

Agilent E4981A 120Hz/1kHz/1MHz Capacitance Meter

Service Guide

First Edition

FIRMWARE REVISIONS

This manual applies directly to instruments that have the firmware revision A.01.00 or higher.

For additional information about firmware revisions, see Appendix A.



Agilent Technologies

Agilent Part No. E4981-90100

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Manual Printing History

The manual's printing date and part number indicate its current edition. The printing date changes when a new edition is printed. (Minor corrections and updates that are incorporated at reprint do not cause the date to change.) The manual part number changes when extensive technical changes are incorporated.

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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. Such noncompliance would also violate safety standards of design, manufacture, and intended use of the instrument. Agilent Technologies assumes no liability for the customer's failure to comply with these precautions.

NOTE	The E4981A complies with INSTALLATION CATEGORY II as well as POLLUTION DEGREE 2 in IEC61010-1. The E4981A is an INDOOR USE product.
NOTE	The LEDs in the E4981A are Class 1 in accordance with IEC60825-1, CLASS 1 LED PRODUCT
NOTE	This equipment is MEASUREMENT CATEGORY I (CAT I). Do not use for CAT II, III, or IV.
NOTE	This equipment is tested with stand-alone condition or with the combination with the accessories supplied by Agilent Technologies against the requirement of the standards described in the Declaration of Conformity. If it is used as a system component, compliance of related regulations and safety requirements are to be confirmed by the builder of the system.

- Ground the Instrument
To avoid electric shock, the instrument chassis and cabinet must be grounded with the supplied power cable's grounding prong.
- DO NOT Operate in an Explosive Atmosphere
Do not operate the instrument in the presence of inflammable gasses or fumes. Operation of any electrical instrument in such an environment clearly constitutes a safety hazard.
- Keep Away from Live Circuits
Operators 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 voltage levels may remain even after the power cable has been disconnected. To avoid injuries, always disconnect the power and discharge circuits before touching them.
- DO NOT Service or Adjust the Instrument 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 the Instrument
To avoid the danger of introducing additional hazards, do not install substitute parts or perform unauthorized modifications to the instrument. Return the instrument to an Agilent Technologies Sales and Service Office for service and repair to ensure that

safety features are maintained in operational condition.

- 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 voltage levels, capable of causing death, are present in this instrument. Use extreme caution when handling, testing, and adjusting this instrument.

- Do not connect the measuring terminals to mains.

Safety Symbols

General definitions of safety symbols used on the instrument 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 instrument manual.



Alternating current.



Direct current.



On (Supply).



Off (Supply).



In position of push-button switch.



Out position of push-button switch.



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



Stand-by.

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.

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.

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Typeface Conventions

Sample (bold)

Boldface type is used for emphasis.

Sample (Italic)

Italic type is used for emphasis and manual title.

[Sample] key

Indicates a hardkey (key on the front panel or external keyboard) labeled “Sample.” “key” may be omitted.

Sample menu/button/box

Indicates a menu/button/box on the screen labeled “Sample” which can be selected/executed by clicking “menu,” “button,” or “box” may be omitted.

Sample 1 - Sample 2 - Sample 3

Indicates a sequential operation of **Sample 1**, **Sample 2**, and **Sample 3** (menu, button, or box). “-” may be omitted.

1. General Information	
Organization of Service Guide	14
Instruments Covered by This Manual	15
Required Equipment	16
2. Performance Test	
Introduction	18
Test Equipment Required	18
Individual Test Description	19
1. Test Signal Frequency Accuracy Test	19
2. Test Signal Level Accuracy Test	20
3. Impedance Measurement Accuracy Test	26
3. Adjustment	
Safety Considerations	36
Warm-up for Adjustment	36
Required Equipment	36
Required Adjustment after Replacing Assembly	37
Writing ID	37
Test Signal Level Monitor Adjustment	37
Test Signal Level Adjustment	37
VRD Gain Adjustment	38
TRD Rr Adjustment	39
Impedance Adjustment	39
Cable Error Range Dependency Correction	39
4. Troubleshooting	
Introduction	42
To Troubleshoot the Instrument	43
Primary Trouble Isolation	43
Power On Sequence Troubleshooting	45
Check the Line Voltage and Fuse	45
Check the Power Supply Unit Output	45
Check booting process	46
Troubleshooting Using Service Function	47
Power On Test	47
Contents of the power on test results	47
Self Test	47
SERVICE Page	49
Power On Test / Self Test Failure Troubleshooting	53
Function Specific Troubleshooting	55
To Check the Front Panel	56
To Check the LCD	56
To Check the Front USB port	56
To Check the External Trigger Input	57
To Check the LAN	57
To Check the GPIB	59
To Check the USB (USBTMC) Interface	60

To Check the Handler Interface Function	60
To Check the Scanner Interface Function	64
Performance test failure troubleshooting	67
Performance test failure troubleshooting	67
5. Replaceable Parts	
Ordering Information	70
Direct Mail Order System	70
Exchange Assemblies	70
Replaceable Parts List	71
Top View (A34 Analog Board Assembly)	71
Top View (Major Assemblies)	72
Top View (Cables and Miscellaneous Parts)	73
Rear Chassis Assembly (PPMC PCA)	74
Rear Chassis Assembly (A31 Digital Board)	75
Power Supply Unit Assembly	76
Fan Assembly	77
Front View	78
Rear View	79
Chassis Assembly	80
3/4 Rack Module Assembly	81
Front Panel	82
Front Panel and Inverter Assembly	85
Label Assembly	86
Bumpers & Handle Assembly	87
Other Parts	88
6. Replacement Procedure	
Replacing an Assembly	90
Tightening Torque of Screws	90
Required Tools	91
3/4 Rack Module Top Replacement	92
Tools Required	92
Removal Procedure	92
Replacement Procedure	92
PSU Deck Assembly Removal	95
Tools Required	95
Removal Procedure	95
Replacement Procedure	95
PSU Assembly Replacement	97
Tools Required	97
Removal Procedure	97
Replacement Procedure	97
Front Chassis Assembly Removal	99
Tools Required	99
Removal Procedure	99
Replacement Procedure	99
Front Panel Assembly Removal	101

Tools Required	101
Removal Procedure	101
Replacement Procedure	101
A34 Analog Board Assembly Replacement	103
Tools Required	103
Removal Procedure	103
Replacement Procedure	103
Interface Board Assembly Replacement	105
Tools Required	105
Removal Procedure	105
Replacement Procedure	105
PPMC PCA Replacement	107
Tools Required	107
Removal Procedure	107
Replacement Procedure	107
A31 Digital Board Assembly Replacement	108
Tools Required	108
Removal Procedure	108
Replacement Procedure	108
Rear Chassis Assembly Removal	110
Tools Required	110
Removal Procedure	110
Replacement Procedure	110
Plate Assembly Replacement	111
Tools Required	111
Removal Procedure	111
Replacement Procedure	111
Fan Assembly Replacement	112
Tools Required	112
Removal Procedure	112
Replacement Procedure	112
GPIB Assembly Replacement	114
Tools Required	114
Removal Procedure	114
Replacement Procedure	114
Power Inlet Assembly Replacement	115
Tools Required	115
Removal Procedure	115
Replacement Procedure	115
USB Assembly Replacement	117
Tools Required	117
Removal Procedure	117
Replacement Procedure	117
Binding Post Assembly Replacement	118
Tools Required	118
Removal Procedure	118
Replacement Procedure	118
Inverter Assembly Replacement	119
Tools Required	119

Contents

Removal Procedure	119
Replacement Procedure	119
Display Support Removal	121
Tools Required	121
Removal Procedure	121
Replacement Procedure	121
LCD and Display Interface Board Replacement	123
Tools Required	123
Removal Procedure	123
Replacement Procedure	123
Front Panel, Key Pad and Key Flex Circuit Replacement	125
Tools Required	125
Removal Procedure	125
Replacement Procedure	125
7. Post-Repair Procedures	
Post-Repair Procedures	128
A. Manual Changes	
Manual Changes	132
B. Firmware Update	
Update the E4981A firmware using USB/GPIB interface	134
Required Equipment	134
How to update E4981A firmware using USB/GPIB interface	134
Update the E4981A firmware using USB cable	135
Required Equipment	135
How to update E4981A firmware using USB cable	135
C. Power Requirement	
Replacing Fuse	138
Fuse Selection	138
Setting up the fuse	138
Power Requirements	139
Power Cable	139
D. Error Messages	
Error Messages	142
1 - 100	142
A	142
B	142
C	142
D	143
E	143
F	144
G	144
H	144
I	144

L 145
M 145
N 145
O 146
P 146
Q 146
R 147
S 147
T 147
U 148
Warning Message 149

1 General Information

This Service Guide is a guide to servicing the E4981A 20 Hz/1 kHz/1 MHz Capacitance Meter. The Service Guide provides information about performance test, adjustment, troubleshooting, and repairing the E4981A.

Organization of Service Guide

Tabs are used to divide the major chapter and appendix of this manual. The contents of each chapter and appendix in this manual as follows.

- Chapter 1, “General Information.”

This Service Guide is a guide to servicing the E4981A 20 Hz/1 kHz/1 MHz Capacitance Meter. The Service Guide provides information about performance test, adjustment, troubleshooting, and repairing the E4981A.
- Chapter 2, “Performance Test.”

This chapter provides the outline of the E4981A performance tests.
- Chapter 3, “Adjustment.”

This chapter provides the adjustment information for the E4981A to ensure that it is within its specifications. The adjustment must be performed Agilent’s qualified service personnel. If you need the adjustment for your E4981A, it should be sent to the nearest Agilent Technologies service office.
- Chapter 4, “Troubleshooting.”

This chapter provides the procedure to isolate a faulty assembly in the E4981A.
- Chapter 5, “Replaceable Parts.”

This chapter contains information for ordering replacement parts for the E4981A.
- Chapter 6, “Replacement Procedure.”

This chapter provides procedure for removing and replacing the major assemblies in the E4981A.
- Chapter 7, “Post-Repair Procedures.”

This chapter lists the procedures required to verify the E4981A operation after an assembly is replaced with a new one.
- Appendix A, “Manual Changes.”

This appendix contains the information required to adapt this manual to versions or configurations of the E4981A manufactured earlier than the current printing date of this manual. The information in this manual applies directly to E4981A units with the serial number that is printed on the title page of this manual.
- Appendix B, “Firmware Update.”

This appendix describes how to update the E4981A firmware. When you want to update the E4981A firmware, refer to this appendix.
- Appendix C, “Power Requirement.”
- Appendix D, “Error Messages.”

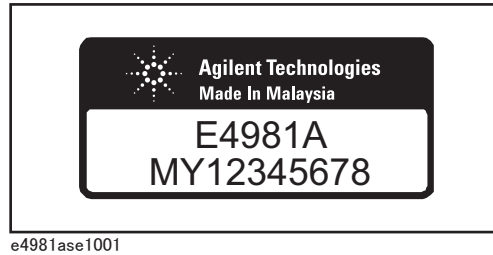
The Agilent E4981A provides error messages to indicate its operating status. This appendix describes the error messages of the E4981A in alphabetical order.

Instruments Covered by This Manual

The ten-character serial number is stamped on the serial number plate (Figure 1-1) on the rear panel.

Figure 1-1

Serial Number Label



An instrument manufactured after the printing date of this manual may have 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 data and is 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 Changes* supplement, contact the nearest Agilent Technologies office.

Required Equipment

Table 1-1 lists the recommended equipment for performance test, adjustment and troubleshooting for E4981A.

Table 1-1 Recommended Test Equipment

Equipment	Critical Specifications	Recommended Model	Qty.	Use ^{*1}
Frequency Counter	Frequency Range: 1 MHz Time Base Error < 50 ppm/year	Agilent 53131A or Agilent 53181A	1	P
Digital Multimeter	No Substitute	Agilent 3458A	1	P,A
Standard Capacitors Set	No Substitute	16380A	1	P,A
Standard Capacitors Set	No Substitute	16380C with option 001	1	P,A
Four Terminal Pair Standard Resistor Set	No Substitute	Agilent 42030A	1	A,T
4TP Open Termination	No Substitute	Agilent 42090A	1	P,A
4TP Short Termination	No Substitute	Agilent 42091A	1	A
Test Leads (BNC), 1 m	No Substitute	Agilent 16048A	1	P,A
Test Leads (BNC), 2 m	No Substitute	Agilent 16048D	1	P,A
DC Power Supply	+ 5V, 0.1A	Agilent E3610A	1	T
Handler Simulator	No Substitute	p/n 04278-65001	1	T
Scanner Simulator	No Substitute	p/n 04278-65301	1	T
Interface Box	No Substitute	p/n 04284-65007	1	P,A
Cables	BNC(m)-BNC(m) Cable, 122 cm	p/n 8120-1840	1	P,A
Adapter	BNC(f)-BNC(f) Adapter	p/n 1250-1830	4	P,A
	Dual Banana-BNC(f) Adapter	p/n 1251-2277	1	P,A

*1.P:Performance Test A:Adjustment T:Troubleshooting

2 Performance Test

This chapter provides the outline of the E4981A performance tests.

Introduction

This chapter provides the performance tests outline for Agilent E4981A. The performance test names are listed in Table 2-1. The test descriptions are described sequentially in the following pages.

NOTE Allow the analyzer to warm up for at least 30 minutes before you execute any of the performance tests.

Perform all performance tests in an ambient temperature of 23 ± 5 °C

NOTE The performance tests should be performed periodically. The recommended test interval is 12 months.

The test interval depends on maintenance and the environmental conditions under which the instrument is used. You may find that the interval could be shortened or lengthened; however, such a decision should be based on substantial quantitative data.

Table 2-1 List of the E4981A performance tests

Para.	Title
1	Test Signal Frequency Accuracy Test
2	Test Signal Level Accuracy Test
3	Impedance Measurement Accuracy Test

Test Equipment Required

The required equipment for the performance test is listed in Table 1-1. Use only calibrated equipment when doing the performance test.

Individual Test Description

1. Test Signal Frequency Accuracy Test

Description

This test checks the frequency accuracy of the E4981A test signal.

Specification

@23 ± 5 °C

Frequency [Hz]	Spec.
120 to 1M*1	± 0.02%

*1. Option 001 only.

Test equipment

Frequency Counter	Agilent 53131A or Agilent 53181A
Interface Box	Agilent 04284-65007
Test Leads (BNC), 2m	Agilent 16048D
BNC(f)-BNC(f) Adapter	Agilent 1250-1830, 4ea
BNC(m)-BNC(m) Cable (122cm)	Agilent 8120-1840

Test point and limits

Cable Length : 2 m

Frequency	Frequency Shift	Test Limit	Measurement Uncertainty	TAR
120 Hz	0 %	± 0.024 Hz	0.00093 Hz	25.88
1 kHz	0 %	± 0.20 Hz	0.00784 Hz	25.51
1 MHz*1	-2 %	± 196 Hz	7.93 Hz	24.74
	-1 %	± 198 Hz	7.93 Hz	24.97
	0 %	± 200 Hz	7.93 Hz	25.24
	+1 %	± 202 Hz	7.93 Hz	25.49
	+2 %	± 204 Hz	7.92 Hz	25.77

*1. Option 001 only.

2. Test Signal Level Accuracy Test

Description

This test checks the signal level accuracy of the E4981A source port output signal.

