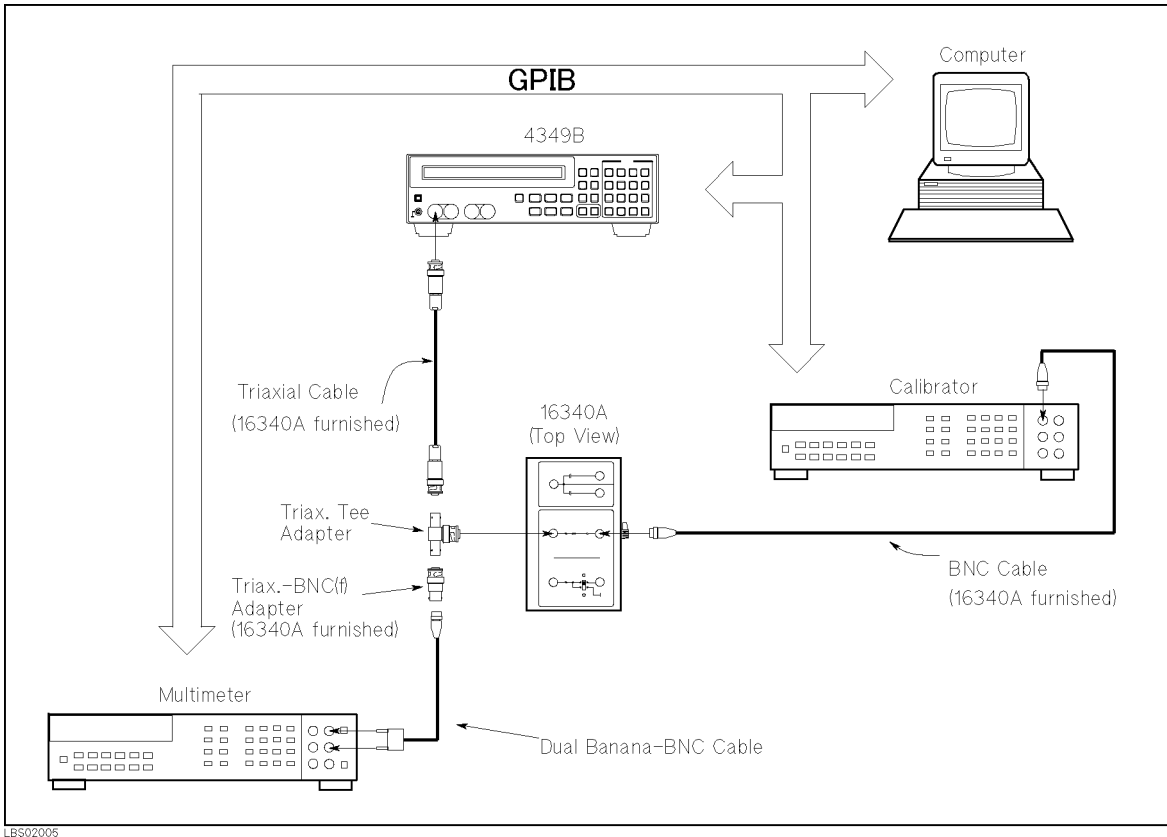


Figure 2-5. Channel 1 Adjustment, Setup 2/2 (using DCV Calibrator)

Upon the program instruction, perform the following change.

1. Connect the Multimeter input and the Triaxial-BNC(f) Adapter using the Dual Banana-BNC Cable.

Channel 2, 3, and 4 Adjustments

Perform the same setup for corresponding channel as used for Channel 1.

Note Channel 3 and 4 adjustments are for 4349Bs without Option 001 only.



Assembly Replacement

Introduction

This chapter provides the 4349B replaceable parts lists, and the step by step disassembly procedures for the major assemblies. Table 3-1 to Table 3-7 describe all the 4349B replaceable parts. The figure section of Table 3-7 also shows the cable connections.

Ordering Information

To order a part listed in the replaceable parts lists, quote the Agilent Technologies part number, indicate the quantity required, and address the order to the nearest Agilent Technologies office.

To order a part that is not listed in the replaceable parts list, include the instrument model number, complete instrument serial number, the description and function of the part, and the quantity of parts required. Address the order to the nearest Agilent Technologies office.

Restored Exchange Assemblies

Some replacement assemblies are available as either new or restored assemblies. The restored assembly is more economical than a new assembly and, as with new assemblies, a 90-day warranty applies through the instrument's support life. The defective assembly must be returned for credit. For this reason, new assemblies must be ordered for spare parts. The part numbers for both new and restored assemblies are given in the replaceable parts lists.

Note



The Exchange Program may not apply in your country. Contact the nearest Agilent Technologies office for further details.

Replacing the A2 CPU Board Assembly

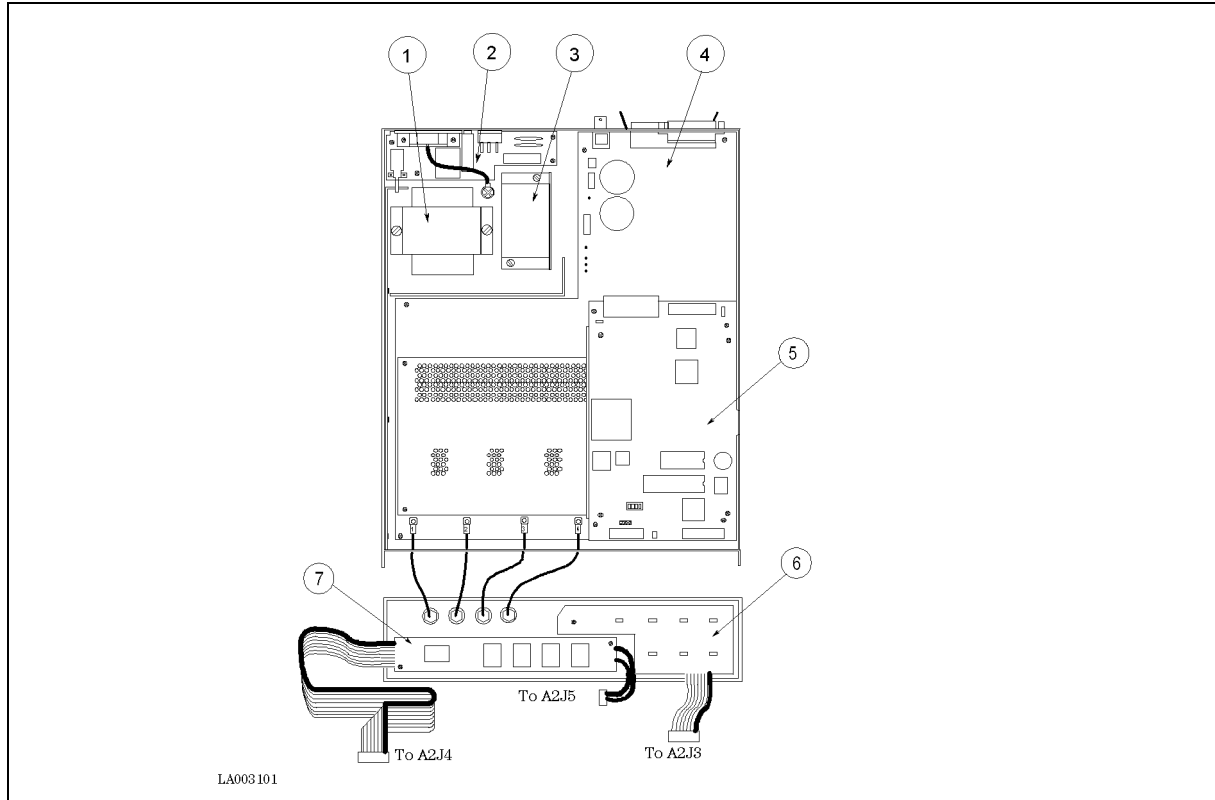
The A2 CPU Board Assembly has a ROM for the firmware and an EEPROM for the adjustment data and user data. Both ROM and EEPROM are mounted in sockets for easy replacement. If the A2 assembly is replaced, the ROM and EEPROM may be transferred from the defective assembly to the new assembly as long as the ROM and EEPROM are not defective. The ROM transfer reduces parts cost for the repair, and the EEPROM transfer saves time from readjusting the 4349B. For this purpose, the A2 assembly can only be ordered without the ROM.

When the A2 assembly is replaced, make sure that the jumpers and switches on the A2 assembly are in the default position as shown in Appendix B.

Replaceable Assembly List

The replaceable electrical assemblies are listed in Table 3-1 and Table 3-3.

Table 3-1. Replaceable Major Assembly List



Reference Designation	Agilent Part Number	Qty.	Description
1	04349-60001	1	Transformer
2	04339-66505	1	A5 AC Inlet Board Assembly
3	04263-80901	1	DC-DC Converter Unit
4	04349-66511	1	A1 Main Board Assembly (Std)
	04349-69511		A1 Main Board Assembly (Std, Exchange Assembly)
	04349-66521		Main Board Assembly (Opt. 001)
	04349-69521		Main Board Assembly (Opt. 001, Exchange Assembly)
5	04263-66532	1	A2 CPU Board Assembly w/o ROM
	04263-00604	1	Case Shield ¹
	0515-1550	4	Screw M3
6	04349-66504	1	A4 Keyboard Assembly
	04349-25101	1	Rubber Key
	0515-1550	2	Screw M3
7	04263-61010	1	LCD
	04263-25003	1	Filter Transparent
	0515-1550	2	Screw M3

¹ Included in 04263-66532

Table 3-2. A2 CPU Board Assembly, Replaceable Assembly List

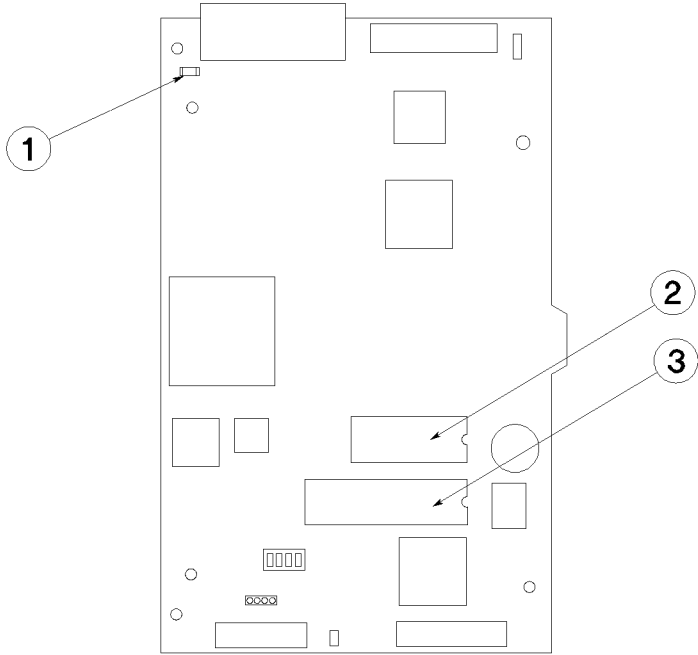
			
Reference Designation	Agilent Part Number	Qty.	Description
1	2110-1123	1	A2F1, Fuse SMT 2 A
2	1818-5146	1	A2U1, EEPROM
3	04349-85031	1	A2U11, ROM Rev. 1.00