Specification

@23 ± 5 °C

Signal Level [V]	Spec.
0.1 to 1.0	± 5.0 %

Test equipment

Digital Multimeter	Agilent 3458A
Interface Box	Agilent 04284-65007
Test Leads (BNC), 2m	Agilent 16048D
BNC(f)-BNC(f) Adapter	Agilent 1250-1830, 4ea
BNC(m)-BNC(m) Cable (122cm)	Agilent 8120-1840
Dual Banana-BNC(f) Adapter	Agilent 1251-2277

Test point and limits

Cable Length : 2 m

Frequency	Frequency Shift	Level	Range	Test Limit	Measurement Uncertainty	TAR
120 Hz	0 %	0.1 V	10 uF	5.0 mV	± 0.28 mV	18.26
		0.2 V		10.0 mV	± 0.15 mV	66.96
		0.3 V		15.0 mV	± 0.41 mV	36.83
		0.4 V		20.0 mV	± 0.38 mV	53.25
		0.5 V		25.0 mV	± 0.23 mV	108.73
		0.6 V		30.0 mV	± 0.40 mV	76.52
		0.7 V		35.0 mV	± 0.40 mV	87.67
		0.8 V		40.0 mV	± 0.45 mV	89.41
		0.9 V		45.0 mV	± 0.24 mV	191.54
		1.0 V		50.0 mV	± 0.26 mV	197.42
		0.1 V	1 uF	5.0 mV	± 0.24 mV	21.52
		0.2 V		10.0 mV	± 0.45mV	22.46
		0.3 V		15.0 mV	± 0.34 mV	44.91
		0.4 V		20.0 mV	± 0.31 mV	65.84
		0.5 V		25.0 mV	± 0.44 mV	57.42
		0.6 V		30.0 mV	± 0.33 mV	92.39
		0.7 V		35.0 mV	± 0.40 mV	88.02
		0.8 V		40.0 mV	± 0.21 mV	192.88
		0.9 V		45.0 mV	± 0.23 mV	196.27
		1.0 V		50.0 mV	± 0.28 mV	184.35

2. Performance Test

Performance Test
Individual Test Description

Frequency	Frequency Shift	Level	Range	Test Limit	Measurement Uncertainty	TAR
1 kHz	0 %	0.1 V	1 uF	5.0 mV	± 0.12 mV	42.84
		0.2 V		10.0 mV	± 0.41 mV	24.36
		0.3 V		15.0 mV	± 0.21 mV	72.84
		0.4 V		20.0 mV	± 0.33 mV	61.11
		0.5 V		25.0 mV	± 0.26 mV	97.56
		0.6 V		30.0 mV	± 0.26 mV	116.02
		0.7 V		35.0 mV	± 0.24 mV	150.70
		0.8 V		40.0 mV	± 0.18 mV	232.77
		0.9 V		45.0 mV	± 0.43 mV	105.66
		1.0 V		50.0 mV	± 0.32 mV	156.65
		0.1 V	100 nF	5.0 mV	± 0.30 mV	16.98
		0.2 V		10.0 mV	± 0.19 mV	54.83
		0.3 V		15.0 mV	± 0.34 mV	44.43
		0.4 V		20.0 mV	± 0.28 mV	72.90
		0.5 V		25.0 mV	± 0.27 mV	93.82
		0.6 V		30.0 mV	± 0.41 mV	73.12
		0.7 V		35.0 mV	± 0.31 mV	115.57
		0.8 V		40.0 mV	± 0.39 mV	102.94
		0.9 V		45.0 mV	± 0.26 mV	172.45
		1.0 V		50.0 mV	± 0.31 mV	165.38

Frequency	Frequency Shift	Level	Range	Test Limit	Measurement Uncertainty	TAR
1 MHz ^{*1}	-2 %	0.1 V	100 pF	5.0 mV	± 1.16 mV	4.31
		0.2 V		10.0 mV	± 2.32 mV	4.31
		0.3 V		15.0 mV	± 3.49 mV	4.30
		0.4 V		20.0 mV	± 4.64 mV	4.31
		0.5 V		25.0 mV	± 5.79 mV	4.32
		0.6 V		30.0 mV	± 6.95 mV	4.31
		0.7 V		35.0 mV	± 8.11 mV	4.31
		0.8 V		40.0 mV	± 9.27 mV	4.31
		0.9 V		45.0 mV	± 10.42 mV	4.32
		1.0 V		50.0 mV	± 11.58 mV	4.32
	-1 %	0.1 V		5.0 mV	± 1.19 mV	4.22
		0.2 V		10.0 mV	± 2.32 mV	4.31
		0.3 V		15.0 mV	± 3.48 mV	4.31
		0.4 V		20.0 mV	± 4.64 mV	4.31
		0.5 V		25.0 mV	± 5.80 mV	4.31
		0.6 V		30.0 mV	± 6.95 mV	4.32
		0.7 V		35.0 mV	± 8.10 mV	4.32
		0.8 V		40.0 mV	± 9.26 mV	4.32
		0.9 V		45.0 mV	± 10.42 mV	4.32
		1.0 V		50.0 mV	± 11.57 mV	4.32

2. Performance Test

Performance Test
Individual Test Description

Frequency	Frequency Shift	Level	Range	Test Limit	Measurement Uncertainty	TAR
1 MHz ^{*1}	0 %	0.1 V	100 pF	5.0 mV	± 1.17 mV	4.30
		0.2 V		10.0 mV	± 2.33 mV	4.30
		0.3 V		15.0 mV	± 3.48 mV	4.31
		0.4 V		20.0 mV	± 4.64 mV	4.31
		0.5 V		25.0 mV	± 5.79 mV	4.31
		0.6 V		30.0 mV	± 6.95 mV	4.31
		0.7 V		35.0 mV	± 8.11 mV	4.31
		0.8 V		40.0 mV	± 9.31 mV	4.29
		0.9 V		45.0 mV	± 10.43 mV	4.31
		1.0 V		50.0 mV	± 11.62 mV	4.30
	1 %	0.1 V		5.0 mV	± 1.19 mV	4.22
		0.2 V		10.0 mV	± 2.33 mV	4.30
		0.3 V		15.0 mV	± 3.48 mV	4.31
		0.4 V		20.0 mV	± 4.65 mV	4.30
		0.5 V		25.0 mV	± 5.79 mV	4.32
		0.6 V		30.0 mV	± 6.95 mV	4.32
		0.7 V		35.0 mV	± 8.11 mV	4.31
		0.8 V		40.0 mV	± 9.26 mV	4.32
		0.9 V		45.0 mV	± 10.42 mV	4.32
		1.0 V		50.0 mV	± 11.58 mV	4.31

Frequency	Frequency Shift	Level	Range	Test Limit	Measurement Uncertainty	TAR
1 MHz ^{*1}	2 %	0.1 V	100 pF	5.0 mV	± 1.16 mV	4.31
		0.2 V		10.0 mV	± 2.32 mV	4.31
		0.3 V		15.0 mV	± 3.48 mV	4.31
		0.4 V		20.0 mV	± 4.64 mV	4.31
		0.5 V		25.0 mV	± 5.79 mV	4.31
		0.6 V		30.0 mV	± 6.95 mV	4.32
		0.7 V		35.0 mV	± 8.11 mV	4.31
		0.8 V		40.0 mV	± 9.27 mV	4.31
		0.9 V		45.0 mV	± 10.43 mV	4.31
		1.0 V		50.0 mV	± 11.59 mV	4.31

*1. Option 001 only.

2. Performance Test

3. Impedance Measurement Accuracy Test

Description

This test checks the impedance measurement accuracy of the E4981A.

Specification

@23 ± 5 °C

Impedance Accuracy* ¹	< ± (Relative Accuracy + Cal Accuracy)
----------------------------------	--

*1. Refer to the Specification Chapter in the User's Guide for details.

Test equipment

Standard Capacitors Set	Agilent 16380A
Standard Capacitors Set	Agilent 16380C with option 001
Four Terminal Pair Standard Resistor Set	Agilent 42030A
4TP Open Termination	Agilent 42090A
4TP Short Termination	Agilent 42091A
Test Leads (BNC), 1 m	Agilent 16048A
Test Leads (BNC), 2 m	Agilent 16048D
BNC(f)-BNC(f) Adapter, 4ea	Agilent 1250-1830

Test point and limits

Cable Length : 2 m, MEAS TIME : 1

Range : 100 nF

Standard	Signal Level	Freq	Freq Shift	Param	Test Limit	Measurement Uncertainty	TAR
100 nF	1 V	1 kHz	0 %	Cp	± 85 pF	± 5.44 pF	15.63
			0 %	D	± 0.00065	± 0.000032	20.83

Cable Length : 2 m, MEAS TIME : 8

Range : 100 nF

Standard	Signal Level	Freq	Freq Shift	Param	Test Limit	Measurement Uncertainty	TAR
100 nF	1 V	120 Hz	0 %	Cp	± 70 pF	± 7.68 pF	9.12
			0 %	D	± 0.0005	± 0.000035	14.44
		1 kHz	0 %	Cp	± 70 pF	± 4.37 pF	16.02
			0 %	D	± 0.0005	± 0.000023	22.45
	0.1 V	1 kHz	0 %	Cp	± 205 pF	± 12.36 pF	16.59
			0 %	D	± 0.0019	± 0.000023	83.04

Cable Length : 2 m, MEAS TIME : 8

Range : 220 nF

Standard	Signal Level	Freq	Freq Shift	Param	Test Limit	Measurement Uncertainty	TAR
100 nF	1 V	1 kHz	0 %	Cp	± 88 pF	± 4.60 pF	19.13
			0 %	D	± 0.00068	± 0.000023	30.54

Cable Length : 2 m, MEAS TIME : 8

Range : 470 nF

Standard	Signal Level	Freq	Freq Shift	Param	Test Limit	Measurement Uncertainty	TAR
100 nF	1 V	1 kHz	0 %	Cp	± 126 pF	± 7.10 pF	17.67
			0 %	D	± 0.0011	± 0.000023	47.37

Performance Test
Individual Test Description

Cable Length : 2 m, MEAS TIME : 1

Range : 100 pF

Standard	Signal Level	Freq	Freq Shift	Param	Test Limit	Measurement Uncertainty	TAR
100 pF	1 V	1 MHz*1	0 %	Cp	± 85 fF	± 11.75 fF	7.23
			0 %	D	± 0.00065	± 0.000065	10.03

*1.Option 001 only.

Cable Length : 2 m, MEAS TIME : 8

Range : 100 pF

Standard	Signal Level	Freq	Freq Shift	Param	Test Limit	Measurement Uncertainty	TAR
100 pF	1 V	1 kHz	0 %	Cp	± 85 fF	± 8.65 fF	9.82
			0 %	D	± 0.00065	± 0.000062	10.61
		1 MHz*1	-2 %	Cp	± 70 fF	± 10.63 fF	6.58
			-2 %	D	± 0.0005	± 0.000065	7.71
			-1 %	Cp	± 70 fF	± 11.11 fF	6.30
			-1 %	D	± 0.0005	± 0.000065	7.71
			0 %	Cp	± 70 fF	± 11.15 fF	6.28
			0 %	D	± 0.0005	± 0.000065	7.71
			1 %	Cp	± 70 fF	± 10.90 fF	6.42
			1 %	D	± 0.0005	± 0.000065	7.71
			2 %	Cp	± 70 fF	± 10.92 fF	6.41
			2 %	D	± 0.0005	± 0.000065 f	7.71

*1.Option 001 only.

Cable Length : 2 m, MEAS TIME : 8

Range : 100 pF

Standard	Signal Level	Freq	Freq Shift	Param	Test Limit	Measurement Uncertainty	TAR
100 pF	0.1 V	1 MHz*1	0 %	Cp	± 205 fF	± 17.79 fF	11.52
			0 %	D	± 0.0019	± 0.000065	28.55

*1.Option 001 only.

Cable Length : 2 m, MEAS TIME : 8

Range : 220 pF

Standard	Signal Level	Freq	Freq Shift	Param	Test Limit	Measurement Uncertainty	TAR
100 pF	1 V	1 MHz ^{*1}	-2 %	Cp	± 88 fF	± 13.16 fF	6.68
			-2 %	D	± 0.00068	± 0.000065	10.49
			-1 %	Cp	± 88 fF	± 13.70 fF	6.42
			-1 %	D	± 0.00068	± 0.000065	10.49
			0 %	Cp	± 88 fF	± 13.64 fF	6.45
			0 %	D	± 0.00068	± 0.000065	10.49
			1 %	Cp	± 88 fF	± 17.76 fF	4.95
			1 %	D	± 0.00068	± 0.000065	10.49
			2 %	Cp	± 88 fF	± 15.33 fF	5.74
			2 %	D	± 0.00068	± 0.000065	10.49

*1.Option 001 only.

Cable Length : 2 m, MEAS TIME : 8

Range : 470 pF

Standard	Signal Level	Freq	Freq Shift	Param	Test Limit	Measurement Uncertainty	TAR
100 pF	1 V	1 MHz ^{*1}	-2 %	Cp	± 126 fF	± 18.70 fF	6.71
			-2 %	D	± 0.0011	± 0.000065	16.28
			-1 %	Cp	± 126 fF	± 19.47 fF	6.44
			-1 %	D	± 0.0011	± 0.000065	16.28
			0 %	Cp	± 126 fF	± 16.97 fF	7.39
			0 %	D	± 0.0011	± 0.000065	16.28
			1 %	Cp	± 126 fF	± 19.30 fF	6.50
			1 %	D	± 0.0011	± 0.000065	16.28
			2 %	Cp	± 126 fF	± 15.45 fF	8.12
			2 %	D	± 0.0011	± 0.000065	16.28

*1.Option 001 only.

Performance Test
Individual Test Description

Cable Length : 2 m, MEAS TIME : 8

Range : 10 nF

Standard	Signal Level	Freq	Freq Shift	Param	Test Limit	Measurement Uncertainty	TAR
10 nF	1 V	120 Hz	0 %	Cp	± 7 pF	± 0.61 pF	11.60
			0 %	D	± 0.0005	± 0.000024	20.89
		1 kHz	0 %	Cp	± 7 pF	± 0.71 pF	9.94
			0 %	D	± 0.0005	± 0.000021	24.83

Cable Length : 2 m, MEAS TIME : 8

Range : 10 pF

Standard	Signal Level	Freq	Freq Shift	Param	Test Limit	Measurement Uncertainty	TAR
10 pF	1 V	1 MHz*1	-2 %	Cp	± 7 fF	± 1.11 fF	6.34
			-2 %	D	± 0.0005	± 0.000065	7.73
			-1 %	Cp	± 7 fF	± 1.14 fF	6.15
			-1 %	D	± 0.0005	± 0.000065	7.73
			0 %	Cp	± 7 fF	± 0.98 fF	7.16
			0 %	D	± 0.0005	± 0.000065	7.73
			1 %	Cp	± 7 fF	± 0.75 fF	9.34
			1 %	D	± 0.0005	± 0.000065	7.73
			2 %	Cp	± 7 fF	± 0.84 fF	8.40
			2 %	D	± 0.0005	± 0.000065	7.73

*1.Option 001 only.

Cable Length : 2 m, MEAS TIME : 8

Range : 10 uF

Standard	Signal Level	Freq	Freq Shift	Param	Test Limit	Measurement Uncertainty	TAR
10 uF	1 V	120 Hz	0 %	Cp	± 7 nF	± 0.53 nF	13.40
			0 %	D	± 0.0005	± 0.000072	6.98
		1 kHz	0 %	Cp	± 7 nF	± 0.79 nF	8.96
			0 %	D	± 0.0005	± 0.000066	7.67

Cable Length : 2 m, MEAS TIME : 8

Range : 1 nF

Standard	Signal Level	Freq	Freq Shift	Param	Test Limit	Measurement Uncertainty	TAR
1 nF	1 V	1 kHz	0 %	Cp	± 0.7 pF	± 88.49 fF	7.91
			0 %	D	± 0.0005	± 0.000062	8.14
		1 MHz *1	- 2 %	Cp	± 0.7 pF	± 119.53 fF	5.85
			- 2 %	D	± 0.0005	± 0.000068	7.45
			- 1 %	Cp	± 0.7 pF	± 128.11 fF	5.46
			- 1 %	D	± 0.0005	± 0.000068	7.45
			0 %	Cp	± 0.7 pF	± 142.70 fF	4.90
			0 %	D	± 0.0005	± 0.000068	7.45
			1 %	Cp	± 0.7 pF	± 161.84 fF	4.32
			1 %	D	± 0.0005	± 0.000068	7.45
			2 %	Cp	± 0.7 pF	± 146.28 fF	4.78
			2 %	D	± 0.0005	± 0.000068	7.45

*1.Option 001 only.

Cable Length : 2 m, MEAS TIME : 8

Range : 1 pF

Standard	Signal Level	Freq	Freq Shift	Param	Test Limit	Measurement Uncertainty	TAR
1 pF	1 V	1 MHz *1	-2 %	Cp	± 0.85 fF	± 0.19 fF	4.53
			-2 %	D	± 0.00065	± 0.000072	9.14
			-1 %	Cp	± 0.85 fF	± 0.17 fF	5.14
			-1 %	D	± 0.00065	± 0.000072	9.15
			0 %	Cp	± 0.85 fF	± 0.19 fF	4.64
			0 %	D	± 0.00065	± 0.000072	9.15
			1 %	Cp	± 0.85 fF	± 0.21 fF	4.17
			1 %	D	± 0.00065	± 0.000072	9.15
			2 %	Cp	± 0.85 fF	± 0.16 fF	5.34
			2 %	D	± 0.00065	± 0.000072	9.15

*1.Option 001 only.

Performance Test
Individual Test Description

Cable Length : 2 m, MEAS TIME : 1

Range : 1 uF

Standard	Signal Level	Freq	Freq Shift	Param	Test Limit	Measurement Uncertainty	TAR
1 uF	1 V	120 Hz	0 %	Cp	± 0.85 nF	± 70.05 pF	12.13
			0 %	D	± 0.00065	± 0.000042	15.79

Cable Length : 2 m, MEAS TIME : 8

Range : 1 uF

Standard	Signal Level	Freq	Freq Shift	Param	Test Limit	Measurement Uncertainty	TAR
1 uF	1 V	120 Hz	0 %	Cp	± 0.7 nF	± 69.30 pF	10.10
			0 %	D	± 0.0005	± 0.000023	22.55
		1 kHz	0 %	Cp	± 0.7 nF	± 44.52 pF	15.72
			0 %	D	± 0.0005	± 0.000032	16.02

Cable Length : 2 m, MEAS TIME : 8

Range : 1 uF

Standard	Signal Level	Freq	Freq Shift	Param	Test Limit	Measurement Uncertainty	TAR
1 uF	0.1 V	120 Hz	0 %	Cp	± 2.05 nF	± 73.32 pF	27.21
			0 %	D	± 0.0019	± 0.000042	44.94

Cable Length : 2 m, MEAS TIME : 8

Range : 2.2 uF

Standard	Signal Level	Freq	Freq Shift	Param	Test Limit	Measurement Uncertainty	TAR
1 uF	1 V	120 Hz	0 %	Cp	± 0.88 nF	± 70.82 pF	12.42
			0 %	D	± 0.00068	± 0.000042	16.51

Cable Length : 2 m, MEAS TIME : 8

Range : 4.7 uF

Standard	Signal Level	Freq	Freq Shift	Param	Test Limit	Measurement Uncertainty	TAR
1 uF	1 V	120 Hz	0 %	Cp	± 1.26 nF	± 81.21 pF	15.45
			0 %	D	± 0.0011	± 0.000042	25.62

Cable Length : 1 m, MEAS TIME : 8

Range : 100 pF

Standard	Signal Level	Freq	Freq Shift	Param	Test Limit	Measurement Uncertainty	TAR
100 pF	1 V	1 MHz *1	-2 %	Cp	± 70 fF	± 10.35 fF	6.76
			-2 %	D	± 0.0005	± 0.000065	7.71
			-1 %	Cp	± 70 fF	± 10.80 fF	6.48
			-1 %	D	± 0.0005	± 0.000065	7.71
			0 %	Cp	± 70 fF	± 10.73 fF	6.52
			0 %	D	± 0.0005	± 0.000065	7.71
			1 %	Cp	± 70 fF	± 11.17 fF	6.26
			1 %	D	± 0.0005	± 0.000065	7.71
			2 %	Cp	± 70 fF	± 9.73 fF	7.20
			2 %	D	± 0.0005	± 0.000065	7.71

*1.Option 001 only.

Performance Test
Individual Test Description

Cable Length : 0 m, MEAS TIME : 8

Range : 100 pF

Standard	Signal Level	Freq	Freq Shift	Param	Test Limit	Measurement Uncertainty	TAR
100 pF	1 V	1 MHz *1	-2 %	Cp	± 70 fF	± 10.04 fF	6.97
			-2 %	D	± 0.0005	± 0.000065	7.71
			-1 %	Cp	± 70 fF	± 10.20 fF	6.86
			-1 %	D	± 0.0005	± 0.000065	7.71
			0 %	Cp	± 70 fF	± 10.83 fF	6.46
			0 %	D	± 0.0005	± 0.000065	7.71
			1 %	Cp	± 70 fF	± 10.50 fF	6.66
			1 %	D	± 0.0005	± 0.000065	7.71
			2 %	Cp	± 70 fF	± 10.31 fF	6.79
			2 %	D	± 0.0005	± 0.000065	7.71

*1.Option 001 only.

Cable Length : 2 m, MEAS TIME : 8

Range : 1 mF

Standard	Signal Level	Freq	Freq Shift	Param	Test Limit	Measurement Uncertainty	TAR
1 Ω	1 V	120 Hz	0 %	Rs	± 4.3 mΩ	± 0.15 mΩ	29.48

Cable Length : 2 m, MEAS TIME : 8

Range : 0.1 mF

Standard	Signal Level	Freq	Freq Shift	Param	Test Limit	Measurement Uncertainty	TAR
1 Ω	1 V	1 kHz	0 %	Rs	± 4.3 mΩ	± 0.15 mΩ	30.40

Cable Length : 2 m, MEAS TIME : 8

Range : 0.1 mF

Standard	Signal Level	Freq	Freq Shift	Param	Test Limit	Measurement Uncertainty	TAR
10 Ω	1 V	120 Hz	0 %	Rs	± 7.0 mΩ	± 1.30 mΩ	5.39

3 Adjustment

This chapter provides the adjustment information for the E4981A to ensure that it is within its specifications. The adjustment must be performed Agilent's qualified service personnel. If you need the adjustment for your E4981A, it should be sent to the nearest Agilent Technologies service office.

Safety Considerations

This manual contains NOTES, CAUTIONs, and WARNINGs that must be followed to ensure the safety of the operator and to keep the instrument in a safe and serviceable condition. The adjustment must be performed by Agilent's qualified service personnel.

WARNING

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

Warm-up for Adjustment

Warm-up the E4981A for at least 30 minute before performing any of the following Adjustment procedures to ensure proper results and correct instrument operation.

Required Equipment

Table 1-1 on page 16 lists the equipment required to perform the Adjustment procedures described in this chapter. Use only calibrated test equipment when adjusting the E4981A.

Required Adjustment after Replacing Assembly

After replacing the analog assembly (PPMC, A31 and A34), all adjustment must be required. The adjustment must be performed Agilent's qualified service personnel. If you need the adjustment for your E4981A, it should be sent to the nearest Agilent Technologies service office.

Writing ID

This item writes the serial number, option information into the A31 board of the E4981A.

Required equipment for the writing ID

None

Test Signal Level Monitor Adjustment

This adjustment calibrate the Signal Level Monitor's absolute measurement accuracy.

Required equipment for the Signal Level Monitor Adjustment

Description	Recommended Model
Multimeter	Agilent 3458A
Interface Box	Agilent 04284-65007
BNC(m)-BNC(m) Cable (122cm)	Agilent 8120-1840
Dual Banana-BNC(f) Adapter	Agilent 1251-2277

Test Signal Level Adjustment

This adjustment calibrate the Signal Level absolute measurement accuracy.

Required equipment for the Test Signal Level adjustment

Description	Recommended Model
Multimeter	Agilent 3458A
Interface Box	Agilent 04284-65007
BNC(m)-BNC(m) Cable (122cm)	Agilent 8120-1840
Dual Banana-BNC(f) Adapter	Agilent 1251-2277

Adjustment

Required Adjustment after Replacing Assembly

VRD Gain Adjustment

The adjustment calibrates the amplifiers' gain and phase shift.

Required equipment for the VRD Gain adjustment

Description	Recommended Model
4TP Open Termination	Agilent 42090A
1 k Ω Standard Resistor	Agilent 42037A

TRD Rr Adjustment

The adjustment calibrate the resistance ratio between neighbor range resistor.

Required equipment for the TRD Rr adjustment

Description	Recommended Model
4TP Open Termination	Agilent 42090A
Standard Resistor Set	Agilent 42030A

Impedance Adjustment

The adjustment calibrate the capacitance measurement accuracy to measure the standard capacitor as a reference.

Required equipment for the Impedance adjustment

Description	Recommended Model
Standard Capacitors Set	Agilent 16380A
Standard Capacitors Set	Agilent 16380C with option 001
Test Leads (BNC), 1m	Agilent 16048A
Test Leads (BNC), 2m	Agilent 16048D
4TP Open Termination	Agilent 42090A
4TP Short Termination	Agilent 42091A
BNC(f)-BNC(f) Adapter	Agilent 1250-1830, 4ea

Cable Error Range Dependency Correction

The purpose of this procedure is correction of the cable length error on 10 k Ω /100 k Ω @1 kHz and 100 Ω /10 k Ω / 100 k Ω @1 MHz.

Required equipment for the Cable Error Range Dependency Correction

Description	Recommended Model
Standard Capacitors Set	Agilent 16380A
Standard Capacitors Set	Agilent 16380C with option 001
Test Leads (BNC), 1m	Agilent 16048A
Test Leads (BNC), 2m	Agilent 16048D
BNC(f)-BNC(f) Adapter	Agilent 1250-1830, 4ea

Adjustment
Required Adjustment after Replacing Assembly

4 Troubleshooting

This chapter provides the procedure to isolate a faulty assembly in the E4981A.

Introduction

WARNING These servicing instructions are for use by qualified personnel only. To avoid possible electrical shock, do not perform any servicing unless you are qualified to do so.

WARNING The opening of covers or removal of parts is likely to expose dangerous voltages. Disconnect the instrument from its power supply beforehand.

CAUTION Many of the assemblies in the instrument are very susceptible to damage from ESD (electrostatic discharge). Perform the following procedures only at a static-safe workstation and wear a grounding strap.

CAUTION DO NOT operate without following instructions. Programs or files in the instrument may be broken.

To Troubleshoot the Instrument

This section describes the basic procedural flow of troubleshooting when servicing the E4981A. The primary procedural tool in this section is the flowchart. The flowchart contains the entire troubleshooting path from a failure symptom to the isolation of faulty assembly, and will direct you to the completion of repair in an ordinary manner through the possible failure symptoms. Reference letters (Yes/No) on the flowcharts point to procedural steps that briefly explain the troubleshooting method to be performed next.

Primary Trouble Isolation

The primary trouble isolation in Figure 4-1 is to help direct you to the correct section for troubleshooting the E4981A.

Step 1. Turn the E4981A power on

With the E4981A plugged in and the power turned off, the front panel orange standby LED should be on. When the front panel power switch is turned on, the orange LED should go out and the yellow-green LED should come on. Also, the fan should start rotating. In case of unexpected results, go to “Power On Sequence Troubleshooting” on page 45.

Step 2. Check the display

- The power on test is executed once automatically before the measurements start. If the power on test fails, go to “Troubleshooting Using Service Function” on page 47.
- If one of the following error messages **A31 EEPROM write error**, **CPU Bd EEPROM write error**, **CPU Bd FLASH ROM write error**, **Fan failed**, or **Power failed** is displayed during the measurement process, go to “Power On Sequence Troubleshooting” on page 45 (check booting process).

Step 3. Check the basic function

If the front-panel, LCD display, data storage, remote interface or another function (except for measurement part) does not work correctly, go to “Function Specific Troubleshooting” on page 55.

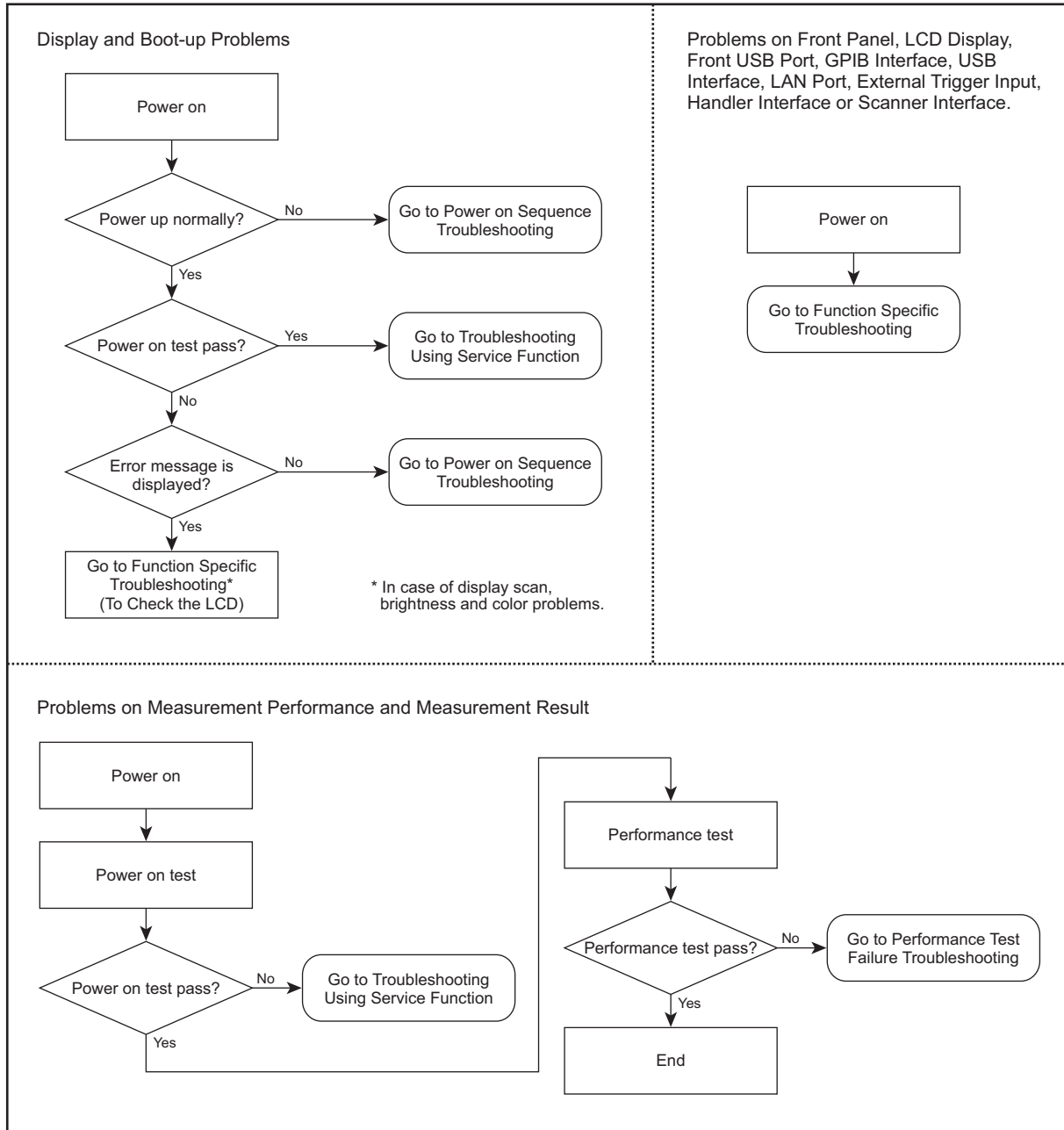
Step 4. Check the measurement function

If the E4981A fails any of the performance tests, go to “Performance test failure troubleshooting” on page 67.

A faulty part should be replaced as outlined in Chapter 5 which gives replacement procedures for each part. The procedures required after part replacement are given in Chapter 6.

Troubleshooting
To Troubleshoot the Instrument

Figure 4-1 Primary trouble isolation flowchart



e4981ase1005

Power On Sequence Troubleshooting

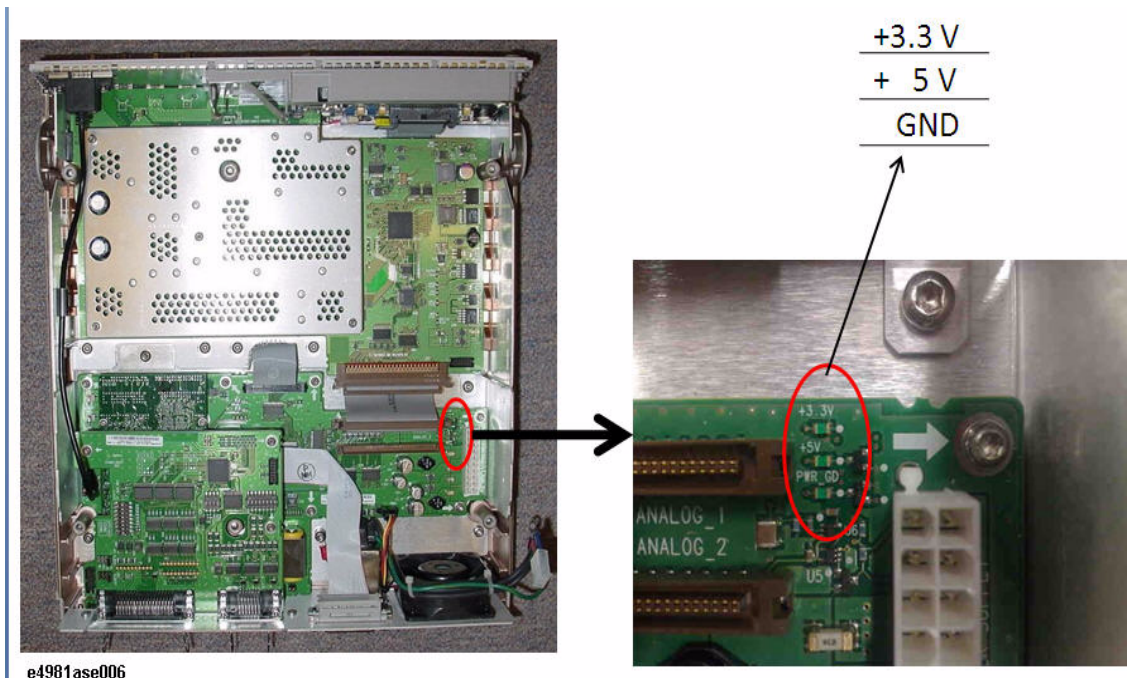
Check the Line Voltage and Fuse

Check the main power line cord, power fuse, and actual line voltage to see that they are all correct. For more information about the line cord and power fuse, see the Power Requirements in Appendix B.