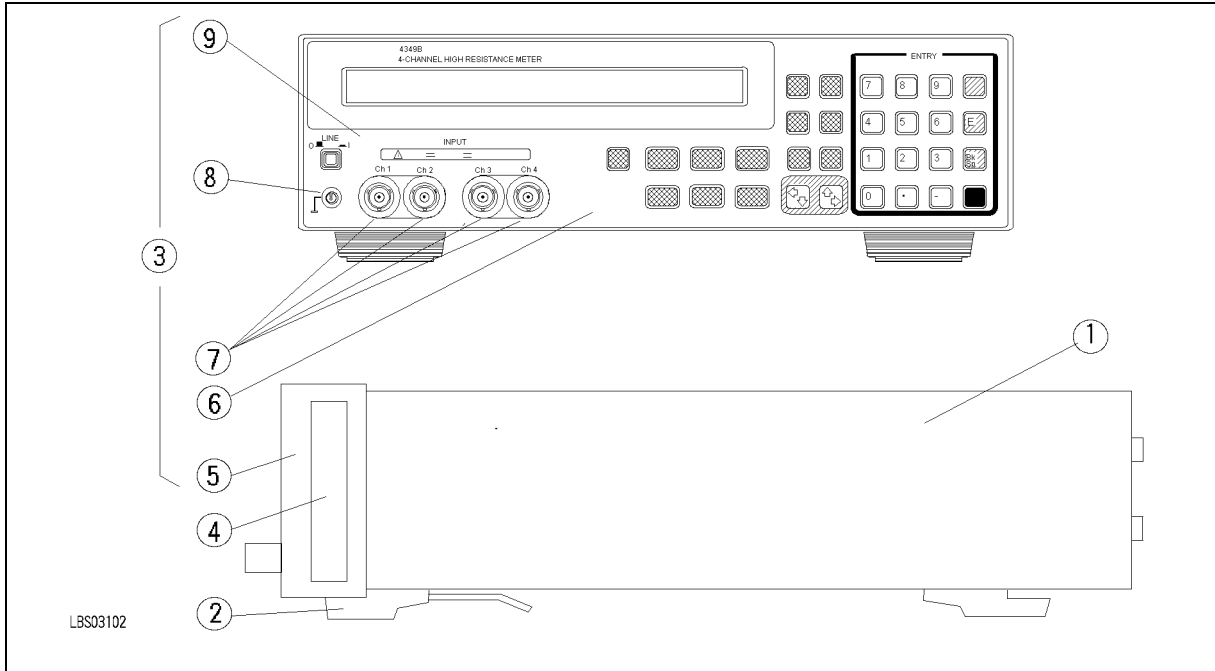
Table 3-3. Replaceable Assembly List

Reference Designation	Agilent Part Number	Qty.	Description
A1C500	0180-4334	1	Capacitor, 22000 μ F (for power supply)
A1C501	0180-4334	1	Capacitor, 22000 μ F (for power supply)
A5SW1	3101-3173	1	Line Switch
A5SW2	3101-3156	1	Voltage Selection Switch
A5VR1	0837-0237	1	Varistor
A5VR2	0837-0237	1	Varistor

Replaceable Mechanical Parts List

The replaceable mechanical parts are listed in Table 3-4 to Table 3-7.

Table 3-4. Replaceable Mechanical Parts List 1



Reference Designation	Agilent Part Number	Qty.	Description
1	04339-04004	1	Cover
	0363-0125	30 mm x 2	Gasket
2	5041-9167	4	Foot
	1460-1345	2	Tilt Stand
3	04349-65020	1	Front Panel Assembly (Std) ¹
	04349-65021	1	Front Panel Assembly (Opt. 001) ¹
4	5041-9170	2	Trim Side
	0515-0914	4	Screw M3 (Hidden)
	04263-40001	1	Front Bezel ²
6	04349-00606	1	Sub Panel (Hidden) ²
	0515-0914	4	Screw M3 (Hidden) ²
	0515-1550	2	Screw M3 (Hidden) ²
7	1250-1906	4	Triaxial Connector ^{2 3 4}
	04349-01202	2	Angle (Hidden) ^{2 5}
	6960-0041	2	Plug Hole ⁶
8	1510-0130	1	Binding Post ²
	2190-0067	1	Washer (Hidden) ²
	2950-0006	1	Nut (Hidden) ²
9	04349-87121	1	Panel Label ²

1 The assembly consists of the parts designated by 5 through 9 and cables connected to the triaxial connectors.

2 This part is included in the Front Panel Assembly, 3.

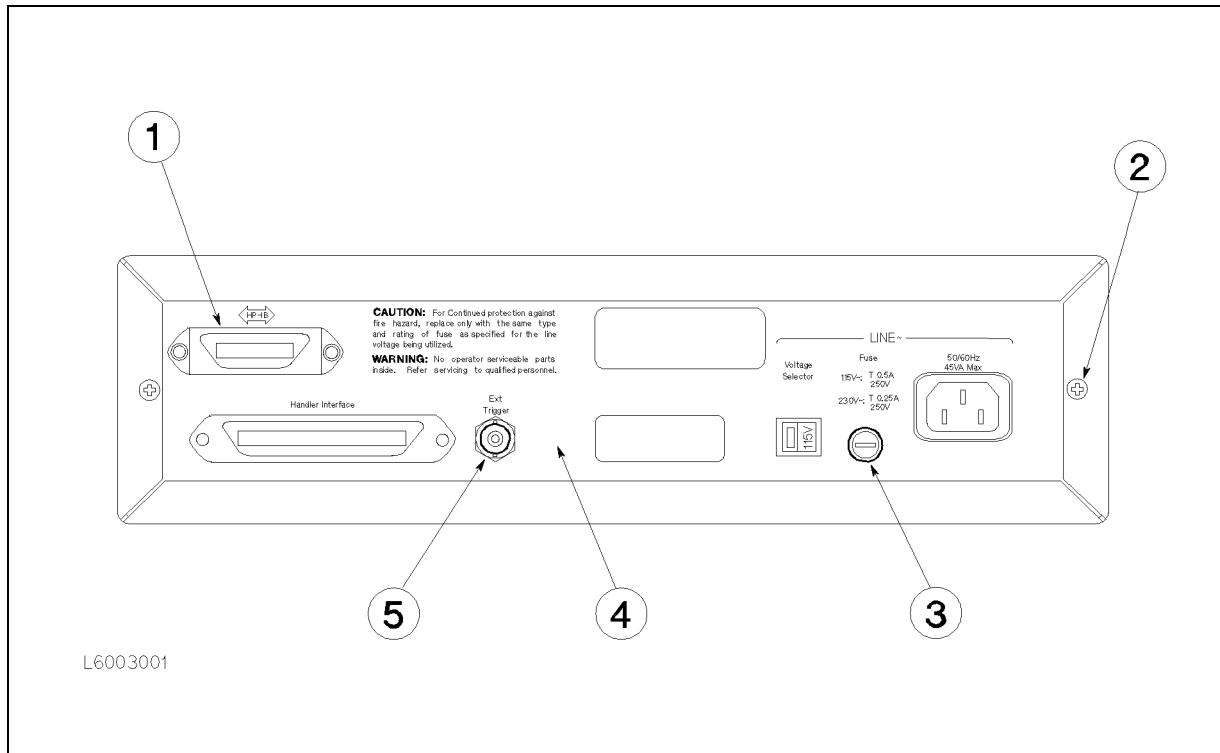
3 Includes washer and nut

4 Qty. is 2 for Opt. 001

5 Qty. is 1 for Opt. 001

6 Opt. 001 only

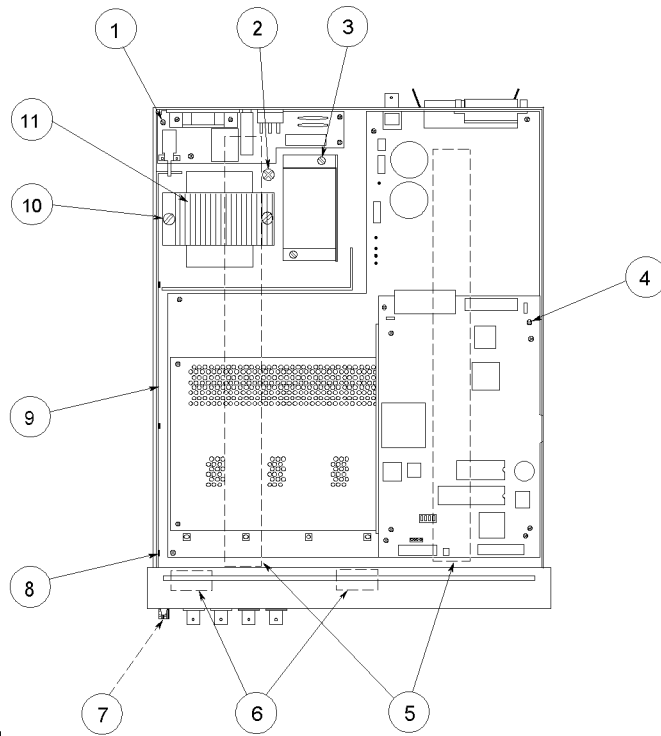
Table 3-5. Replaceable Mechanical Parts List 2



Reference Designation	Agilent Part Number	Qty.	Description
1	04339-61697	1	GPIB Connector with flatcable ¹
2	0515-1551	2	Screw M3
3	2110-0565	1	Fuse Holder
	2110-0202	1	Fuse 0.25 A, Slow Blow (230V)
	2110-0201		Fuse 0.5 A, Slow Blow (115V)
4	04349-00102	1	Chassis
5	2190-0054	1	Washer
	2950-0054	1	Nut

¹ Includes two sets of screw, washer, and nut.

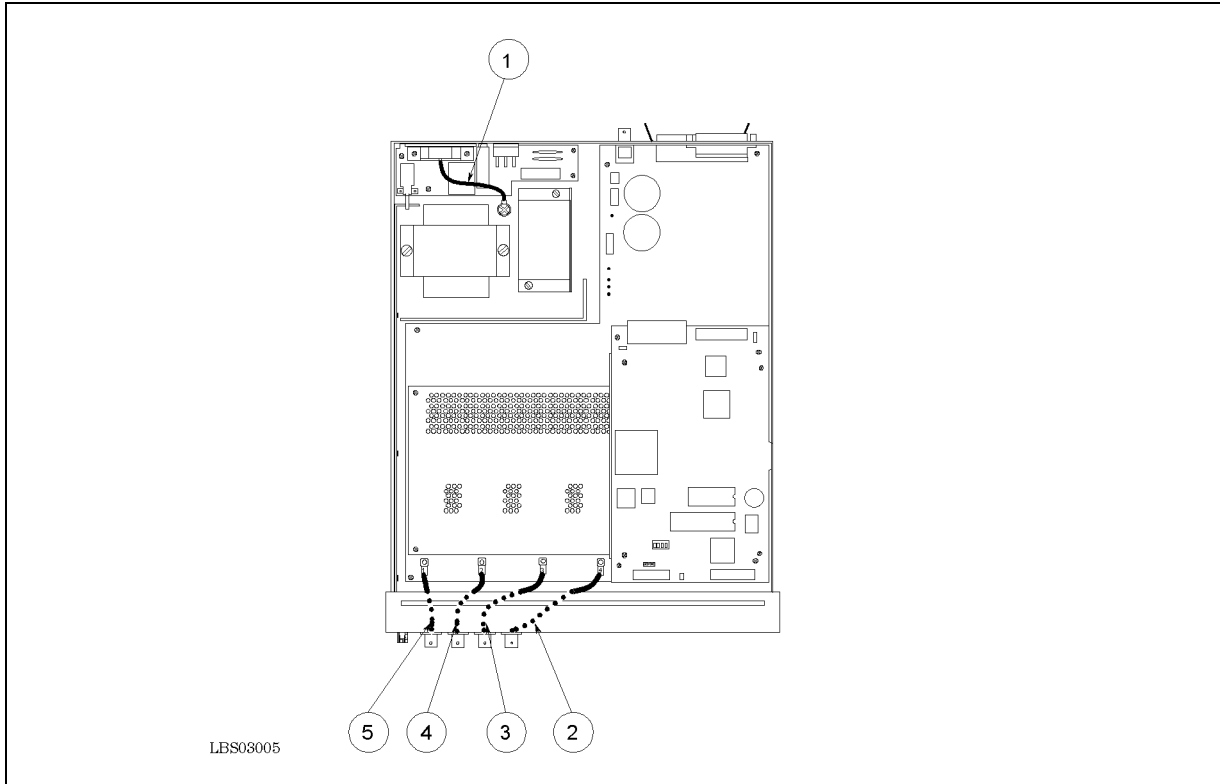
Table 3-6. Replaceable Mechanical Parts List 3