Check the Power Supply Unit Output

- Step 1.** Remove the E4981A's outer cover.
- Step 2.** Turn the E4981A power on.
- Step 3.** Check the output voltage (+3.3 V and +5 V) of the power supply unit. LED on A31 board are turn on with green if the power unit is worked correctly. The location of LED on the A31 board is shown in Figure 4-2.

Figure 4-2 Output Voltage Location



e4981ase006

Check booting process

If the power on sequence has a problem despite it being powered from the power supply unit properly, check the following events in this order.

1. With the E4981A plugged in and the power turned off, the orange standby LED should be on. If the orange LED doesn't light, check the key flex circuit, display interface board, A31 board, and relevant cables.
2. When the front panel power switch is turned on, the orange LED should go out and the yellow-green LED should come on. If the yellow-green LED doesn't light, check the key flex circuit, display interface board, A31 board, and relevant cables.
3. Three LEDs (+3.3V, +5V, and PWR_GD) on the A31 board should be on. If the LEDs don't light, a problem in the A31 board is suspected.
4. The fan should be rotating and audible. If the fan doesn't run, it is probably defective.
5. The LED on the display interface board should blink. If the LED doesn't blink, check the display interface board, the A31 board, and the relevant cable.
6. The firmware revision and hardware option information along with copyright declaration should be displayed. If nothing is displayed, check the LCD, display interface board, inverter board, and the relevant cables.
7. The power on test should be executed once automatically before the measurement starts. If the power on test fails, an error code or an error message is displayed. For more details, refer to "Troubleshooting using service function".
8. The measurement view should be displayed.
9. If the following error message **A31 EEPROM write error** is displayed during the measurement process, a problem in the A31 board is suspected.
10. If the following error message **CPU Bd EEPROM write error**, or **CPU Bd FLASH ROM write error** is displayed during the measurement process, a problem in the PPMC PCA is suspected.
11. If the following error message **Fan failed** is displayed during the measurement process, a problem in the fan is suspected.
12. If the following error message **Power failed** is displayed during the measurement process, a problem in the power supply is suspected.

Troubleshooting Using Service Function

The Agilent E4981A has a service function to diagnose the analog measurement section, digital section, and internal dc power supply voltages. The Power On Test or Self Test of the service function makes it possible to isolate a faulty board assembly.

Power On Test

The Power On Test always takes place once the E4981A is turned on. When a failure is detected, a message "Power on test failed" is displayed in the system message area and the normal measurement screen does not appear (Service Mode). The Service Mode is a state that occurs when the power-on test fails. Here, the characters on the display turn yellow and all of the front panel keys are unavailable.

NOTE

When you want to use the front panel keys in the Service Mode while carrying out any repairs to the unit, Power Switch + Preset keys can be pressed. The characters on the display turn yellow too, but you can use all keys.

Contents of the power on test results

The Power On Test contains tests as shown in Table 4-3. If the power on test is failed, an error code or an error message is also displayed. You can identify a failure section with the error code or the error message. The error code or error message is related to each test group as shown in Table 4-3. For example, the first item of the error code is for CPU test group, second item is for System test group, and sixth item is for A34 test group. The value for each test group is given in hexadecimal.

Example of error code: Power on test failed: 0,0,0,0,3f,1f

NOTE

When the test no.1 or 2 of System test group fails, tests of A31, A34 test groups are not performed. In case of this failure, the value for the fifth and sixth item is indicated as ffff.

Self Test

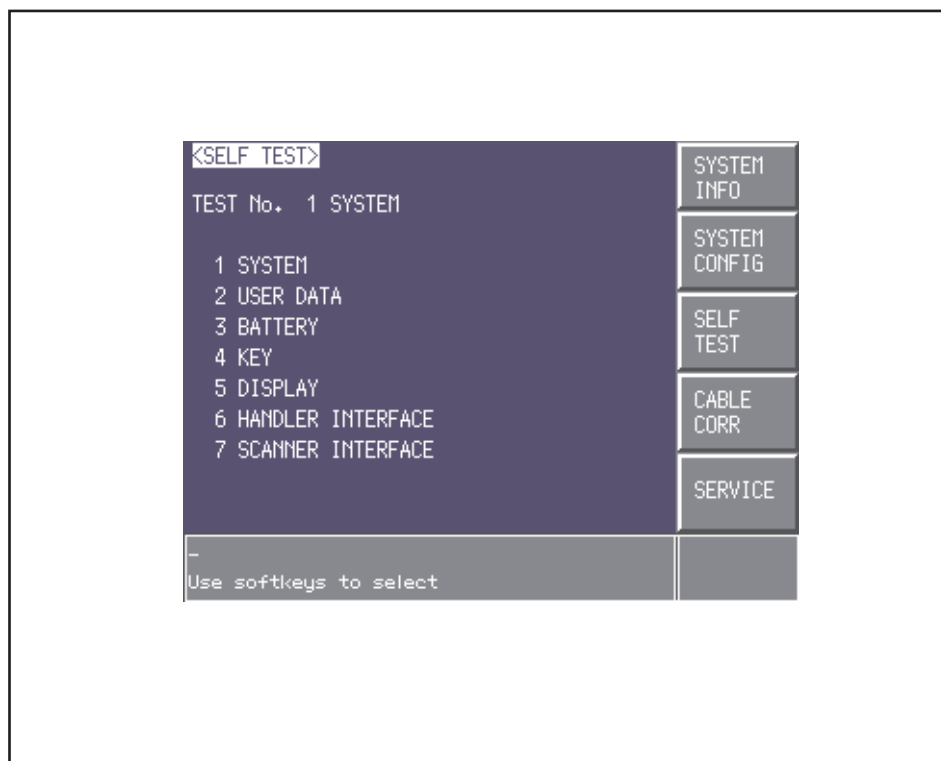
The Self Test can perform some test items of the power on test. Pressing the [System] key followed by the **SELF TEST** softkey opens the SELF TEST page. The SELF TEST page, intended for maintenance and repair, allows you to check the digital and analog behavior of E4981A. You can choose one of the available test items with the cursor placed in the corresponding field (parenthesized field).

- Choosing a Test Item (TEST No. field)

Figure 4-3 shows the fields available on this page along with the softkeys corresponding to them.

Figure 4-3

SELF TEST Page



e4981ase1006

Choosing a Test Item

Functional Description E4981A can run the following self tests:

The tests of SYSTEM, USER DATA, and BATTERY are also performed by the power on test.

Table 4-1

Test item	Description
SYSTEM	Checks the entire system, A1/A2/A3 boards, system calibration data, and so on.
USER DATA	Checks the GPIB/LAN configurations, instrument configuration information, instrument calibration data, and scanner calibration data.
BATTERY	Checks the internal batteries.
KEY	Checks the front panel keys. (Visual checks only; no result shown on screen.)
DISPLAY	Checks the LCD. (Visual checks only; no result shown on screen.)
HANDLER INTERFACE	Checks the handler interface. (Visual checks only; no result shown on screen.)

Table 4-1

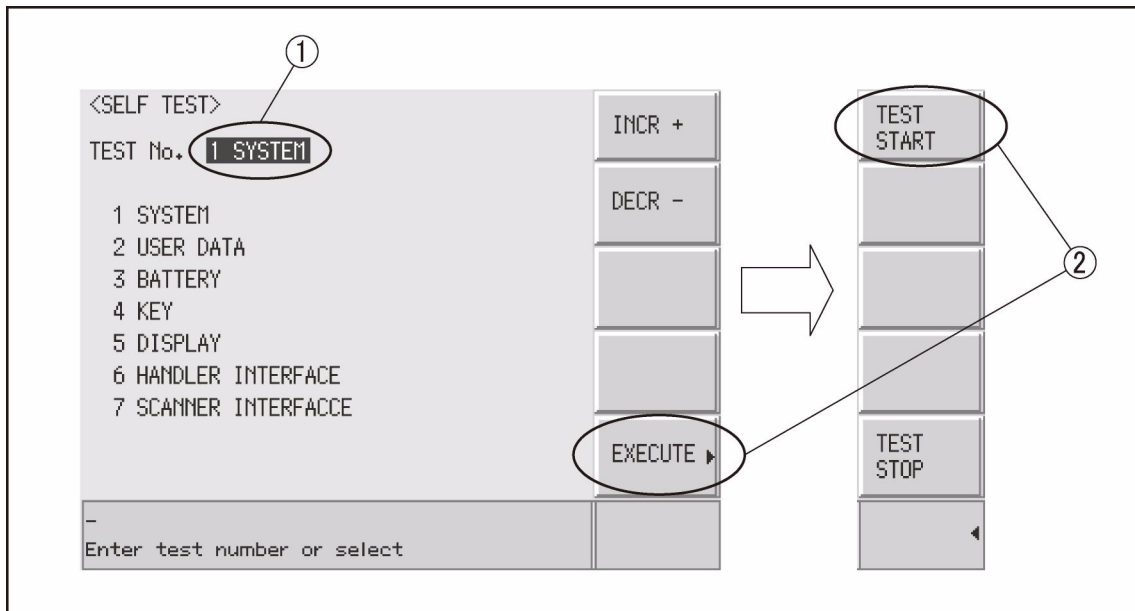
Test item	Description
SCANNER INTERFACE	Checks the scanner interface. (Visual checks only; no result shown on screen.)

Executing the self-test from the front panel The self-test of the E4981A can be executed from the front panel. The steps are given below.

Self-test procedure

- Step 4.** Press [System] - **SELF TEST**
- Step 5.** Use the cursor key to highlight the selection item to the right of “TEST No.” (1 in Figure 4-4)
- Step 6.** Select the number corresponding to the test that you want to perform by using the **INCR+** and **DECR-** softkeys.
- Step 7.** Press **EXECUTE - TEST START** (2 in Figure 4-4) to execute the selected test item.

Figure 4-4 Self-test screen and procedure



e4981ase1007

SERVICE Page

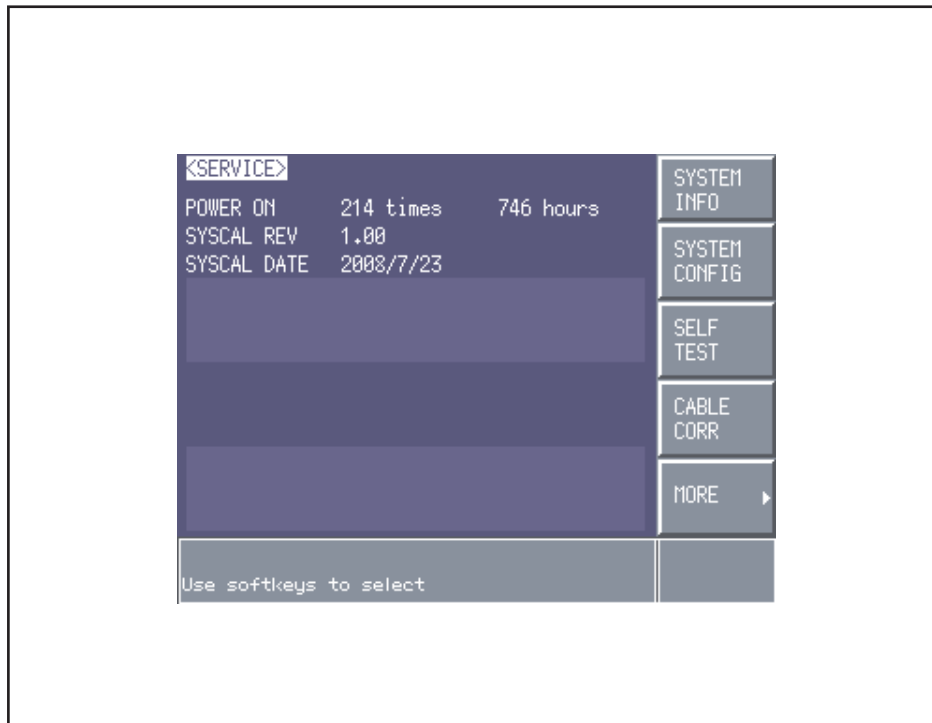
The results of the power on test or the self test (SYSTEM, USER DATA, and BATTERY) can be saved into a USB memory. Pressing the [System] key followed by the **SERVICE** softkey opens the SERVICE page.

This page is read-only.

This page displays the system information of E4981A and allows you to save the displayed information into the USB memory, but does NOT allow you to modify or delete the information.

NOTE The system information of E4981A may be used for the purposes of support and repair by Agilent Technologies, but will never be used for any other purposes.

Figure 4-5 SERVICE Page



e4981ase1008

Monitor Information

The SERVICE page displays the following monitor information, which cannot be edited on the SERVICE page.

Table 4-2

Monitor Information	Description
POWER ON	Displays how many times E4981A have been started up and its cumulative power-on time.
SYSCAL REV	Displays the program revision of the adjustment for the E4981A.
SYSCAL DATE	Displays the date of the last adjustment for the E4981A.

Saving the System Information into External Memory

The system information of E4981A can be saved into external memory.

The system information may be used for the purposes of support and repair by Agilent Technologies.

The file location on the USB memory is as follows:

`\e4981a\system\sysinfo.txt`

NOTE

The system information of E4981A may be used for the purposes of support and repair by Agilent Technologies, but will never be used for any other purposes.

To save the system information into external memory:

- Step 1.** Plug a USB memory stick into the front USB port.
- Step 2.** Press [System].
- Step 3.** Press the **SERVICE** softkey.
- Step 4.** Press the **MORE** softkey.
- Step 5.** Press the **SAVE SYS INFO** softkey.
- Step 6.** While the data is being saved, a "PROCESSING..." message is shown on the display. When the data has been saved into the USB memory, a "Storing data completed." message appears in the system message area.

Example of the System Information

The sysinfo.txt can be read by using an external computer (PC). The example of the system information is as follows:

Example 4-1

System information

```
ID: Agilent Technologies,E4981A,MY12345678,A.01.00
OPT: 0
POWER CYCLE: 214
POWER ON HOURS: 746
SYSCAL REV: 1.00
SYSCAL DATE: 2008/7/23
R: Rev.1.11
CPU[1]: 0
CPU[2]: 0
SYST[1]: 0
SYST[2]: 0
SYST[3]: 0
SYST[4]: 0
DATA[1]: 0
DATA[2]: 0
DATA[3]: 0
DATA[4]: 0
OPT[1]: 0
A1[1]: -1.156394958E+01
A1[2]: +1.184382915E+01
A1[3]: +5.129516602E+00
A1[4]: +3.364257813E+00
```

Troubleshooting
Troubleshooting Using Service Function

A1[5]: +2.509765625E+00
A1[6]: +5.138140202E+00
A4[1]: -3.594675164E-02
A4[2]: +9.541090152E-01
A4[3]: +9.995238615E-01
A4[4]: -1.075078767E+00
A4[5]: +9.505389726E-01
A4[6]: -1.075030646E+00
A4[7]: +2.398871813E-01
USER[1]: 0
USER[2]: 0
USER[3]: 0
USER[4]: 0BATT[1]: +3.188476563E+00
+4.150000000E+01
+2.927168354E-01

Power On Test / Self Test Failure Troubleshooting

Table 4-3 represents the contents of the power on tests or self test and the relationships of failed tests to probable faulty board assemblies. If power on test failed is displayed or self test fail is displayed, replace the faulty board assembly as shown in Table 4-3.