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Reference Designation	Agilent Part Number	Qty.	Description
1	0515-1550	4	Screw M3 (for A5)
2	0515-2079	1	Screw M4 (on the Chassis)
3	04263-24002	2	Nut Rod (for DC-DC Conv.)
	2190-0584	2	Washer Spring M3
4	0515-1550	10	Screw M3 (for A1 and A2)
	04339-24006	4	Standoff (Hidden, for A1)
5	5040-3347	2	Plate (Hidden, Chassis Reverse side)
	0460-0616	200 mm × 2	Adhesive Tape (for Plate)
6	04263-07001	2	Gasket
	0515-1550	4	Screw M3
7	0370-2862	1	Button, Line Switch
	04339-23001	1	Shaft, Line Switch
	0535-0031	1	Nut (for Shaft)
8	04339-25002	3	Support, Line Switch Plate
	0515-1076	3	Screw M3L4 Flat Head
9	04339-01202	1	Plate, Line Switch
10	04263-24001	2	Nut Rod (for Transformer)
	2190-0586	2	Washer Spring M4
	3050-0893	1	Washer, Flat M4
11	04263-00607	1	Plate Shield

Table 3-7. Replaceable Mechanical Parts List 4



Reference Designation	Agilent Part Number	Qty.	Description
1	04339-61614	1	Wire Assy (Binding Post)
2	04349-61605	1	Cable Assembly, "4" ¹
	04349-24003	1	Sleeve ¹
	0890-0312	25 mm	Tube, Heat Shrink ¹
3	04349-61606	1	Cable Assembly, "3" ¹
	04349-24003	1	Sleeve ¹
	0890-0312	25 mm	Tube, Heat Shrink ¹
4	04349-61607	1	Cable Assembly, "2"
	04349-24003	1	Sleeve
	0890-0312	25 mm	Tube, Heat Shrink
5	04349-61608	1	Cable Assembly, "1"
	04349-24003	1	Sleeve
	0890-0312	25 mm	Tube, Heat Shrink

1 Std Only

Disassembly Procedures

This section provides the procedures to disassemble the 4349B major assemblies. Tools and fasteners required for the replacement are described.

Caution SUSCEPTIBLE TO DAMAGE FROM ESD.



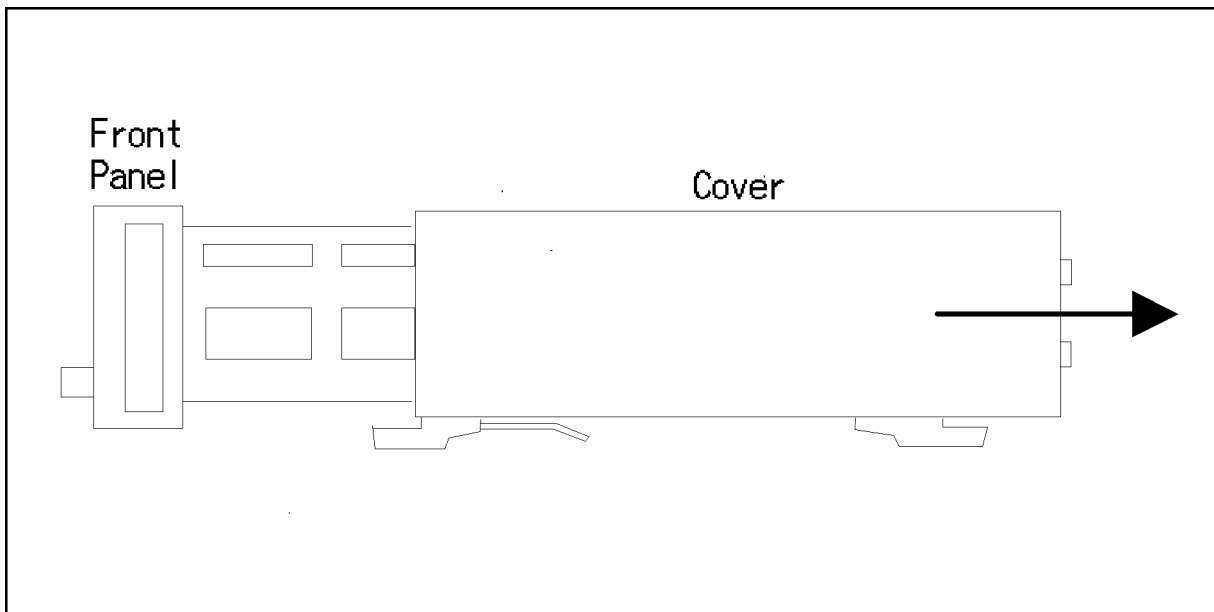
Perform the following procedures only at a static-safety workstation and wear a grounding strap.

Tools and Fasteners

The 4349B mechanical components are secured using metric threaded fasteners. Many fasteners in the 4349B may appear to be Phillips type, but they are in fact, Pozidrive type. To avoid damaging them, use only pozidrive screwdrivers to remove or tighten pozidrive type fasteners.

Cover Removal

The following procedure is common for gaining access to any of the assemblies.



LCS03103

Figure 3-1. Cover Removal

1. Remove the two screws which fasten the cover to the chassis rear panel.
2. Slide the cover toward rear while hold the front panel bezel as shown in Figure 3-1.

A1 Main Board Removal

Removal Procedure

1. Remove the A2 CPU Board Assembly referring to “A2 CPU Board Assembly Removal”.
2. Disconnect the following cable assemblies from the A1 board.
 - a. Four (or two for Option 001) cables connected to the Unknown connectors
 - b. The cable assembly from the transformer
 - c. Two cable assemblies from the DC-DC Converter
3. Remove the nut which fasten the Ext Trigger connector on the rear panel.
4. Remove the four studs, that secure the A1 board to the chassis, by rotating them with a flat bladed screwdriver.
5. Remove six screws that secure the A1 to the chassis.
6. Remove the A1 assembly from the chassis.

A2 CPU Board Assembly Removal

Removal Procedure

1. Remove the cover referring to “Cover Removal”.
2. Disconnect the four flatcable assemblies and the wire assembly from the A2 board.
3. Remove the four screws that secure the A2 board to the stud.
4. Remove the A2 board from the chassis.

Note

The ROM and EEPROM on the A2 assembly may be transferred to the new assembly to minimize the repair time and parts cost. Refer to “Replacing the A2 CPU Board Assembly” for more information.

A5 AC Inlet Board Assembly Removal

Removal Procedure

1. Disconnect the cable assembly with the 4 pin connector from the A5 board.
2. Remove the screw which fixes the green and yellow wire connected to the neutral terminal of the power cable connector to the bottom of the chassis.
3. Remove four screws that secure the A5 board to the chassis.
4. Remove the A5 board from the chassis.

Keyboard Assembly Removal

Removal Procedure

1. Remove the cover referring to “Cover Removal”.
2. Disconnect the two flatcable assemblies and the wire assembly from the front side of the A2 board.
3. Remove the two flat head screws that secure the front panel from the bottom.

4. Remove the side trim label from both sides of the front bezel.
5. Remove four screws that secure the front panel bezel to the chassis from both sides.
6. Place the front panel assembly, so that the front panel faces down.
7. Remove the screw that secures the keyboard to the front panel bezel.
8. Remove the keyboard assembly from the front panel bezel.

LCD Assembly Removal

Removal Procedure

1. Remove the cover referring to “Cover Removal”.
2. Disconnect the two flatcable assemblies and the wire assembly from the front side of the A2 board.
3. Remove the two flat head screws that secure the front panel from the bottom.
4. Remove the side trim label from both sides of the front bezel.
5. Remove the four screws that secure the front panel bezel to the chassis from both sides.
6. Place the front panel assembly, so that the front panel faces down.
7. Remove the two screws that secure the LCD to the front panel bezel.
8. Remove the LCD assembly from the front panel bezel.

Triaxial Connector Removal

Caution



When accessing the triaxial connector, use lint free gloves to avoid contaminating the connector. Agilent Technologies supplies lint free gloves (Agilent PN 9300-0163).

Removal Procedure

1. Remove the cover referring to “Cover Removal”.
2. Disconnect the two flatcable assemblies and the wire assembly from the front side of the A2 board.
3. Remove the two flat head screws that secure the front panel from the bottom.
4. Remove the side trim label from both sides of the front bezel.
5. Remove four screws that secure the front panel bezel to the chassis from both sides.
6. Place the front panel assembly, so that the panel faces down.
7. Disconnect the cable assembly which is connected to the triaxial connector being replaced from the A1 main board assembly.
8. Remove the heat shrink tube from the triaxial connector.
9. Unsolder the sleeve from the triaxial connector.
10. Unsolder the coaxial cable from the triaxial connector.
11. Unscrew the nut which fastens the triaxial connector to the sub panel.
12. Remove the triaxial connector.

Note



When soldering the cable assembly to the triaxial connector, refer to Figure 3-2 and carefully solder the cable to the connector so that the center conductor and the outer shield are not shorted.

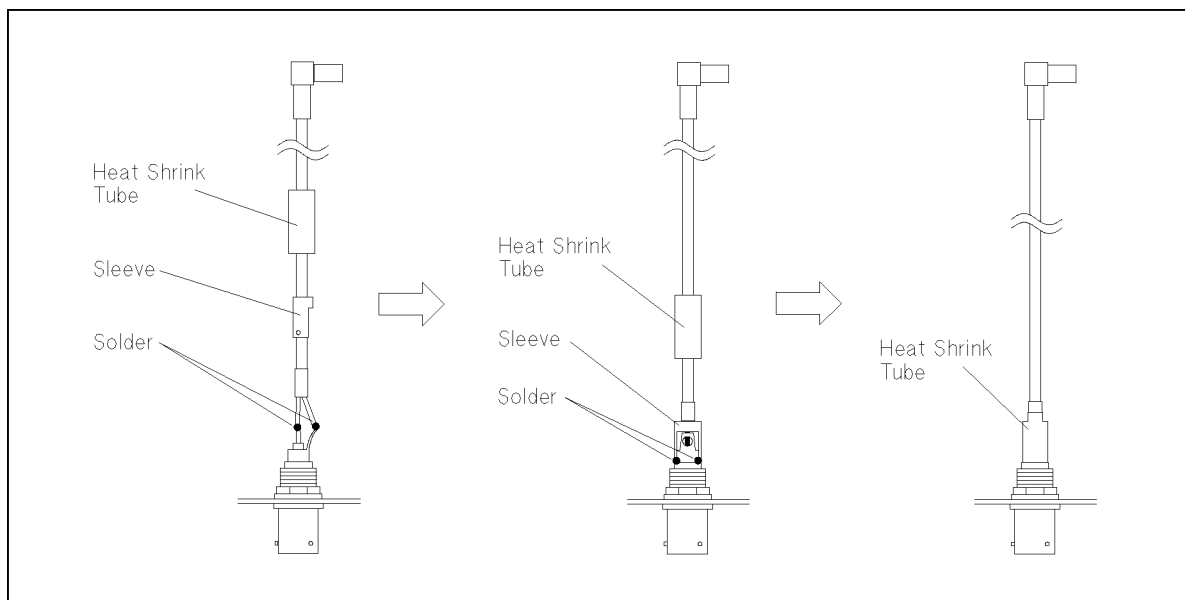


Figure 3-2. Cable Assembly Connection for Triaxial Connector

Troubleshooting

Introduction

This chapter provides assembly level troubleshooting information for the 4349B. The information includes theory of operation, and troubleshooting.