Table 4-3 Power on test / self test failure troubleshooting information

Test group	Test No.	Test Name	Error Code / Message	Probable faulty board assembly		
				A31	A34	PPMC
CPU	1	CPU Test	1 ~ ffff			###
	2	CPU Test	1 ~ ff			###
System	1	A1 FPGA check	0x01	###		#
	2	A4 FPGA check	0x02	##	###	#
	3	A1 Revision check	0x04	###		#
	4	A4 Revision check	0x08	##	###	
Data	1	System Data	0x01	###		#
	2	SysCal Data	0x02	##	###	#
	3	Flash File system check	0x04			###
	4	Test Limit Data	0x08			###
Option	1	Option consistency check	0x01	##		#
A31	1	A31_DCBUS_M12V	0x01	###		
	2	A31_DCBUS_P12V	0x02	###		
	3	A31_DCBUS_P5V	0x04	###		
	4	A31_DCBUS_P3.3V	0x08	###		
	5	A31_DCBUS_P2.5V	0x10	###		
	6	A31_DCBUS_STANBY	0x20	###		
A34	1	A34_DCBUS_GND	0x01		###	
	2	A34_DCBUS_P10V	0x02		###	
	3	A34_DCBUS_P5V	0x04		###	
	4	A34_DCBUS_N10V	0x08		###	
	5	A34_DCBUS_P3R3VA	0x10		###	
	6	A34_DCBUS_N10VPA	0x20		###	
	7	A34_DCBUS_TEMP	0x40		###	

Table 4-3 Power on test / self test failure troubleshooting information

Test group	Test No.	Test Name	Error Code / Message	Probable faulty board assembly		
				A31	A34	PPMC
User	1	User Data	User Data Lost			###
	2	State Data	State Data Lost			###
	3	Correction Data	Corr Data Lost			###
	4	Scanner Correction Data	Scanner Data Lost			###
Battery	1	A1_DCBUS_BATTERY	Battery Low	###		

###: Most suspicious assembly

##: Suspicious assembly

#: Possible faulty assembly

Function Specific Troubleshooting

If the E4981A exhibits a failure symptom that is related to a specific function or control such as a front panel key control, display, data storage, remote control interface, external trigger, isolate the trouble using the Function Specific Troubleshooting procedures described below. The major functions of the E4981A and the troubleshooting procedure for each function are shown in Table 4-4.

Table 4-4 Major functions and troubleshooting procedures

Function	Description	Troubleshooting
Front panel keys	All the E4981A functions can be set and controlled via the front panel keys.	Refer to “To Check the Front Panel” on page 56.
LCD	Almost all the information including the measurement value, setup state, result data processing, menu bar, softkey label and others are indicated on the LCD.	Refer to “To Check the LCD” on page 56.
Front USB port	The USB port is used to save data in a USB memory.	Refer to “To Check the Front USB port” on page 56.
External trigger input	The external trigger input terminal (BNC) on the rear panel allows an external trigger source to be used for measurement trigger.	Refer to “To Check the External Trigger Input” on page 57.
LAN port	The LAN interface port on the rear panel allows the E4981A to be connected to 10/100 Base-T Ethernet.	Refer to “To Check the LAN” on page 57.
GPIB Interface	The GPIB compatibility allows the E4981A to be operated as a talker/listener on IEEE 488 interface bus.	Refer to “To Check the GPIB” on page 59.
USB (USBTMC) Interface	Through this port, you can control the E4981A via external controllers. It is equivalent to control via GPIB.	Refer to in “To Check the USB (USBTMC) Interface” on page 60.
Handler interface	The interface is for data exchange with an automatic machine (handler) used on production line.	Refer to in “To Check the Handler Interface Function” on page 60.
Scanner interface	The interface to connect a scanner to perform up to 128 sets of multi-channel correction and measurements.	Refer to in “To Check the Scanner Interface Function” on page 64.

To Check the Front Panel

Procedure

Randomly press the front panel keys to verify that they work normally.

- Step 1.** Press [System] - **SELF TEST**
- Step 2.** Use the cursor key to highlight the selection item to the right of “TEST No.”.
- Step 3.** Select **4 KEY** using the **INCR+** or **DECR-** softkey.
- Step 4.** Press **EXECUTE - TEST START**.
- Step 5.** Randomly press the front panel keys. The key name of the pressed key is displayed.
- Step 6.** To exit the front panel test, press **TEST STOP** three times consecutively, and then press [Return].
 - If multiple keys fail to work, a problem in key function (keypad, key flex circuit) or display interface board.
 - If only a specific key doesn't work, check first if the key is subsided in the panel.

To Check the LCD

Procedure

- Step 1.** Press [System] - **SELF TEST**
- Step 2.** Use the cursor key to highlight the selection item to the right of “TEST No.”.
- Step 3.** Select **5 DISPLAY** using the **INCR+** or **DECR-** softkey.
- Step 4.** Press **EXECUTE - TEST START**. The whole of the LCD screen turns Red, Green, Blue, Black, and White every 2 seconds.
- Step 5.** To exit the DISPLAY test, press **TEST STOP**, and then press [Return].
 - If the LCD display has a problem, check the LCD and the display interface board.
 - If the LCD is not illuminated with backlight, check the inverter board.

To Check the Front USB port

Procedure

- Step 1.** Plug a USB memory, formatted with FAT16 or FAT32.

NOTE

The following USB memory can be used.

Complies with USB 1.1; mass storage class, FAT16/FAT32 format; maximum consumption current is below 500 mA.

Recommended USB memory: Agilent 512 MB USB Flash memory (Agilent PN 1819-0195).

Use the prepared USB memory device exclusively for the E4981A; otherwise, other

previously saved data may be cleared. If you use a USB memory other than the recommended device, data may not be saved or recalled normally.

- Step 2.** Press [Save/Recall].
- Step 3.** Use the cursor keys to select the MEDIA field.
- Step 4.** Press the **EXT** softkey.
- Step 5.** Use the cursor keys to select the No. 11.
- Step 6.** Press the **SAVE** softkey to save configuration states into the USB memory.
- Step 7.** Press [Save/Recall].
- Step 8.** Use the cursor keys to select the MEDIA field.
- Step 9.** Press the **EXT** softkey.
- Step 10.** Use the cursor keys to select the No. 11.
- Step 11.** Press the **RECALL** softkey to recall configurations from the USB memory.

If the file save or recall operation fails, a failure in the USB port or A31 board is suspected. Also check the cable between the USB port and A31 board.

To Check the External Trigger Input

Procedure

- Step 1.** Press [Preset] - **CLEAR SETTING - OK** to initialize the E4981A.
- Step 2.** Press [Meas Setup].
- Step 3.** Using the cursor keys, select the TRIG field, and then select **EXT** softkey.
- Step 4.** Press [Display Format].
- Step 5.** Connect a BNC Short or 50 Ω termination to the Ext Trig connector on the rear panel and disconnect it. Thereby a measurement trigger should be generated and a measurement result should be refreshed.
- Step 6.** If no trigger occurs, a failure in the A1 board is suspected.

To Check the LAN

Procedure

- Step 1.** Connect a LAN cable between the LAN port on the rear panel and an external computer (PC).

NOTE

Use a crossed LAN cable to enable the peer-to-peer communication between the E4981A and the PC. If the E4981A needs to be connected to the PC via a multi port Hub, use a straight LAN cable.

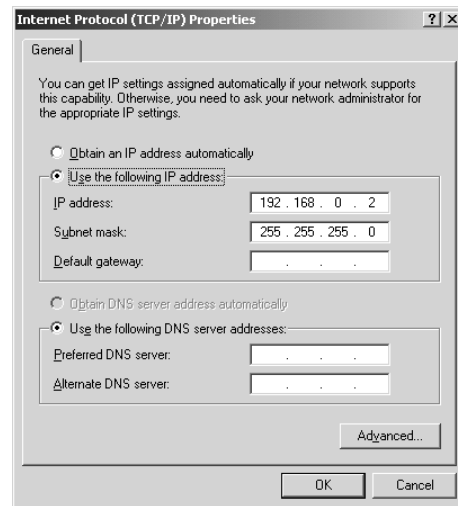
- Step 2.** Press [System].

Troubleshooting

Function Specific Troubleshooting

- Step 3.** Press the **SYSTEM CONFIG** softkey.
- Step 4.** Select the DHCP ENABLED field using the cursor keys and then press the **OFF** softkey.
- Step 5.** Select the AUTO-IP ENABLED field using the cursor keys and then press the **OFF** softkey.
- Step 6.** Enter the following IP address and subnet mask using the enter keys. For selecting the MANUAL IP ADDR or MANUAL SUBNET MASK field, use the cursor keys.
- IP Address: 192.168.0.1
- Subnet Mask: 255.255.255.0
- Step 7.** Set up the IP address/subnet mask for the external PC.
- a. Double-click “**My Computer**” icon on Windows desktop of the external PC. And double-click **Control Panel**. The Control Panel window will appear.
 - b. In the Control Panel window, double-click **Network**. The Network dialog box will appear. In the **Configuration** tab, select **TCP/IP** (display it in reverse video) and press the **Properties** button.
 - c. The dialog box appears. If **Specify an IP address** has been selected, record the IP address and subnet mask.
 - d. If the **Obtain an IP address automatically** has been selected, select the **Specify an IP address**. Enter the IP address xxx.xxx.xxx.y and subnet mask xxx.xxx.xxx.xxx as shown in Figure 4-6. The letters x represent the IP address and subnet mask of the E4981A. The letter y is different from the IP address of the E4981A. Press the **OK** button. Then, restart the external PC.

Figure 4-6 Network Dialog Box (“IP Address” Tab)

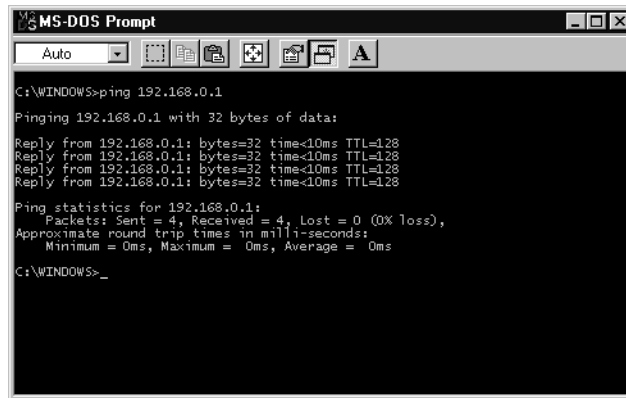


e4980ase1055

- Step 8.** By clicking “OK” button, the network settings take effect. Verify the E4981A LAN settings and response to a command from the external computer as follows:
- a. On the external computer, click "Start" button in the Windows Start menu bar using a mouse.

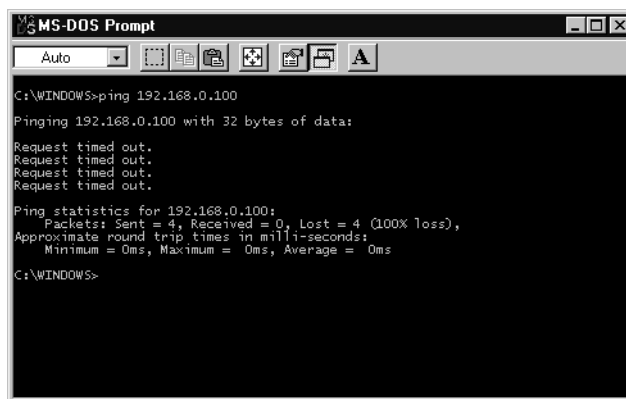
- b. Click "Programs" and "MS-DOS Prompt" (or "Command Prompt") to open the DOS (Command) Prompt window.
- c. Type a ping command followed by the E4981A IP address as "ping xxx.xxx.xxx.xxx" (where, xxx.xxx.xxx.xxx is the IP address such as 192.168.0.1 assigned in step 3-d.) Press [Enter] key on the keyboard.
- d. The external computer displays a message of ping command response from the E4981A. Figure 4-7 shows an example of normal result that indicates the IP address, packet size, and a response time counted by the computer. The ping command is repeated 4 times.

Figure 4-7 Example of normal ping command test result



If the E4981A doesn't return the response, the external computer displays a message of "Request timed out" as shown in Figure 4-8. In this case, a failure in the PPMC PCA is suspected.

Figure 4-8 Example of no response for ping command



To Check the GPIB

Procedure

Perform the E4981A performance test program. If the controller cannot detect the E4981A, the problem seems in the PPMC PCA or the connection of the GPIB cable.

To Check the USB (USBTMC) Interface

Procedure

Connect the USB cable between the controller PC and the E4981A. Turn the controller PC on. If the E4981A cannot detect the controller PC, the problem seems in the USB (USBTMC) Interface of the PPMC PCA is suspected.

To Check the Handler Interface Function

Perform this test only when troubleshooting the Interface Board. This test verifies the handler interface functions.

Equipment

Table 4-5

Equipment List of the Handler Interface Function Test

Handler Simulator	Agilent p/n 04278-65001
-------------------	-------------------------

Procedure

- Step 1.** Disconnect the power cable from the E4981A and allow 1 minute for the internal capacitors to discharge.

NOTE

Dangerous energy/voltage exists when the E4981A is in operation, and for a time after it is powered down. Allow 1 minutes for the internal capacitors to discharge.

- Step 2.** Remove the PSU Deck Assembly according to the procedure for describing in “PSU Deck Assembly Removal” on page 95.

NOTE

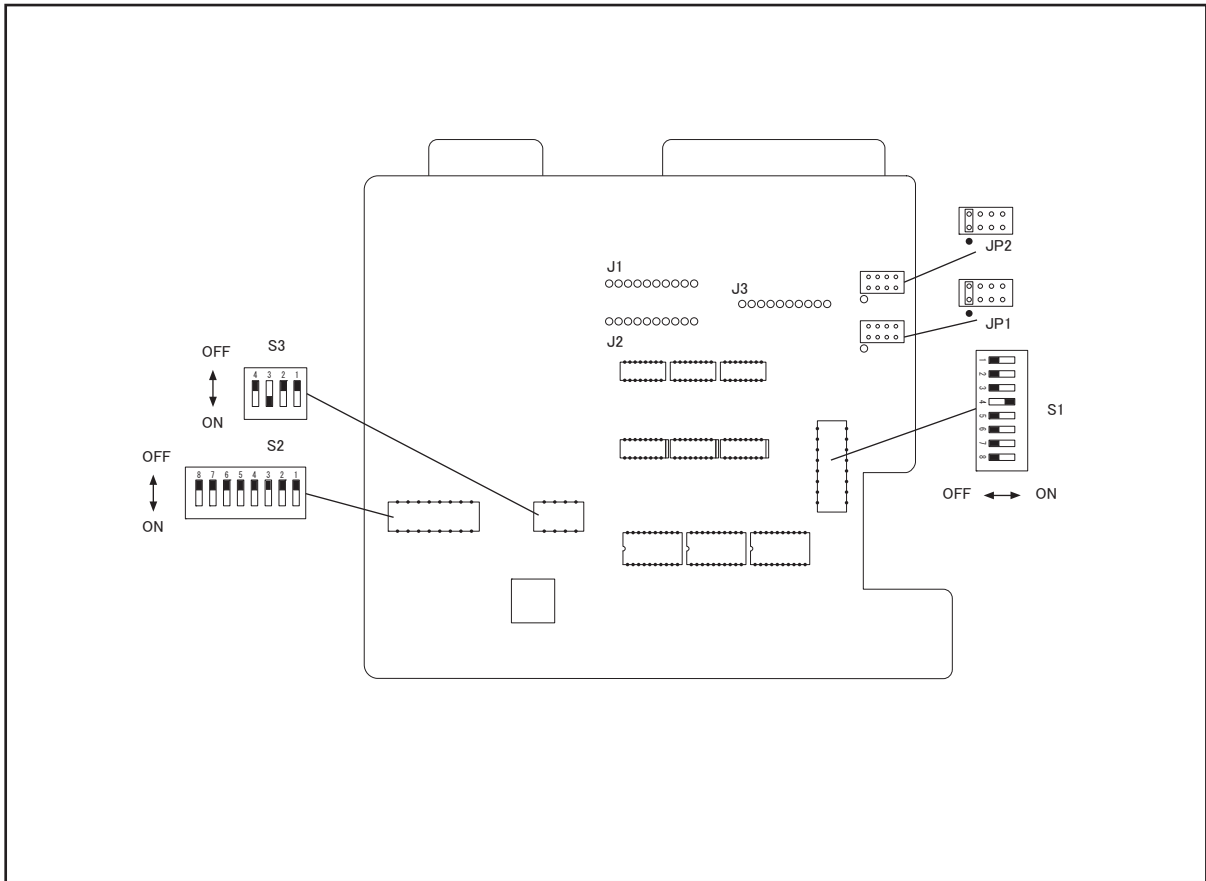
The Interface Board contains electronic components that can be damaged by static electricity through electrostatic discharge (ESD). To prevent ESD damage, maintain frequent contact with any bare sheet metal surface on the chassis. A grounding wrist strap (or similar device) is useful for this purpose. Handle the board carefully at all times. Avoid touching electronic components or circuit paths.

NOTE

Before performing Step 3, note the jumper and switch settings on the Interface Board in order to return them to the same settings at the end of this function test.

- Step 3.** Set the jumpers and switch on the Interface board to the same settings as when the board is shipped from the factory. Refer to Figure 4-9, Table 4-6, and Table 4-7.