Safety Considerations

This chapter contains *WARNINGS* and *CAUTIONS* that must be followed for your protection and to avoid damaging the equipment.

Warning



The servicing procedures described herein are performed when power is supplied to the instrument and its protective covers are removed. This type of servicing must be performed only by service trained personnel who are aware of the hazards involved (for example, fire, and electrical shock). When servicing can be performed without power applied to the instrument, remove power from the instrument. Before any repair is completed, ensure that all safety features are intact and functioning, and that all necessary parts are properly connected to the protective grounding system.

Required Equipment

Table 1-1 lists the equipment required for troubleshooting.

After Service Product Safety Checks

Warning



Whenever it appears likely that protective safety provisions have been impaired, the apparatus shall be marked as inoperative and should be secured against any unintended operation. The protection provisions will have likely been compromised if, for example:

- The instrument shows visible signs of damage.
- The instrument fails to perform the intended measurement.
- The unit has undergone prolonged storage under unfavorable conditions.
- The instrument was severely stressed in transport.

Perform the following five safety checks to verify the safety condition of the 4349B (these checks may also be used for safety checks after troubleshooting and repair).

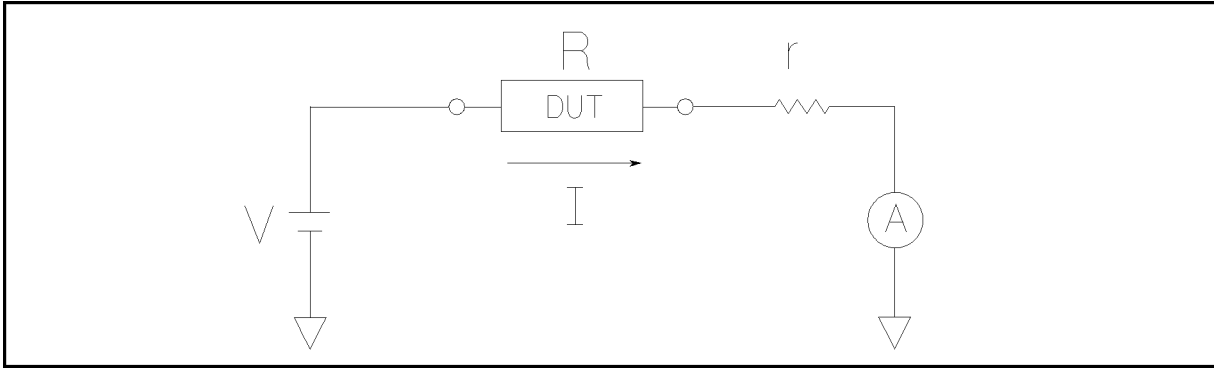
1. Visually inspect the interior of the instrument for any signs of abnormal internally generated heat, such as discolored printed circuit boards and components, damaged insulation, or evidence of arcing. Determine the cause, and repair.
2. Use an ohmmeter which can accurately measure 0.1Ω to check the resistance from the instrument enclosure to the power cord's ground pin. The resistance must be less than 0.1Ω . Flex the power cord while making this measurement to determine if any intermittent discontinuities exist.
3. Unplug the 4349B's power plug from the power source. Set the line switch to ON. Tie the line and neutral pins of the power connector together and check the resistance between them and enclosure. The minimum acceptable resistance is $5 M\Omega$. Find and replace any component which causes the instrument to fail this test.
4. Verify that the correct fuse is installed.
5. Make sure that the grounding wire (green/yellow) is secured to the chassis by a screw and washer.

Theory of Operation

This section describes the overall operation of the 4349B and the operation of each assembly.

Overall Measurement Theory

The 4349B measures the resistance of a Device Under Test (DUT) in the following manner.



LES04001

Figure 4-1. Ohm's Law

In Figure 4-1, a DUT is connected in series with test voltage source V, and ammeter A. If the ammeter measures I amperes when the source voltage is V, the DUT's resistance R is expressed by (when ignoring r):

$$R = \frac{V}{I}$$

This equation means that if the DUT resistance R is extremely high, the current flowing the circuit is extremely low. For example, if $R = 1 \text{ G}\Omega$, and $V = 1 \text{ V}$, the current flowing is 1 nA (10^{-9} A). The 4-Channel High Resistance Meter 4349B is essentially four (or two) sets of very sensitive current meters.

Note



In practice, ammeter input resistance r, which is approximately 1 k Ω , decreases the current flowing through the DUT. The actual current, I, flowing through the DUT, R, is expressed by:

$$I = \frac{V}{R + r}$$

In the current measurement mode, the 4349B displays the actual current I for the measurement result. For example, if $R = 100 \text{ k}\Omega$, and $V = 1 \text{ V}$, the measurement result will be 9.9 μA ($\frac{1}{100k+1k}$) rather than 10 μA ($\frac{1}{100k}$).

In the resistance measurement mode, on the other hand, the 4349B displays the "derived" DUT resistance which coincides with the DUT resistance. In other words, the 4349B shows the resistance calculated by:

$$R = \frac{V}{I} - r$$

For example, if $R = 100 \text{ k}\Omega$, and $V = 1 \text{ V}$, the measurement result will be 100 k Ω , even the actual current flowing through the DUT, thus through the ammeter with r is 9.9 μA .

Overall Block Diagram

Figure 4-2 shows the overall block diagram of the 4349B.

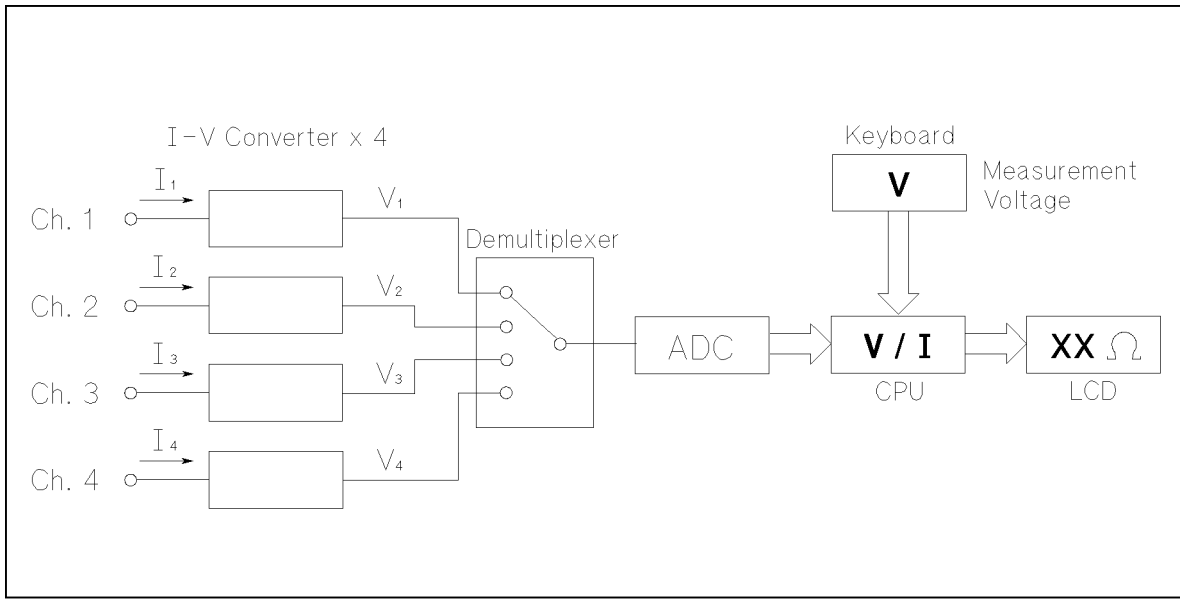


Figure 4-2. 4349B Overall Block Diagram

The 4349B has four channel inputs, or two channel inputs for Option 001. Each I-V converter, which is directly connected to an input connector, converts the current to a voltage ramp of which slope is proportional to the input current. A demultiplexer selects the channel to be measured and passes the voltage ramp to the analog-to-digital converter (ADC). The CPU calculates the current from the voltage ramp slope, then calculates the DUT resistance by dividing the measurement voltage by the current.

Note

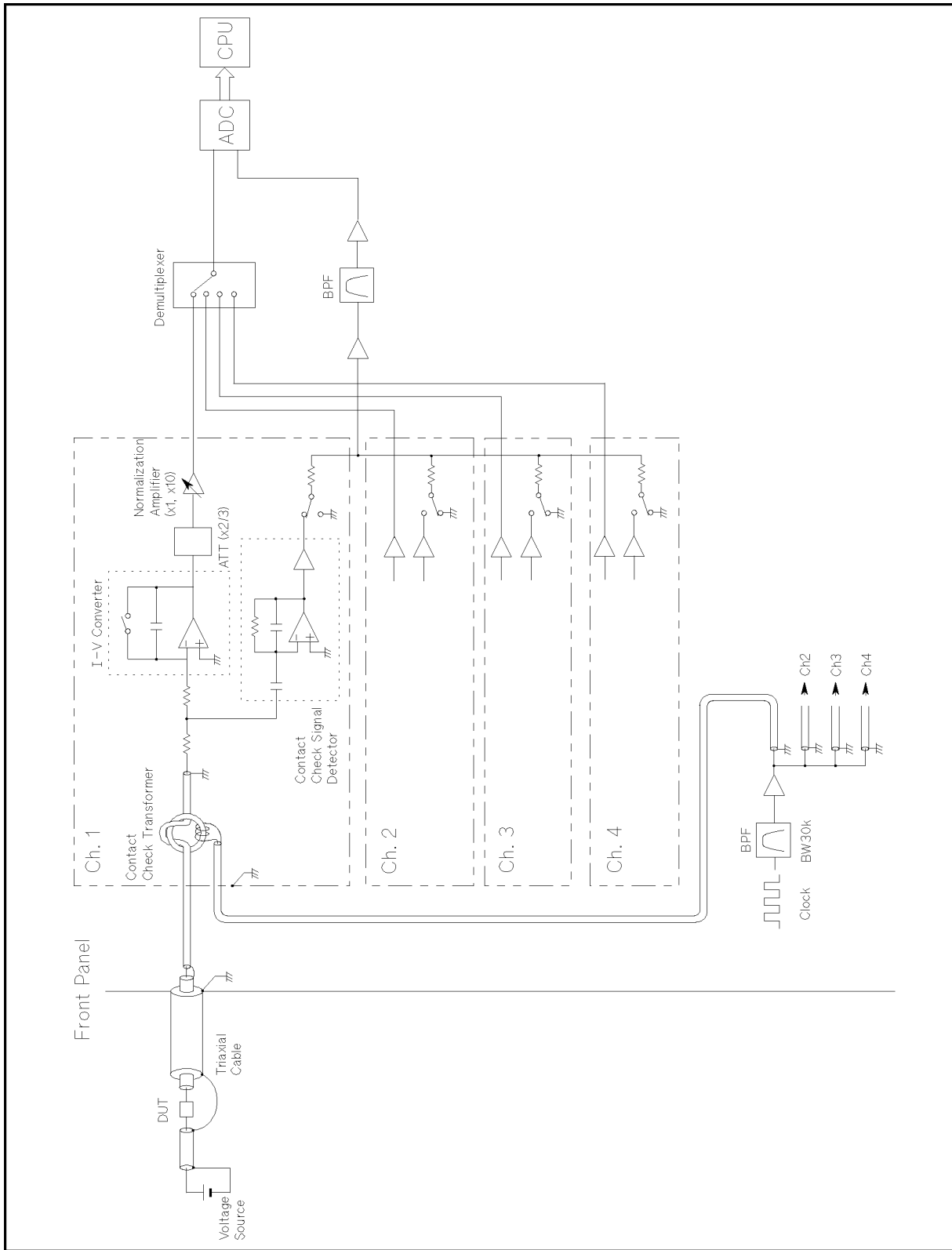


The measurement voltage is data which must be input from the keyboard or by GPIB commands. The 4349B itself has neither voltage output capability nor voltage measurement capability.

Analog Section

Figure 4-3 shows the Analog Section block diagram.

An external dc voltage source applies measurement voltage to the DUT with the I-V Converter connected in series. The DUT is connected to the 4349B measurement channels by a triaxial cable which is a three layered coaxial cable. This triaxial cable prevents noise and improves the contact check function accuracy. The current flows into the I-V Converter via the contact check transformer. As discussed in “I-V Converter”, the I-V Converter converts current flowing into to voltage ramp. The attenuator and normalization amplifier enhances the number of measurement ranges and of measurement speed selections using fewer range capacitors. The demultiplexer selects the measurement channel by selecting one of four (or two for Option 001) I-V converter output voltage ramps. The voltage ramp slope, which is proportional to the I-V Converter input current, is determined by difference between two voltage measurement results in a certain time interval.



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Figure 4-3. Analog Section Block Diagram

I-V Converter

Figure 4-4 shows the I-V converter block diagram.

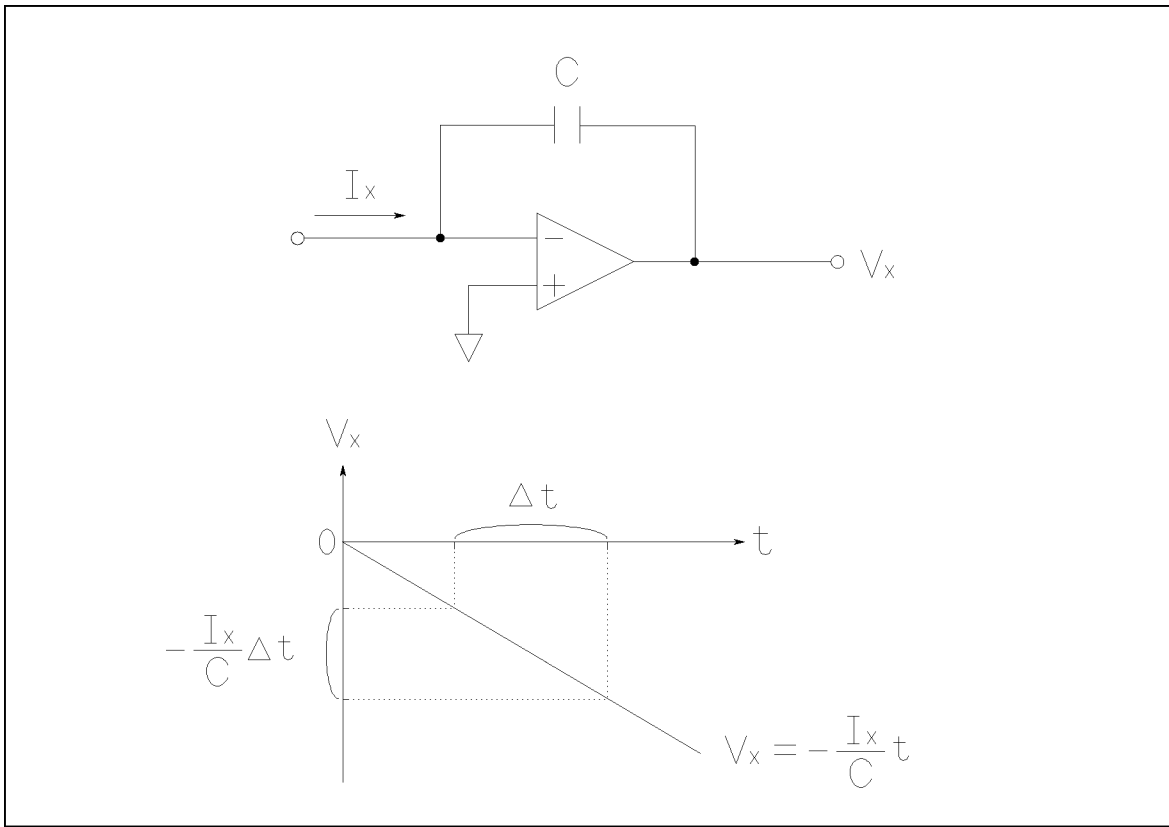


Figure 4-4. I-V Converter Block Diagram

The I-V Converter is essentially an integrator composed of an operational amplifier and a capacitor. When current I_x flows into the integrator, the current charges the capacitor. As a result, the integrator outputs a negative going ramp of which slope is $-\frac{I_x}{C}$. The current I_x can be obtained by $-C \frac{\Delta v}{\Delta t}$, where Δt is a certain time interval, and Δv is the output voltage drop for this interval.

Capacitor C, which is called the range capacitor, determines the applicable measurement range in practical integrator.

Digital Section

Figure 4-5 shows the Digital Section block diagram.

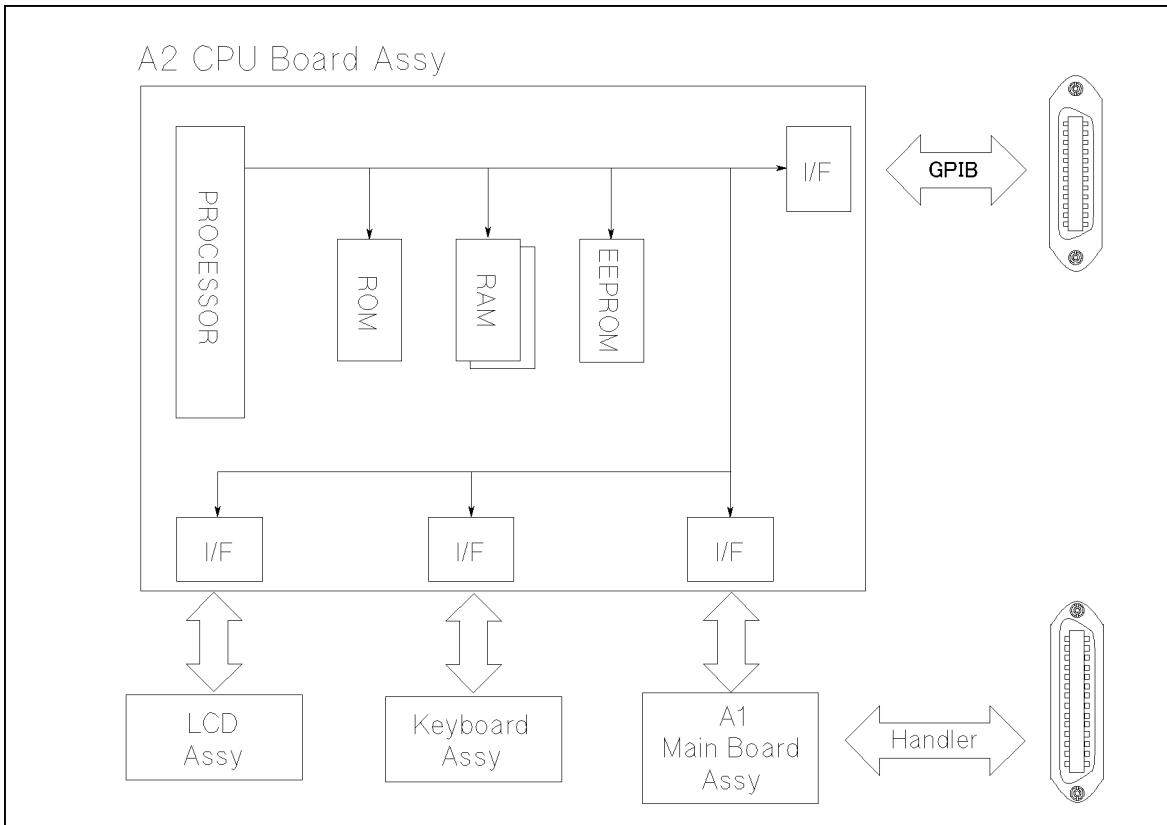


Figure 4-5. Digital Section Block Diagram

The digital section consists of the A2 CPU Board Assembly and other peripheral assemblies such as the keyboard and LCD. The section communicates with the A1 Main Board Assembly in order to control the latches, switches, and other components on the A1 assembly and receive the measurement data. The GPIB interface on the A2 Assembly allows the 4349B communicate with a controller. A handler interface on the A1 Assembly allows the 4349B communicate with an external handler.

The A2 CPU Board Assembly includes a processor, ROM, EEPROM, jumpers, switches, and LEDs.

ROM (A2U11) stores the firmware which controls all the 4349B's operation and functions. The ROM is mounted in a socket for easy replacement.

EEPROM (A2U1) stores the unit unique data, such as the adjustment data and the operator unique data, such as the operator saved measurement setup condition. The EEPROM will not lose its data when power is turned off. The EEPROM is mounted in a socket for easy replacement.

Jumpers and switches set the 4349B's conditions. Refer to Appendix B for more information.

Power Supply Section

Figure 4-6 shows the Power Supply Section block diagram.