Figure 4-9 Jumper, and Switch Settings



e4981ase1046

Table 4-6 Internal jumper settings

Jumper number	Jumper position *1
JP1	1(N)
	2
	3
	4
JP2	1(N)
	2
	3
	4

*1. The factory default setting is position (N) shown in the table above.

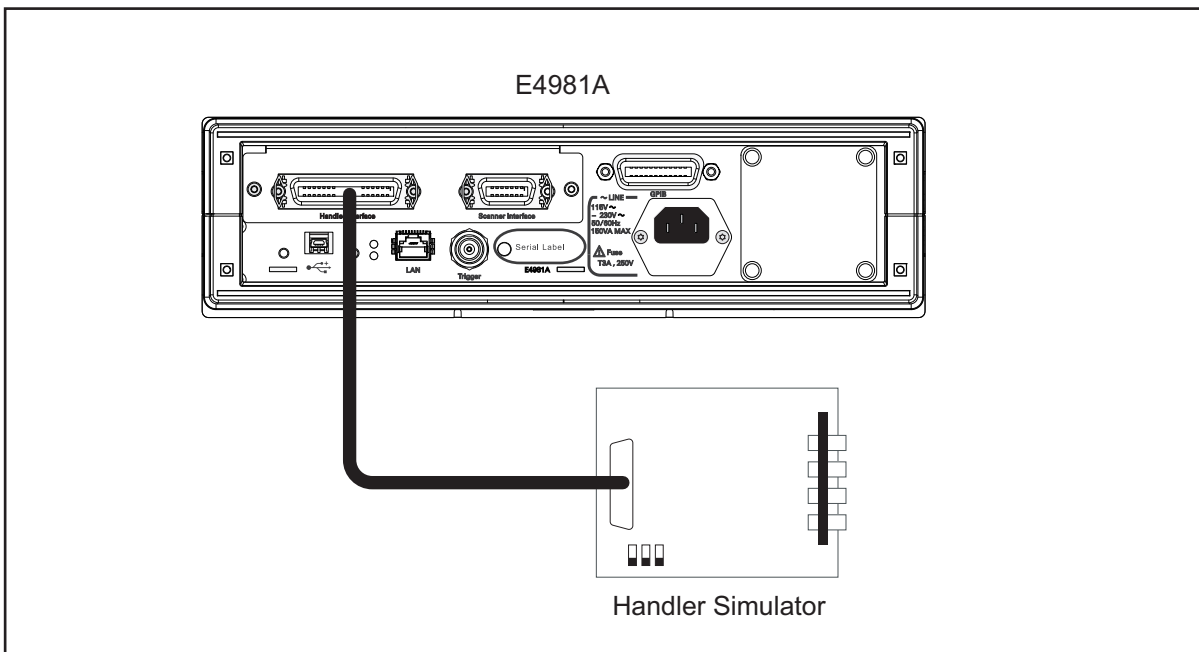
Table 4-7 Bit switch (S1) settings

Bit number *1	Factory default settings
1	Off
2	Off
3	Off
4	On
5	Off
6	Off
7	N.A.
8	N.A.

*1. The bit numbers referenced in this table are the numbers printed on the bit switch (S1) of the interface board.

- Step 4.** Replace the Interface Board.
- Step 5.** Turn the E4981A ON.
- Step 6.** Connect the handler interface connector on the E4981A's rear panel to the handler simulator as shown in Figure 4-10.

Figure 4-10 Handler Interface Function Test Setup



e4981ase1044

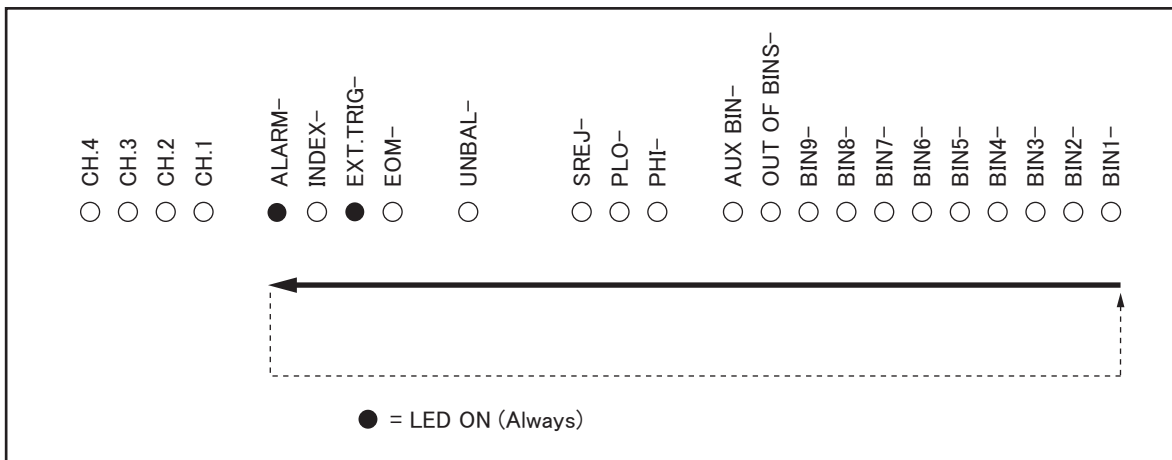
- Step 7.** Press [System].

- Step 8.** Press the **SELF TEST** softkey to display the **SELF TEST** page.
- Step 9.** Use the **CURSOR** arrow keys to move the cursor to the **TEST MENU** field.
- Step 10.** Use the softkeys to select the **HANDLER INTERFACE** test.

Softkey	Function
INCR +	Increments the test number of the Test Menu.
DECR -	Decrements the test number of the Test Menu.

- Step 11.** Press the **EXECUTE - TEST START** softkeys to execute the **HANDLER INTERFACE** test.
- Step 12.** Confirm that the LEDs on the handler simulator turn ON in accordance with the E4981A's output signals displayed on the LCD. The LEDs turns ON light in the sequence shown in Figure 4-11.

Figure 4-11 Handler Interface Function Check



e4980ase1051

- Step 13.** Press the **TEST STOP** softkey.

NOTE

Do not execute any SELF TEST except for the Handler Interface Test or the E4981A will become inoperative.

- Step 14.** Return the jumper and switch settings on the interface board to their original settings.

To Check the Scanner Interface Function

Perform this test only when troubleshooting the Interface Board. This test verifies the scanner interface function.

Equipment

Table 4-8

Equipment List of the Scanner Interface Function Test

Scanner Simulator	Agilent p/n 04278-65301
DC Power Supply	Agilent E3610A
1 kΩ Standard	Agilent 42030A (42037A)

Procedure

Step 1. Disconnect the power cable from the E4981A and allow 1 minute for the internal capacitors to discharge.

NOTE

Dangerous energy/voltage exists when the E4981A is in operation, and for a time after it is powered down. Allow 1 minutes for the internal capacitors to discharge.

Step 2. Remove the PSU Deck according to the procedure for describing in “PSU Deck Assembly Removal” on page 95.

NOTE

The interface board contains electronic components that can be damaged by static electricity through electrostatic discharge (ESD). To prevent ESD damage, maintain frequent contact with any bare sheet metal surface on the chassis. A grounding wrist strap (or similar device) is useful for this purpose. Handle the board carefully at all times. Avoid touching electronic components or circuit paths.

NOTE

Before performing Step 3, note the switch settings on the Interface Board in order to return them to the same settings at the end of this function test.

Step 3. Set S2 and S3 on the Interface Board to the same settings as when the board is shipped from the factory referring to Figure 4-11, Table 4-9, and .Table 4-10

Table 4-9 Setting Bit Switch (S2)

Bit	Default
1-8	Off

Table 4-10 Setting Bit Switch (S3)

Bit	Default
1	Off
2	Off

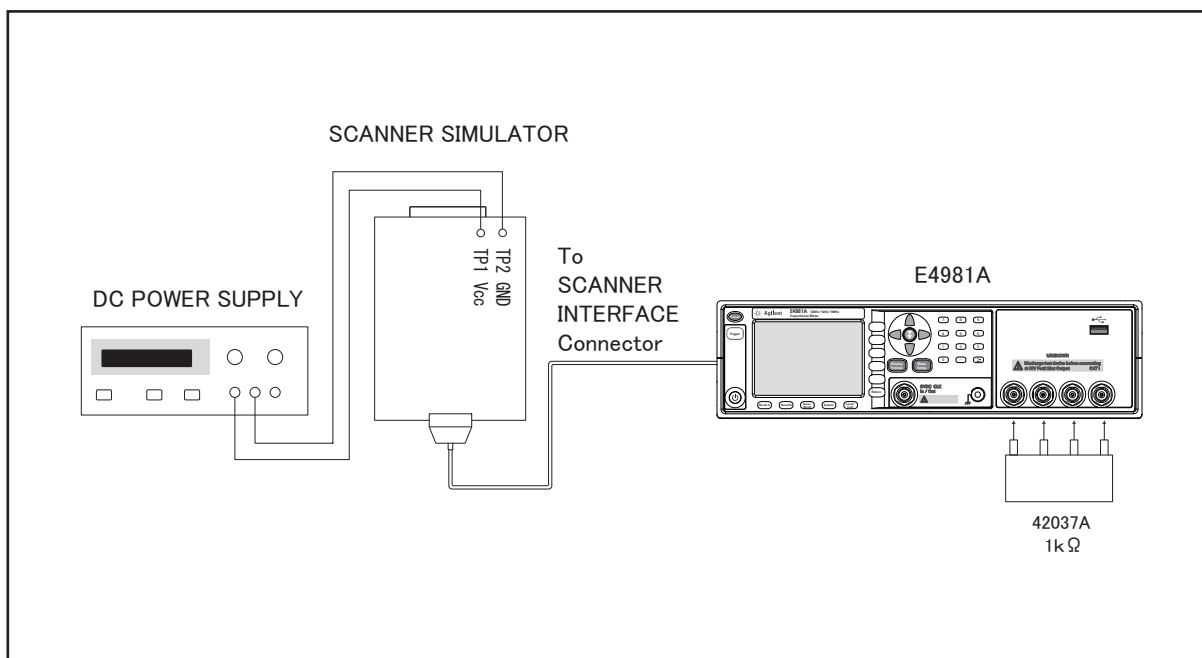
Table 4-10 Setting Bit Switch (S3)

Bit	Default
3	On
4	Off

Step 4. Replace the Interface Board.

Step 5. Set DC power supply output voltage +5 V. Connect TP2 (GND) on the scanner interface simulator to '-' terminal of the power supply. Then connect TP1 (Vcc) on the simulator to '+' terminal of the power supply. (Refer to Figure 4-12.)

Figure 4-12 Scanner Simulator Connections



e4981ase1045

NOTE DC power for the scanner interface simulator can be supplied from the E4981A instead of an external DC power supply.

Step 6. Connect the scanner simulator to the scanner interface connector on the E4981A's rear panel shown in Figure 4-12.

Step 7. Connect the 1 kΩ standard to the UNKNOWN terminal on the E4981A's front panel.

Step 8. Turn the E4981A ON.

Step 9. Press [System].

Step 10. Press the **SELF TEST** softkey to display the **SELF TEST** page.

Step 11. Use the **CURSOR** arrow keys to move the cursor to the **TEST MENU** field.

Troubleshooting
Function Specific Troubleshooting

Step 12. Use the softkeys to select the **SCANNER INTERFACE** test.

Softkey	Function
INCR +	Increments the test number of the Test Menu.
DECR -	Decrements the test number of the Test Menu.

Step 13. Press the **EXECUTE - TEST START** softkeys to execute the **SCANNER INTERFACE** test.

Step 14. Confirm that LEDs on the scanner simulator board turn ON in accordance with the E4981A settings displayed in the LCD.

Step 15. Press the **TEST STOP** softkey.

NOTE Do not execute any SELF TEST except for the Scanner Interface Test or the E4981A will become inoperative.

Step 16. Return the switch settings on the Interface Board to their original settings.

Performance test failure troubleshooting

This section describes the adjustment and troubleshooting procedures used when the E4981A fails the performance tests. If the performance of the instrument is critical for the test limits and seems to be adjustable, perform first the adjustment(s) related to the failed test. When the test result is far from the tolerance of the test or the performance is not adjustable, isolate the faulty assembly in accordance with the "Performance tests failure troubleshooting procedure".

Performance test failure troubleshooting

Table 4-11 represents the relationships between the failed test and probable faulty assembly. If the performance test failure cannot be removed by a proper adjustment, replace the assembly shown in this table.

Note that this table lists some typical cases. There are possibilities that another assembly may be faulty.

Table 4-11 Performance test failure troubleshooting information

Test Num.	First failed test	Probable faulty board assembly		
		A31	A34	PPMC
1	Test Signal Frequency Accuracy Test	#	###	
2	Test Signal Level Accuracy Test	#	###	
3	Impedance Measurement Accuracy Test	#	###	

###: Most suspicious assembly

##: Suspicious assembly

#: Possible faulty assembly

5 **Replaceable Parts**

This chapter contains information for ordering replacement parts for the E4981A.

Ordering Information

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

To order a part not listed in the replaceable parts lists, include the instrument model number, the description and function of the part, and the quantity of parts required. Address the order to the nearest Agilent Technologies Sales Office.

Direct Mail Order System

Within the USA, Agilent Technologies can supply parts through a direct mail order system. There are several advantages to this system:

- Direct ordering and shipping from the Agilent Technologies parts center in California, USA.
- No maximum or minimum on any mail order. (There is a minimum amount for parts ordered through a local Agilent Technologies Sales Office when the orders require billing and invoicing.)
- Prepaid transportation. (There is a small handling charge for each order.)
- No invoices.

In order for Agilent Technologies to provide these advantages, please send a check or money order with each order.

Mail order forms and specific ordering information are available through your local Agilent Technologies Sales Office. Addresses and telephone numbers are located in a separate document shipped with the manuals.

Exchange Assemblies

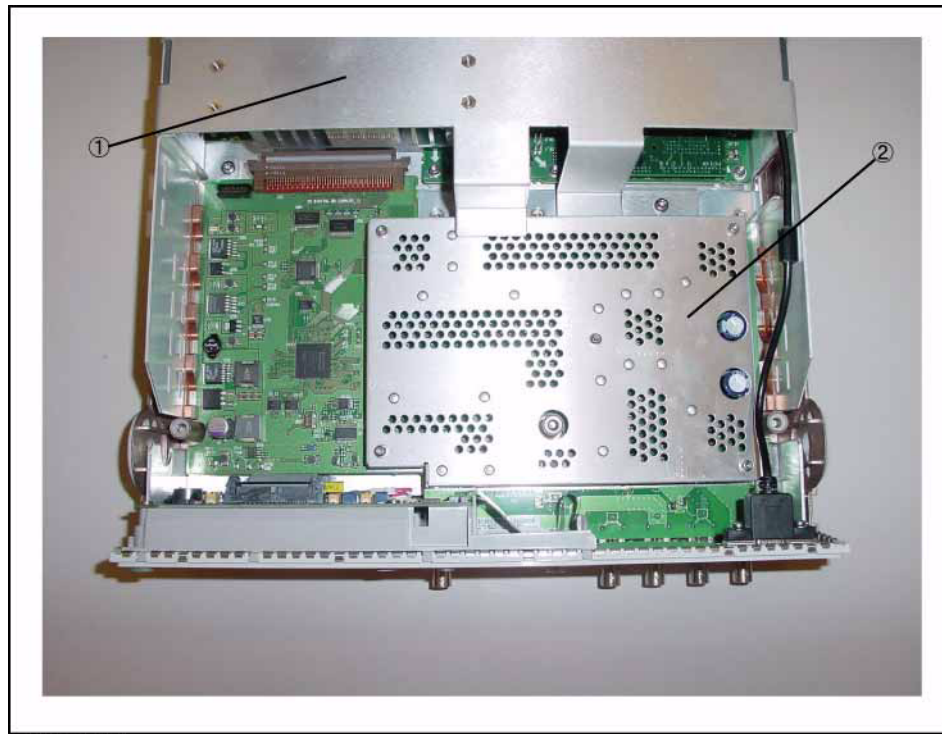
Under the rebuilt-exchange assembly program, certain factory-repaired and tested assemblies are available on a trade-in basis. These assemblies are offered at lower cost than a new assembly, but meet all factory specifications required of a new assembly.

The defective assembly must be returned for credit under the terms of the rebuilt-exchange assembly program. Any spare assembly stock desired should be ordered using the new assembly part number.