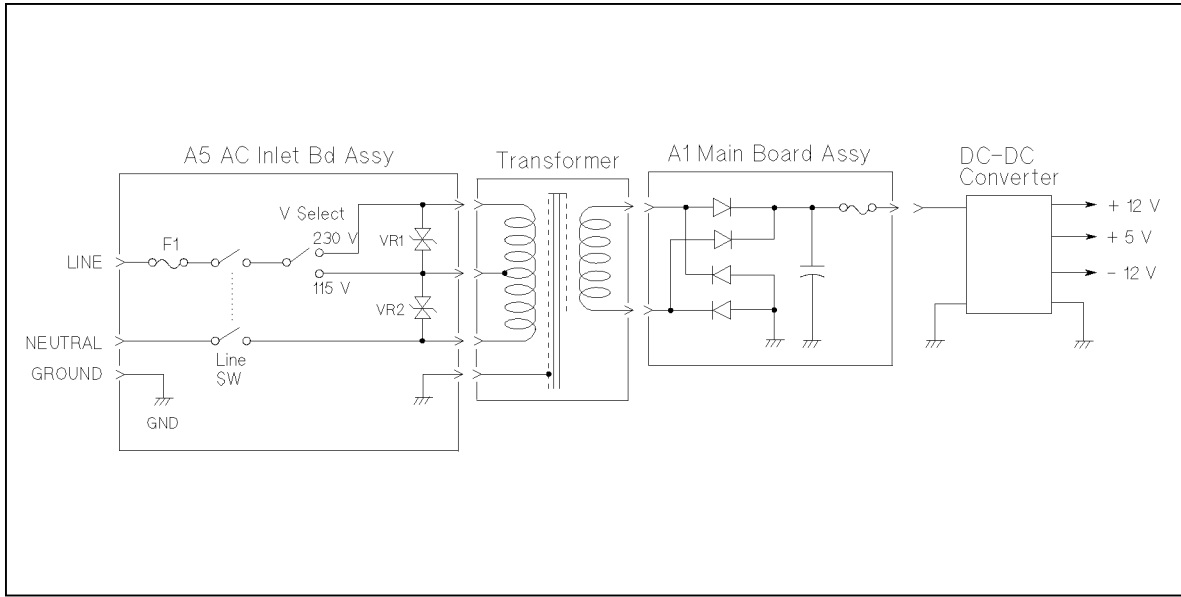


Figure 4-6. Power Supply Section Block Diagram

The ac line power is connected to the A5 AC Inlet Board Assembly, which consists of a fuse, line switch, and varistors. The voltage selection switch selects the ac line voltage from 230V or 115V. According to the selection, the ac line power is connected to the corresponding primary tap of the transformer. Varistor VR1 protects the circuit from surge voltage on the line power. VR2 blows fuse F1 if the 4349B is turned on with the wrong line voltage setting selection, for example, 115V selection when using a 230V line.

The transformer secondary voltage is approximately 14 V. This ac voltage is rectified and filtered by circuitry on the A1 Main Board Assembly, and produces approximately 14 Vdc. The dc voltage is applied to the DC-DC Converter to produce regulated +5V, +12V, and -12 Vdc. The dc voltages are supplied to all the assemblies, either directly or indirectly via the A1 assembly.

Troubleshooting

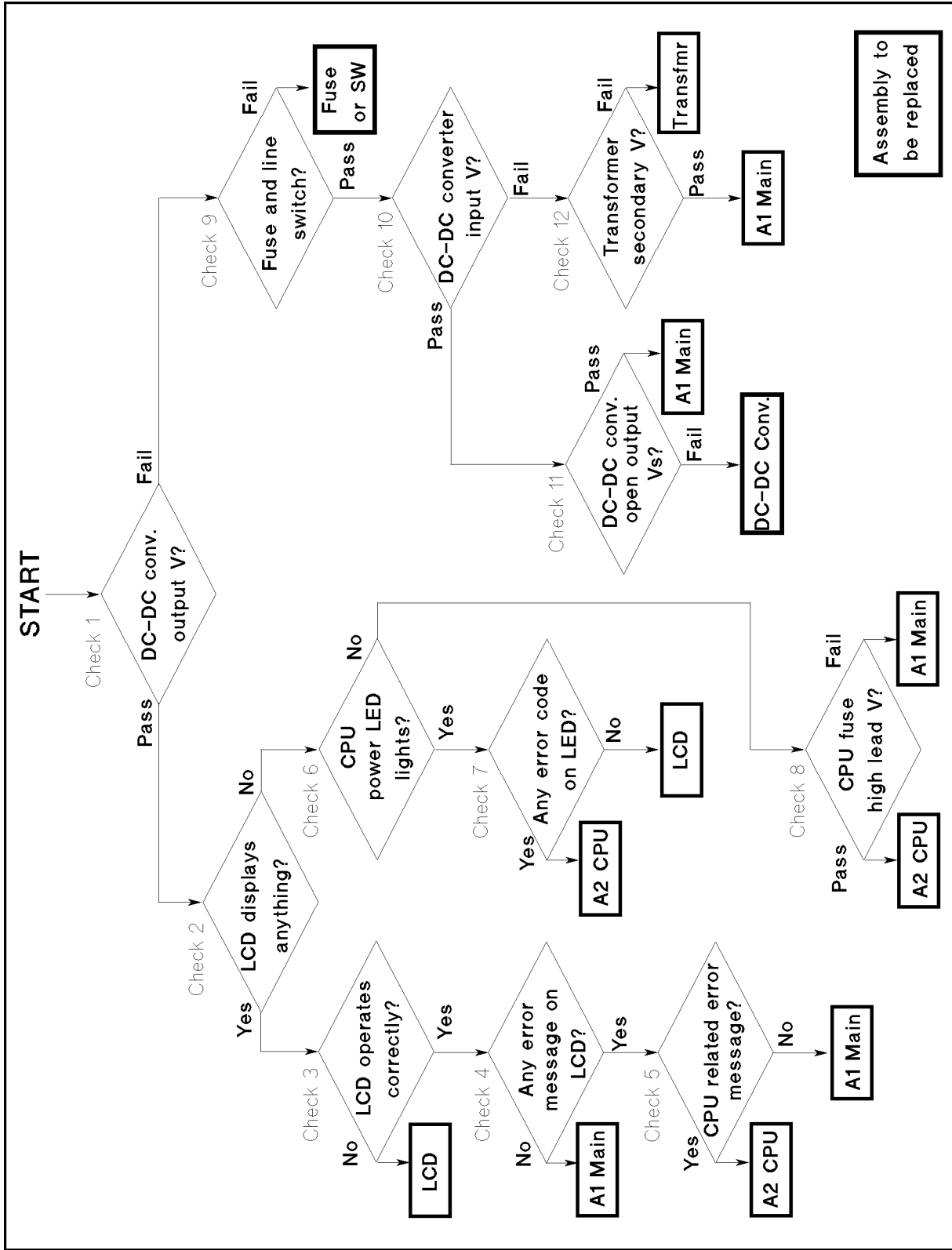
Figure 4-7 shows the overall troubleshooting flowchart to find the defective assembly. Follow the flowchart when troubleshooting. Refer to the “Check Procedure References” for detailed procedure to check each item.

Refer to Chapter 3 for assembly replacement.

Note



Because of each assembly's high SMD (surface mount device) ratio, the repair should be done by assembly replacement. The troubleshooting procedure, therefore, only isolates the defective assembly.



LBS04007

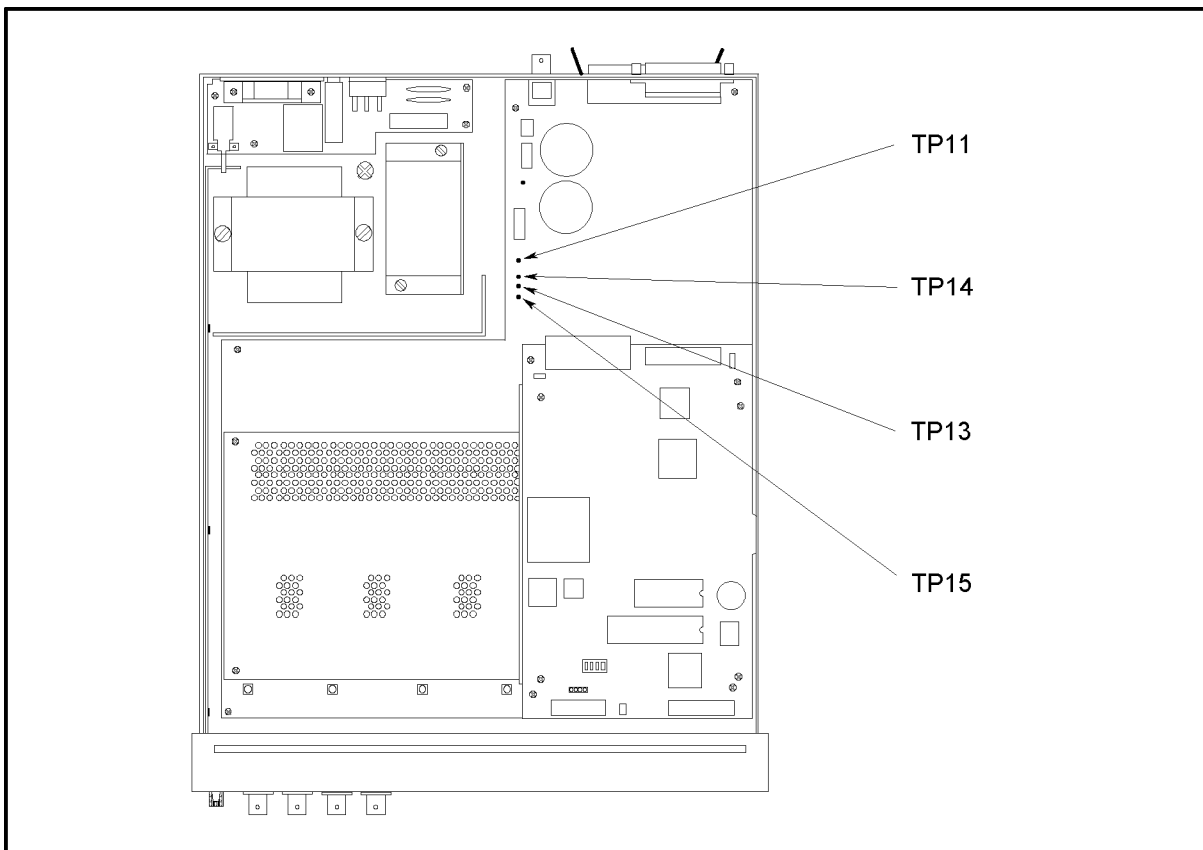
Figure 4-7. Troubleshooting Flow

Check Procedure References

Refer to the corresponding check procedure. Each check procedure is numbered the same as in Figure 4-7 for quick reference.

Check 1, DC-DC Converter Output Voltage

1. Remove the cover referring to “Cover Removal” in Chapter 3.
2. Turn on the 4349B.
3. Using a multimeter, check to see if the voltages between the test pins (TPs), shown in Table 4-1, on A1 Main Board Assembly are in the ranges shown in Table 4-1.
4. If passed, proceed to “Check 2, LCD Displays Anything?”, otherwise proceed to “Check 9, Fuse and Line Switch”.



LBS04008

Figure 4-8. DC-DC Converter Output Voltage Check

Table 4-1. DC-DC Converter Output Voltages (Connected)

Test Pin (+)	Test Pin (-)	Range
11	15	5.1±0.2 V
13	15	12±0.6 V
14	15	-12±0.6 V

Check 2, LCD Displays Anything?

1. Turn off the 4349B.
2. Turn on the 4349B while watching the LCD.
3. Check for a beep sound for a moment and if you see anything is displayed on the LCD.
4. If beep sounds and LCD displays something, proceed to “Check 3, LCD Operates Correctly?”, otherwise proceed to “Check 6, CPU Power LED Lights?”.

Check 3, LCD Operates Correctly?

1. Turn on the 4349B.
2. Reset the 4349B.
3. Check if the LCD’s back light is lit.
4. Press some front panel keys such as Meas Prmtr and check if the characters are correctly displayed in the whole area of the LCD.
5. If the LCD operates correctly, proceed to “Check 4, Any Error Message on LCD?”, otherwise replace the LCD Assembly.

Check 4, Any Error Message on LCD?

1. Turn off the 4349B.
2. Turn on the 4349B while watching the LCD.
3. Check if the LCD displays any error message.
4. If an error has NOT occurred, replace the A1 Main Board Assembly, otherwise proceed to “Check 5, CPU Related Error Message?”.

Check 5, CPU Related Error Message?

1. If the error message is one of the following, replace the A2 CPU Board Assembly, otherwise replace the A1 Main Board Assembly.
 - a. ROM TEST FAILED
 - b. RAM TEST FAILED
 - c. EEPROM R/W FAILED

Note



When replacing the A2 CPU Board Assembly, refer to “Replacing the A2 CPU Board Assembly” in Chapter 3 for handling the ROM and EEPROM on the A2 Assembly.

Check 6, CPU Power LED Lights?

1. Turn on the 4349B.
2. Check if the LED, “+5V” of DS1 on the A2 CPU Board Assembly lights. Refer to Figure 4-9 for DS1 location.
3. If the LED lights, proceed to “Check 7, Any Error Code on LED?”, otherwise proceed to “Check 8, CPU Fuse High Lead Voltage?”.

Check 7, Any Error Code on LED?

1. Turn off the 4349B.
2. Turn on the 4349B while watching LEDs on the A2 CPU Board Assembly.
3. Check if the LEDs light in the sequence shown in Figure 4-9.
4. If LEDs light as the sequence, replace the LCD Assembly, otherwise (possibly, "HALT" doesn't turn off or "BERR" lights) replace the A2 CPU Board Assembly.

Note



When replacing the A2 CPU Board Assembly, refer to "Replacing the A2 CPU Board Assembly" in Chapter 3 for handling the ROM and EEPROM on the A2 Assembly.

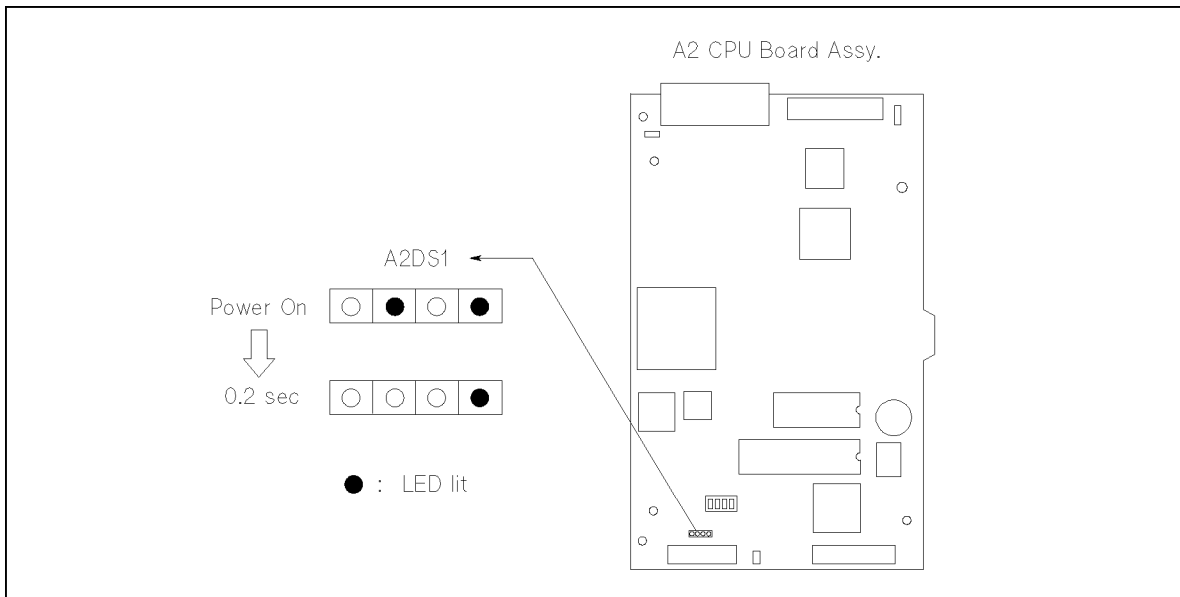


Figure 4-9. CPU Board Assembly LED Light Sequence

Check 8, CPU Fuse High Lead Voltage

1. Turn on the 4349B.
2. Using a multimeter, check if the dc voltage at the high lead of the fuse F1 on the CPU Board shown in Figure 4-10 is $+5\pm 0.2$ V.
3. If the voltage is in the range, replace the A2 CPU Board Assembly, otherwise replace the A1 Main Board Assembly.

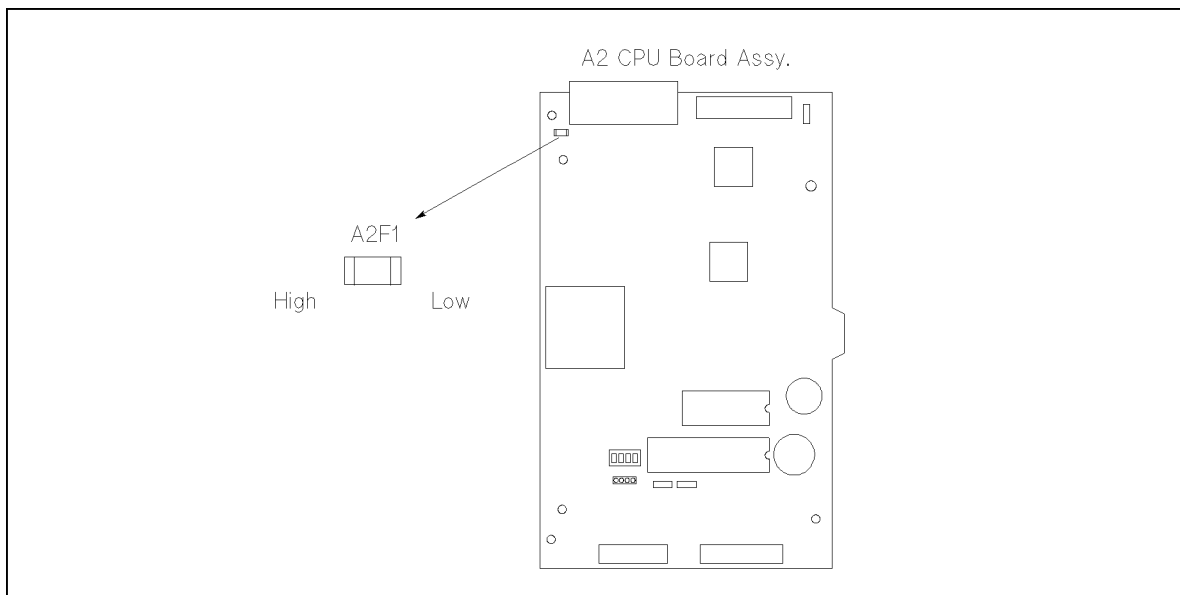
Note

If the multimeter reading is correct, fuse F1 on the A2 CPU Board Assembly is most suspicious. Replacing only the fuse may fix the problem.



Note

When replacing the A2 CPU Board Assembly, refer to “Replacing the A2 CPU Board Assembly” in Chapter 3 for handling the ROM and EEPROM on the A2 Assembly.



LCS04010

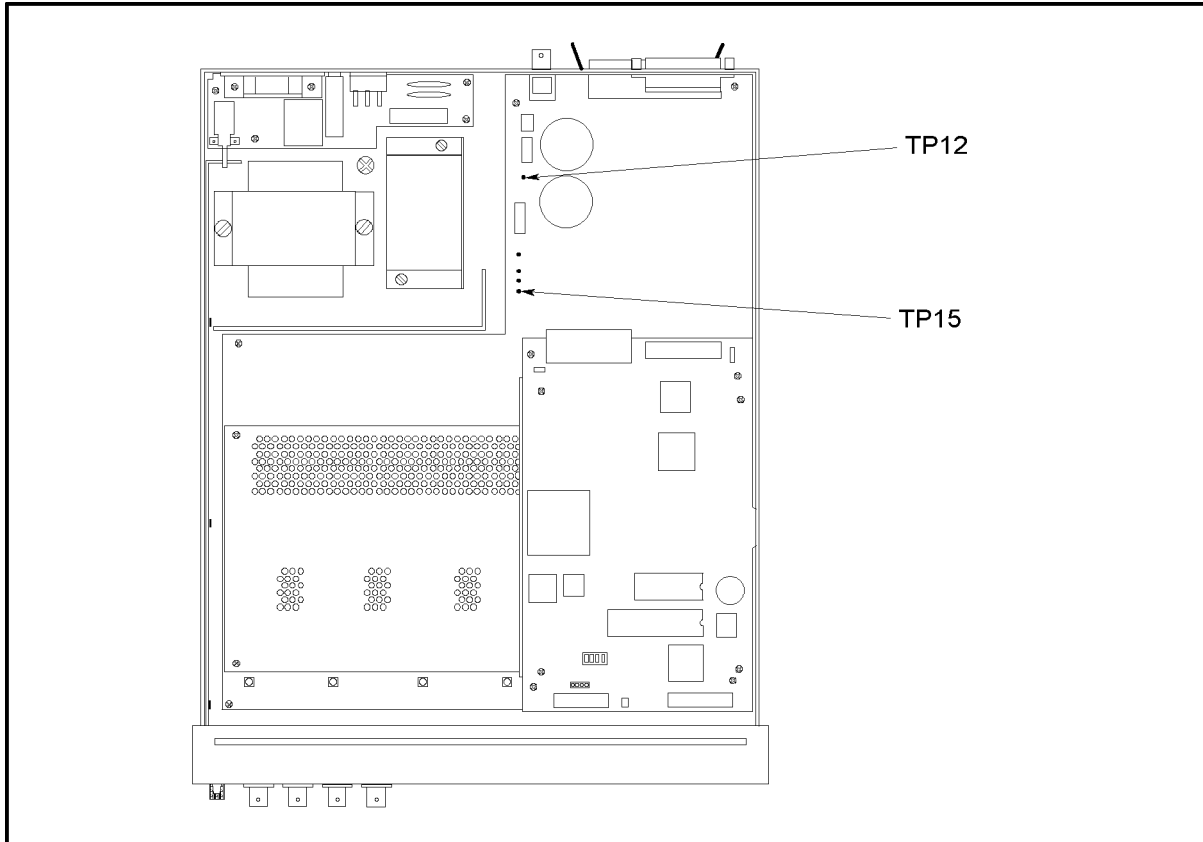
Figure 4-10. Location of High Lead of A2F1 Fuse

Check 9, Fuse and Line Switch

1. Check that the fuse on the 4349B rear panel is not blown.
2. Check that the line switch on the A5 AC Inlet Board Assembly is not defective.
3. If passed, proceed to “Check 10, DC-DC Converter Input Voltage”, otherwise replace the defective line switch or blown fuse.

Check 10, DC-DC Converter Input Voltage

1. Turn on the 4349B.
2. Using a multimeter, check if the voltage between TP12 and TP15 on A1 (DC-DC Converter input voltage) is between 12 V and 15 Vdc. Refer to Figure 4-11 for test pin locations.
3. If the voltage is in range, proceed to the “Check 11, DC-DC Converter Open Output Voltages”, otherwise proceed to the “Check 12, Transformer Secondary Voltage”.