Replaceable Parts List

Top View (A34 Analog Board Assembly)

Figure 5-1 Top View (A34 Analog Board Assembly)



e4981ase1010

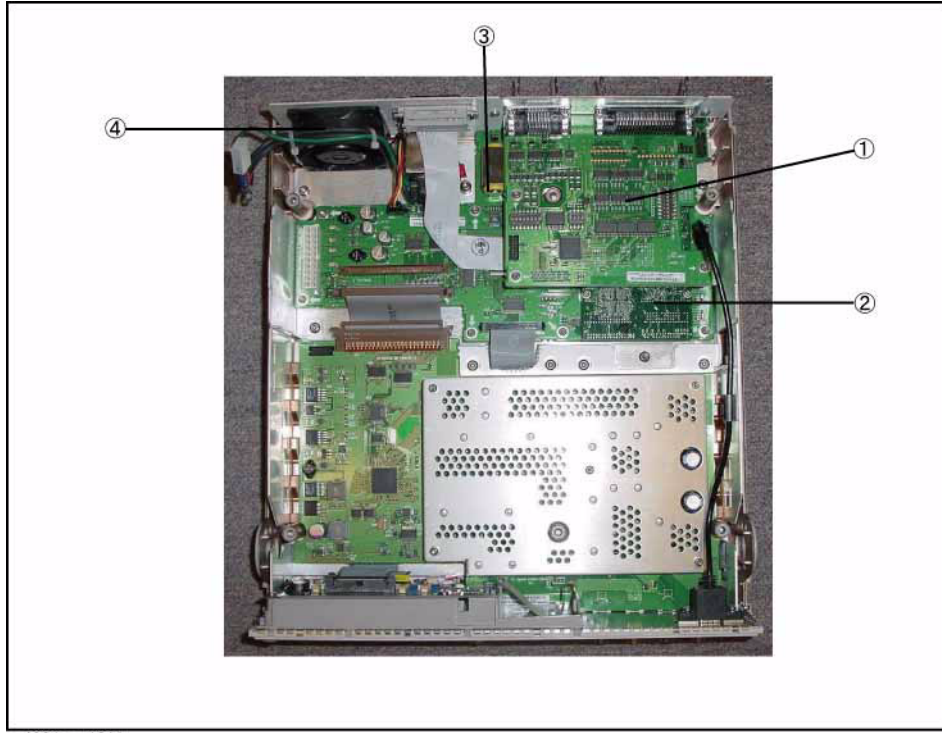
Table 5-1 Top View (A34 Analog Board Assembly)

Ref. Desig.	Agilent Part Number	Qty.	Description
1	See Table 5-6	1	PSU ASSEMBLY
2	E4980-66534	1	PCA EXM-C A34 ANALOG BOARD

Top View (Major Assemblies)

Figure 5-2

Top View (Major Assemblies)



e4981ase1011

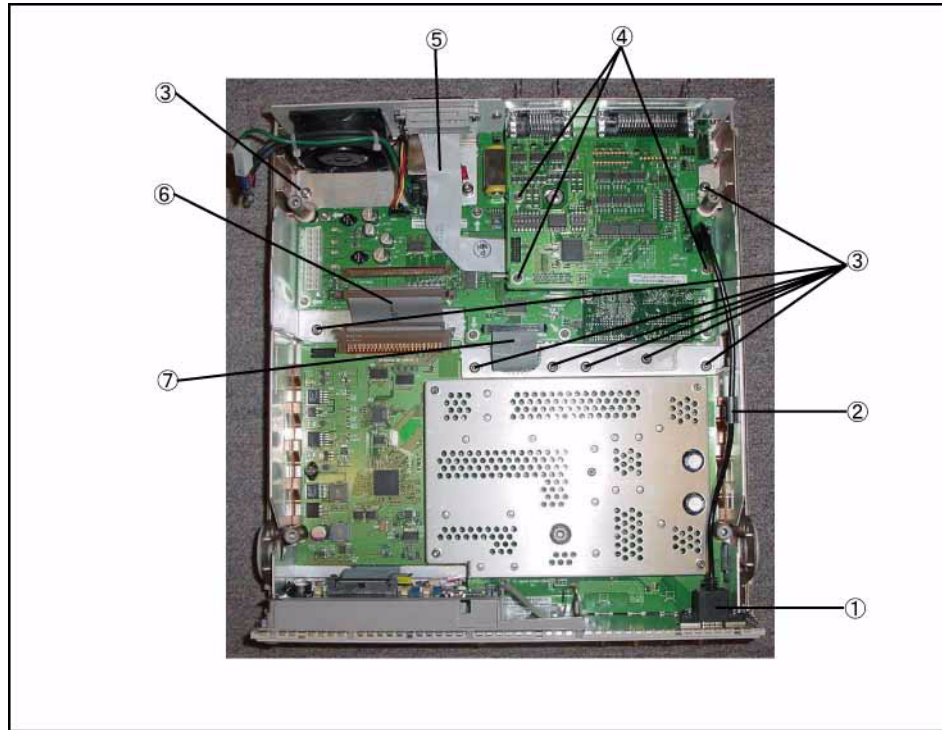
Table 5-2

Top View (Major Assemblies)

Ref. Desig.	Agilent Part Number	Qty.	Description
1	E4980-66537	1	PCA EXM-C INTERFACE BOARD
2	E4980-62004	1	P1001 INSTALLED OS
3	E4980-66531	1	PCA EXM A31 DIGITAL BOARD
4	See Table 5-7	1	FAN ASSEMBLY

Top View (Cables and Miscellaneous Parts)

Figure 5-3 Top View (Cables and Miscellaneous Parts)



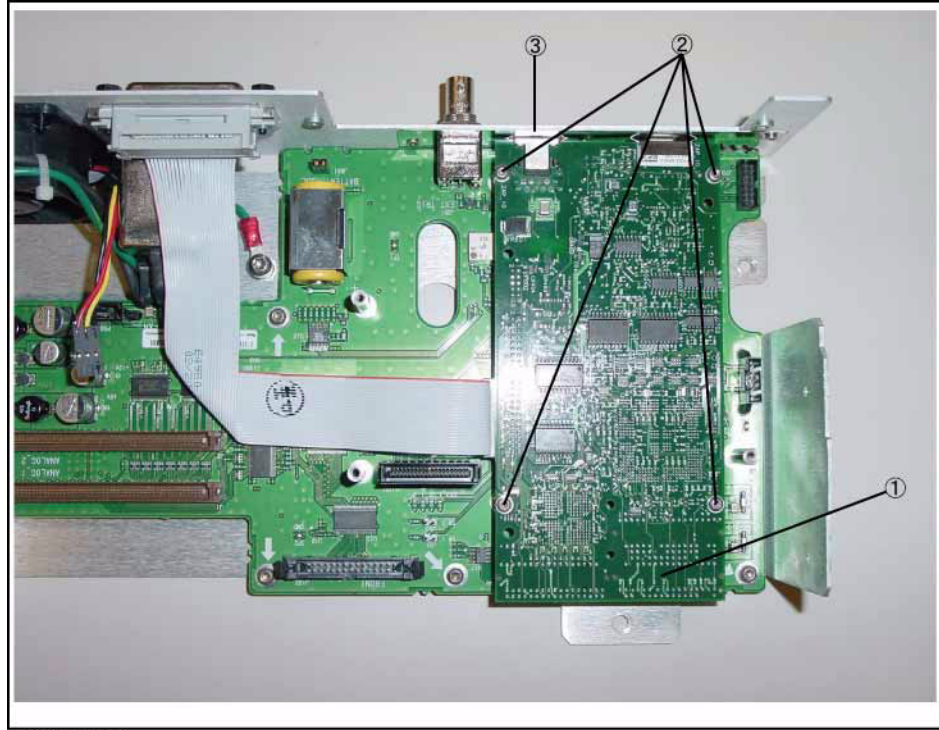
e4981ase1012

Table 5-3 Top View (Cables and Miscellaneous Parts)

Ref. Desig.	Agilent Part Number	Qty.	Description
1	E4980-61626	1	BULKHEAD USB CABLE
2	1400-3337	1	CLAMP-CABLE 0.25-IN-CABLE DIA
3	0515-2143	8	SCREW-MACH M4.0 x L6 PAN T20
4	0515-0430	3	SCREW-MACH M3.0 x L6 PAN T10
5	E4980-61624	1	CABLE ASSY GPIB
6	E4980-61621	1	FLAT CABLE ASSY
7	E4980-61620	1	CABLE ASSY LVDS

Rear Chassis Assembly (PPMC PCA)

Figure 5-4 Rear Chassis Assembly (PPMC PCA)



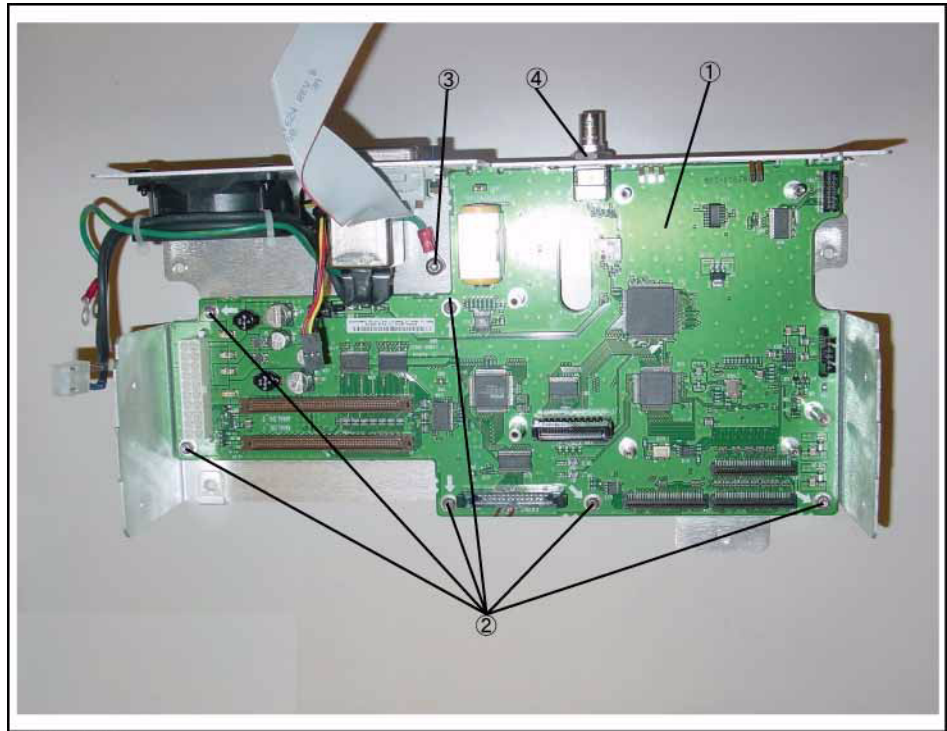
e4981ase1013

Table 5-4 Rear Chassis Assembly (PPMC PCA)

Ref. Desig.	Agilent Part Number	Qty.	Description
1	E4980-62004	1	P1001 INSTALLED OS
2	0515-1940	4	SCREW-MACH M2.5 x L6 PAN T8
3	E4980-07004	1	USB GASKET

Rear Chassis Assembly (A31 Digital Board)

Figure 5-5 Rear Chassis Assembly (A31 Digital Board)

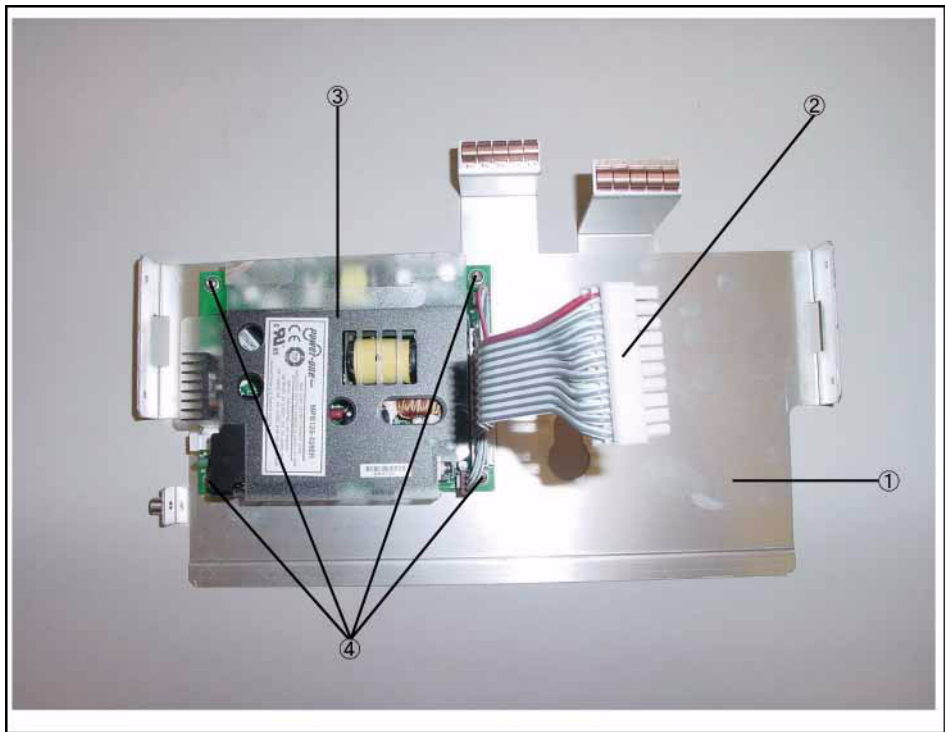


e4981ase1014
 Table 5-5 Rear Chassis Assembly (A31 Digital Board)

Ref. Desig.	Agilent Part Number	Qty.	Description
1	E4980-66531	1	PCA EXM A31 DIGITAL BOARD
2	0515-0430	6	SCREW-MACH M3.0 x L6 PAN T10
3	0515-4830	1	SCREW-MACH M4.0 x L5 PAN T20
4	2950-0054	1	NUT 1/2-28 THD
	3050-2230	1	WASHER-SPR-WAVY 13-MM-ID 17-MM-OD

Power Supply Unit Assembly

Figure 5-6 Power Supply Unit Assembly



e4981ase1016

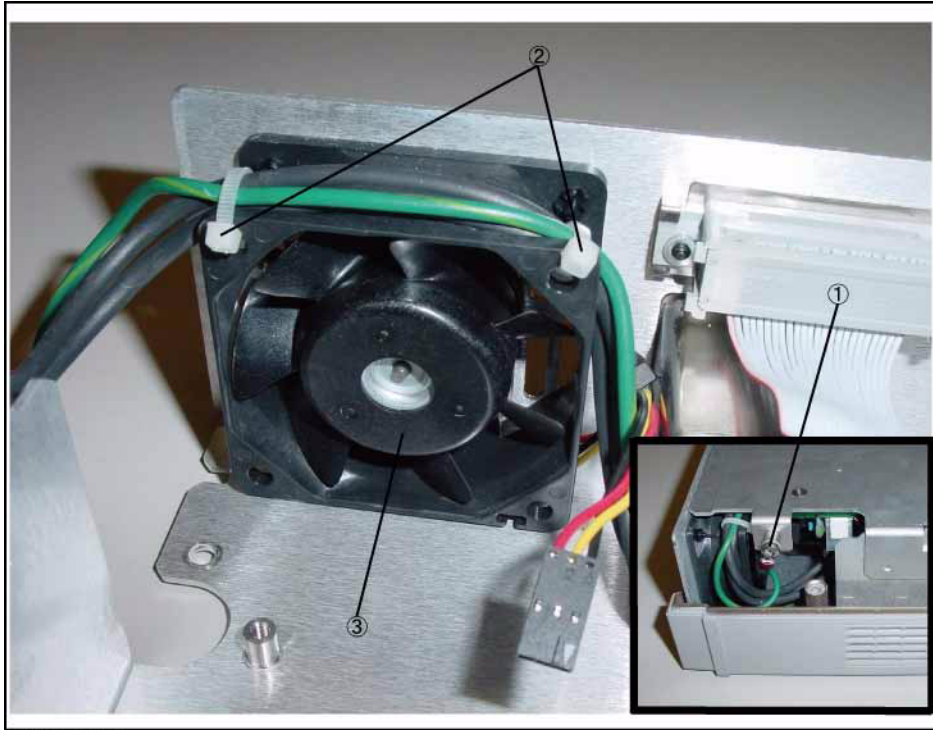
Table 5-6 Power Supply Unit Assembly

Ref. Desig.	Agilent Part Number	Qty.	Description
1	E4980-00104	1	DECK
2	E4980-61622	1	CABLE ASSY POWER
3	0950-4918	1	POWER SUPPLY 125-WATT 4-OUTPUT
	E4980-04002	1	PSU COVER
4	0515-0430	1	SCREW-MACH M3.0 x L6 PAN T10