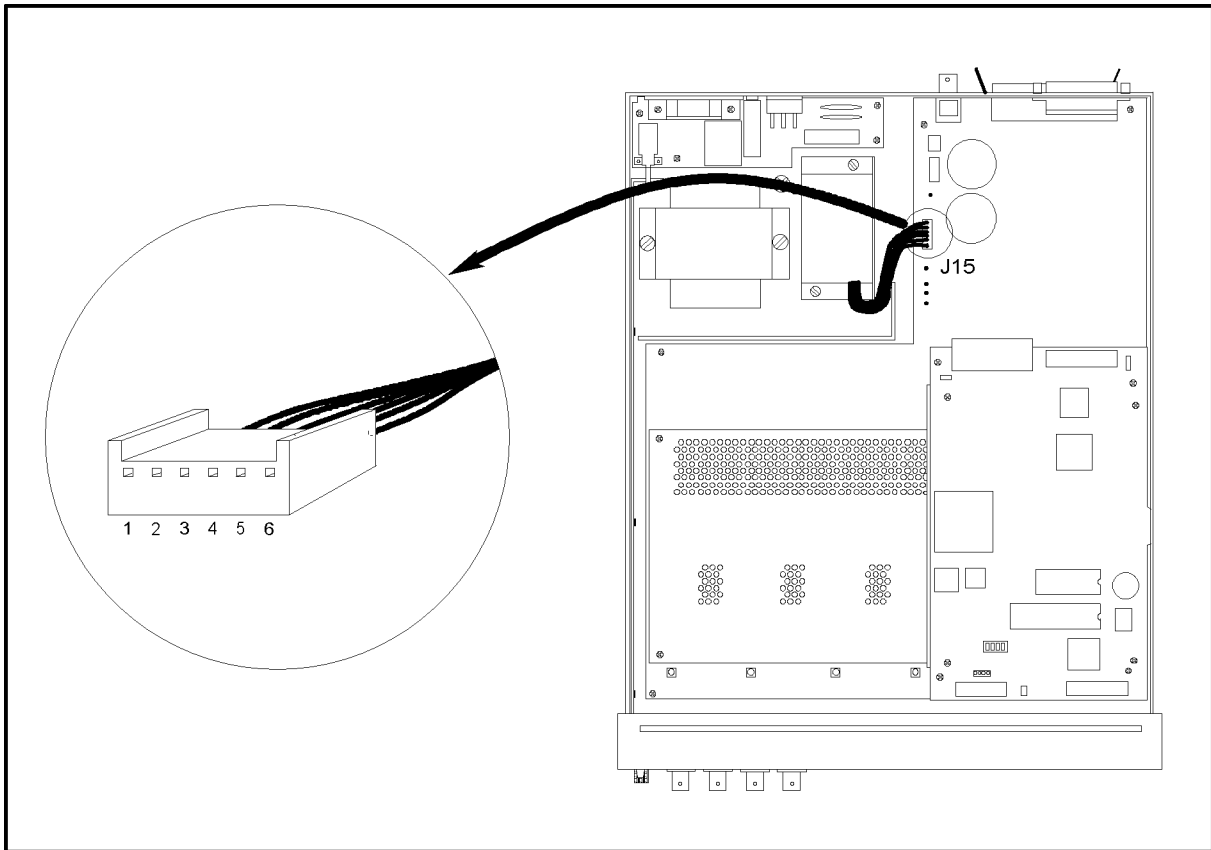


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Figure 4-11. Test Pin Locations

Check 11, DC-DC Converter Open Output Voltages

1. Turn off the 4349B.
2. Disconnect the DC-DC Converter Output Cable shown in Figure 4-12 from connector “J15” on the A1 Main Board Assembly.
3. Turn the 4349B on.
4. Using a multimeter, check if the DC-DC Converter open output voltages on the output connector pins shown in Figure 4-12 are in the ranges shown in Table 4-2.
5. If passed, replace the A1 Main Board Assembly, otherwise replace the DC-DC Converter Assembly.



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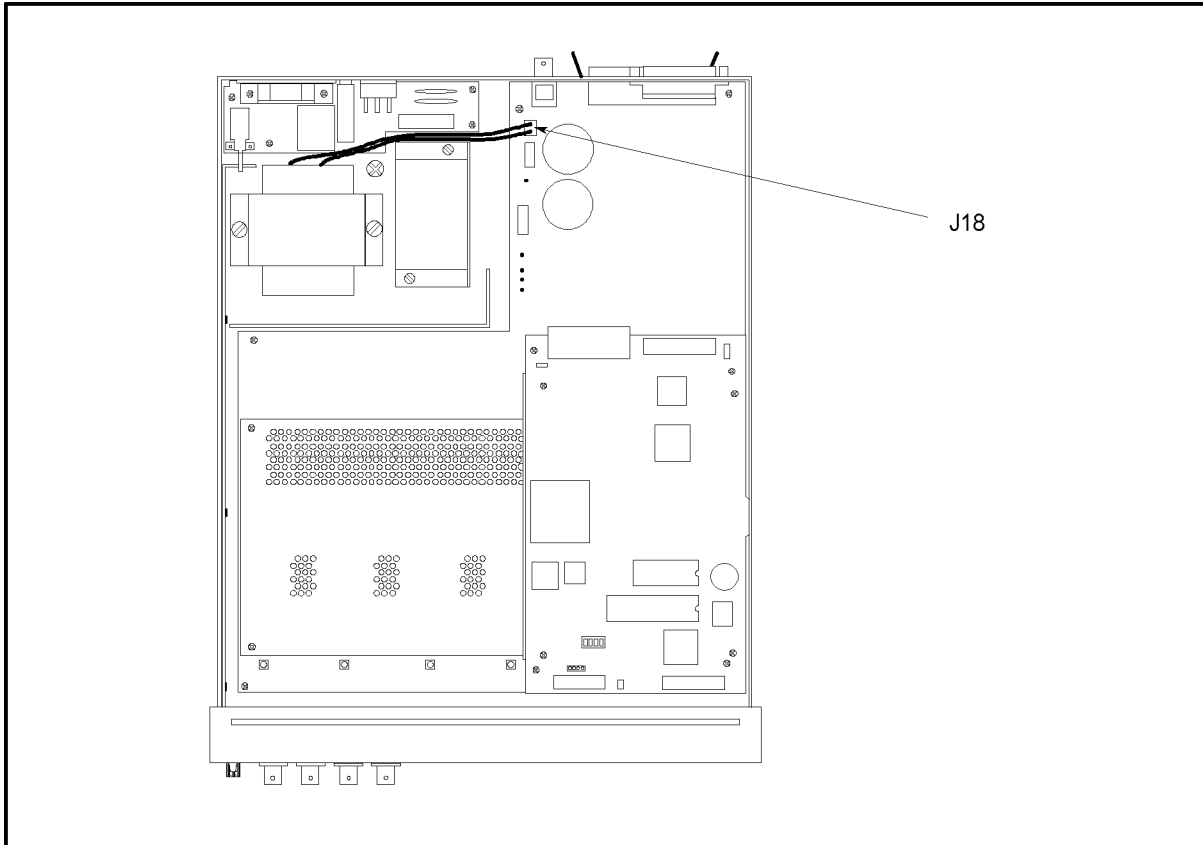
Figure 4-12. DC-DC Converter Output Connector

Table 4-2. DC-DC Converter Open Output Voltages

Pin (+)	Pin (-)	Voltage Range
1	2	5.1 ± 0.1 V
4	3	12 ± 0.6 V
5	3	-12 ± 0.6 V

Check 12, Transformer Secondary Voltage

1. Turn off the 4349B.
2. Disconnect the transformer secondary connector from connector “J18” on the A1 Main Board Assembly. Refer to Figure 4-13 for the connector location.
3. Turn the 4349B on.
4. Using a multimeter, check if the transformer secondary voltage is between 13 V and 17 Vac.
5. If passed, replace the A1 Main Board, otherwise replace the transformer.



LBS04016

Figure 4-13. Transformer Secondary Voltage Check

Manual Changes

Introduction

This appendix contains the information required to adapt this manual to earlier versions or configurations of the 4349B than the current printing date of this manual. The information in this manual applies directly to 4349B 4-Channel High Resistance Meter whose serial number prefix is listed on the title page of this manual.

Manual Changes

To adapt this manual to your 4349B, refer to Table A-1, and make all of the manual changes listed opposite your instrument's serial number.

Instruments manufactured after the printing of this manual may be different from those documented in this manual. Later instrument versions will be documented in a manual changes supplement that will accompany the manual shipped with that instrument. If your instrument serial number is not listed on the title page of this manual or in Table A-1, it may be documented in a *yellow MANUAL CHANGES* supplement.

For additional information on serial number coverage, refer to 4349B Operation manual.

Table A-1. Manual Changes by Serial Number

Serial Prefix or Number	Make Manual Changes
	There are no earlier configurations than the printing date of this manual.

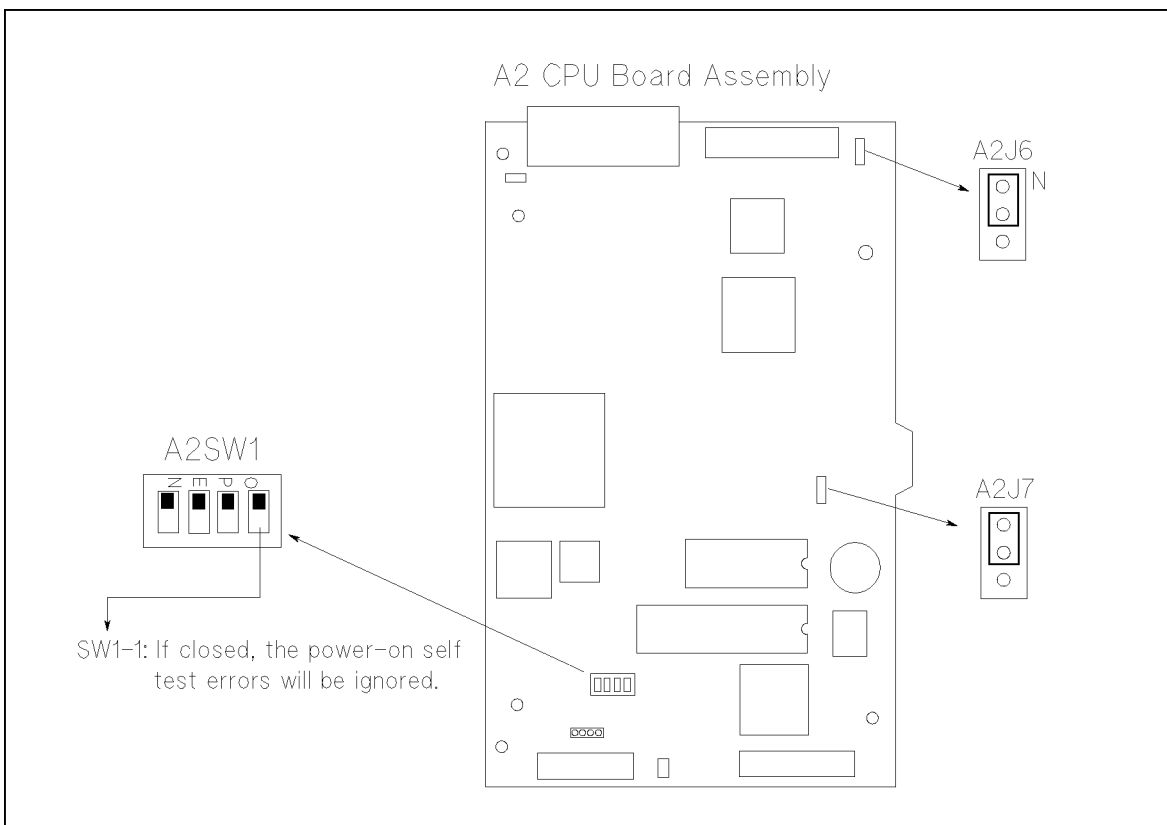
Default Jumper and Switch Settings

Introduction

This appendix describes the setting of the jumpers and switches on the A2 CPU Board Assembly. Use this information when replacing the A2 Assembly.

Jumper and Switch Settings

Figure B-1 shows the Jumper and Switch Settings. When the A2 CPU Board Assembly is replaced, set the jumpers and switches to the *DEFAULT* side as shown in the figure.



LCS0B001

Figure B-1. Jumper and Switch Settings

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