Fan Assembly

Figure 5-7

Fan Assembly



e4981ase1019

Table 5-7 Fan Assembly

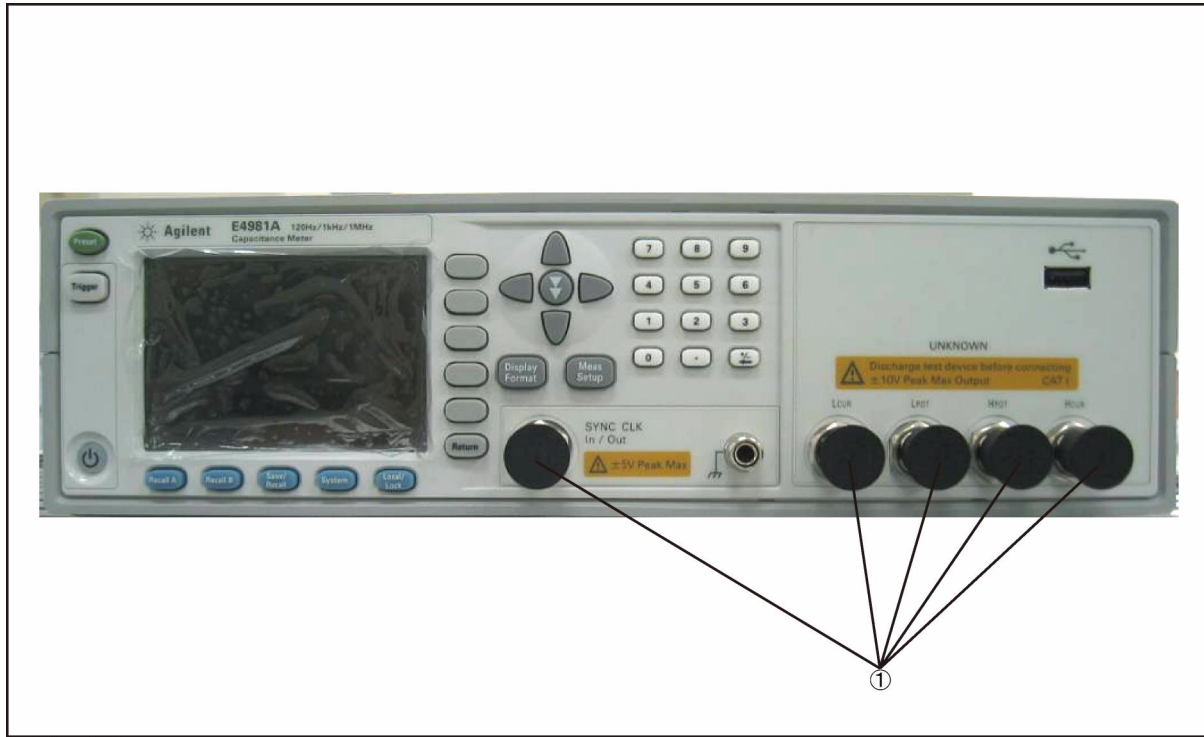
Ref. Desig.	Agilent Part Number	Qty.	Description
1	0515-2143	1	SCREW-MACH M4.0 x L6 PAN T20
2	1400-0249	2	CABLE TIE
3	E4980-61613	1	FAN ASSY

Replaceable Parts
 Replaceable Parts List

Front View

Figure 5-8

Front View



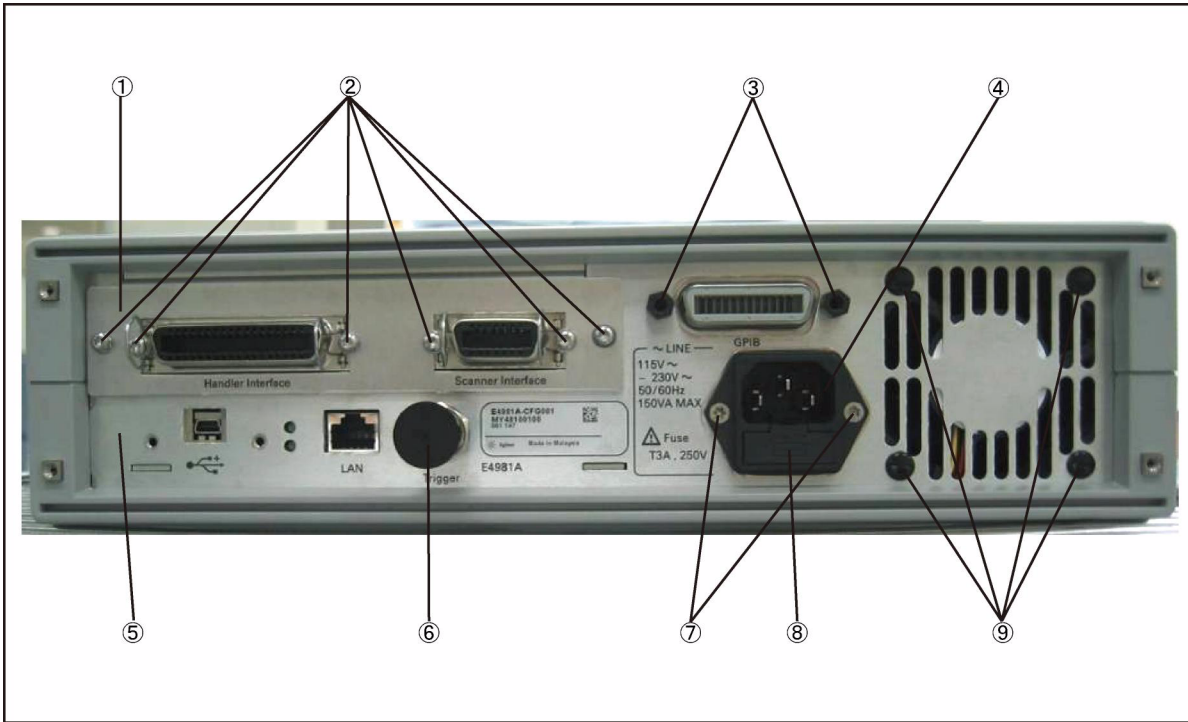
e4981ase1003

Table 5-8 Front View

Ref. Desig.	Agilent Part Number	Qty.	Description
1	1401-0048	5	CAP-BOTTLE
	2950-0054	5	NUT 1/2-28 THD
	3050-2230	5	WASHER-SPR-WAVY 13-MM-ID 17-MM-OD

Rear View

Figure 5-9 Rear View



e4981ase1004

Table 5-9 Rear View

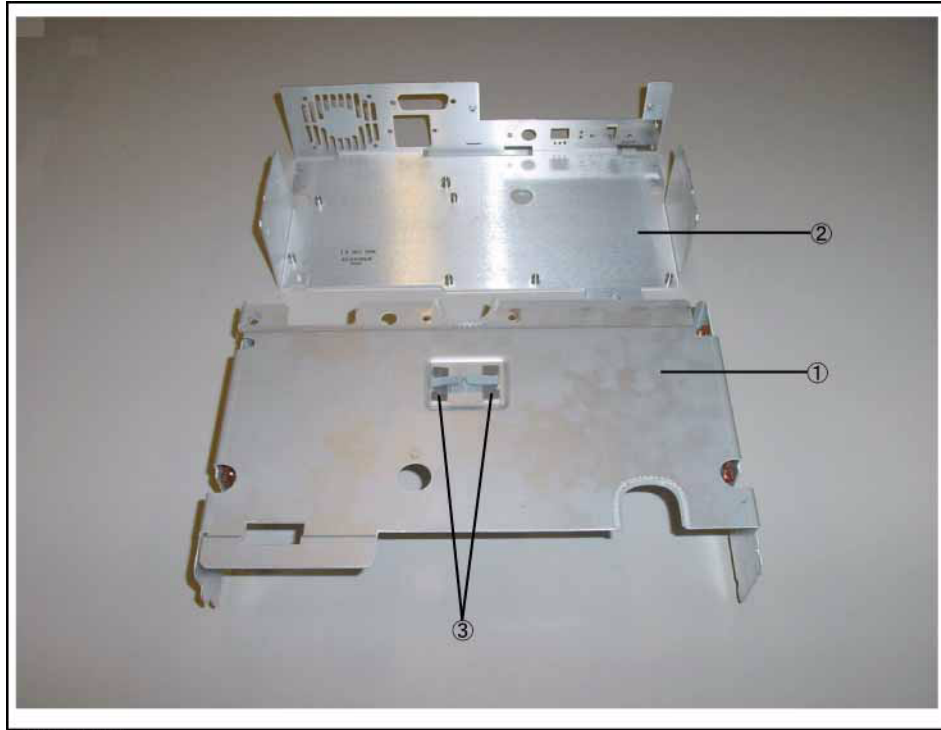
Ref. Desig.	Agilent Part Number	Qty.	Description
1	E4980-00209	1	PANEL I/F-C
2	0515-0430	6	SCREW-MACH M3.0 x L6 PAN T10
3	0380-4870	2	STANDOFF-HEX .591-INCH-LG 4-40-THD
4	E4980-61623	1	INLET ASSY
5	E4980-00102	1	CHASSIS DIGITAL
6	1401-0048	1	CAP-BOTTLE
7	0515-1946	2	SCREW-MACH M3.0 x L6 FT T10
8	2110-1017	1	FUSE 3.0A 250V
9	0361-1890	4	RIVET-PUSH-IN 8-MM-HEAD DIA 4-MM-BODY DIA

5. Replaceable Parts

Chassis Assembly

Figure 5-10

Chassis Assembly



e4981ase1017

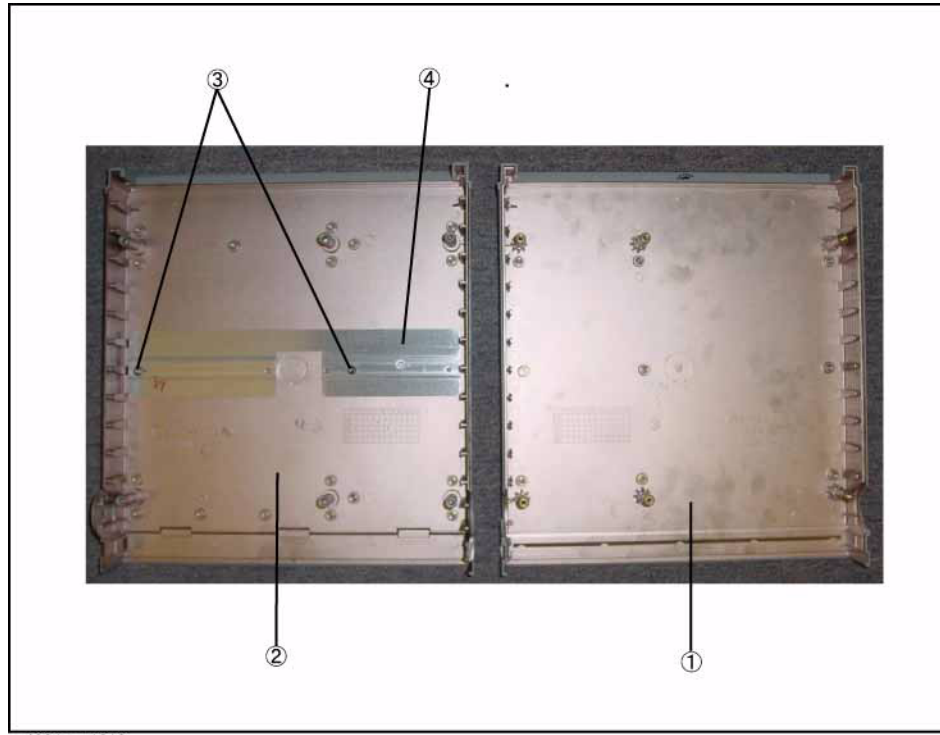
Table 5-10 Chassis Assembly

Ref. Desig.	Agilent Part Number	Qty.	Description
1	E4980-00103	1	CHASSIS ANALOG
2	E4980-00102	1	CHASSIS DIGITAL
3	1400-2143	2	CLAMP-HOSE 1-DIA NYL-6/6

3/4 Rack Module Assembly

Figure 5-11

3/4 Rack Module Assembly



e4981ase1018

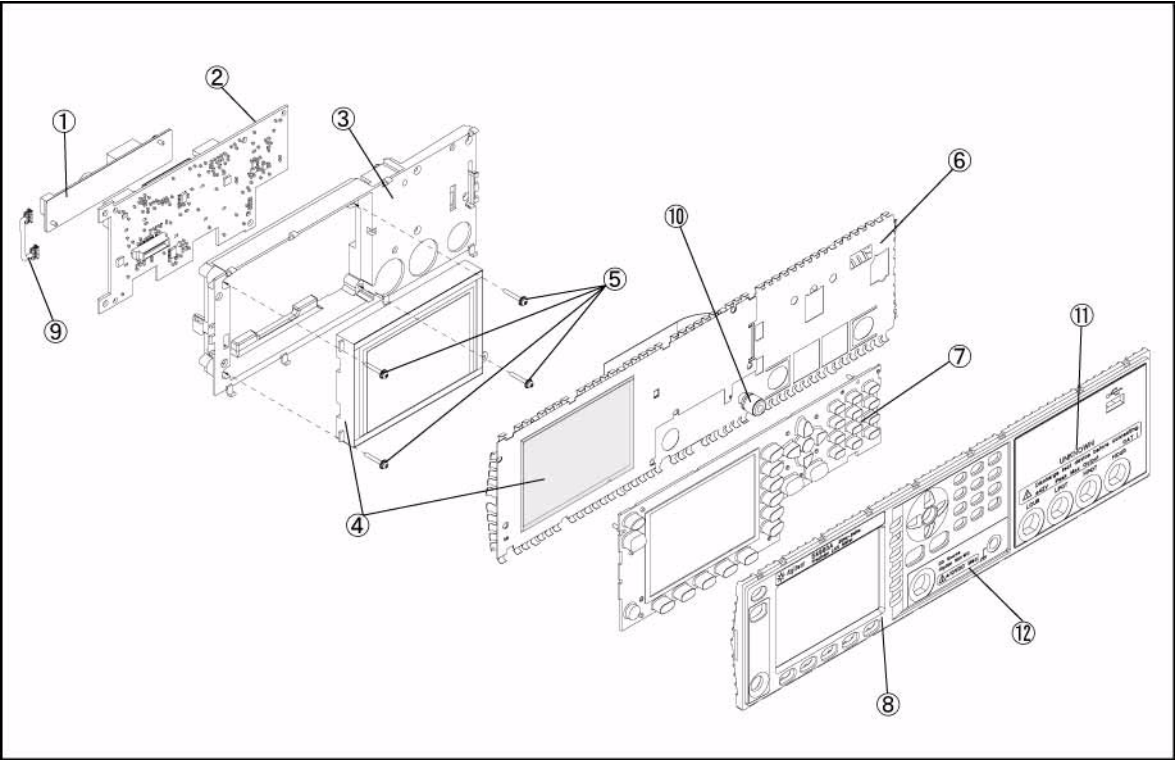
Table 5-11

3/4 Rack Module Assembly

Ref. Desig.	Agilent Part Number	Qty.	Description
1	5041-7719	1	3/4 RACK MODULE TOP
2	E4980-40003	1	3/4 RACK MODULE BOTTOM
3	0515-2143	2	SCREW-MACH M4.0 x L6 PAN T20
4	E4980-01208	1	PLATE

Front Panel

Figure 5-12 Front Panel



e4981ase1015

Table 5-12 Front Panel

Ref. Desig.	Agilent Part Number	Qty.	Description
1	E4980-25001	1	INSULATOR
	0950-4111	1	INVERTER
	0515-0658	2	SCREW-MACH M2.0 x L6 PAN T6
2	N1912-60002	1	DISPLAY INTERFACE
3	N1912-40002	1	DISPLAY SUPPORT
4	2090-0825	1	DISPLAY
	E4980-25003	2	LCD GASKET SHORT
	E4980-25004	2	LCD GASKET LONG
	N1912-20005	1	WINDOW,EMI SHIELD
5	0515-0661	4	SCREW-MACH M2.0 x L14 PAN T6
6	E4980-07006	1	EMI SHIELD FRONT
	N1912-20001	1	KEY FLEX CIRCUIT
7	E4980-40004	1	KEYPAD
8	E4980-40005	1	FRONT PANEL
9	N1912-61002	1	CABLE ASSY BACKLIGHT
10	1510-0130	1	BINDING POST SGL
	3050-2229	1	WASHER-SPR-WAVY 6.4-MM-ID
	2950-0006	1	NUT-HEX-DBL-CHAM 1/4-32-THD

NOTE Part numbers E4980-07001, N1912-20001 and E4980-40012 can be combined as a single sub-assembly under part number E4981-62001 (Refer to Table 5-13).

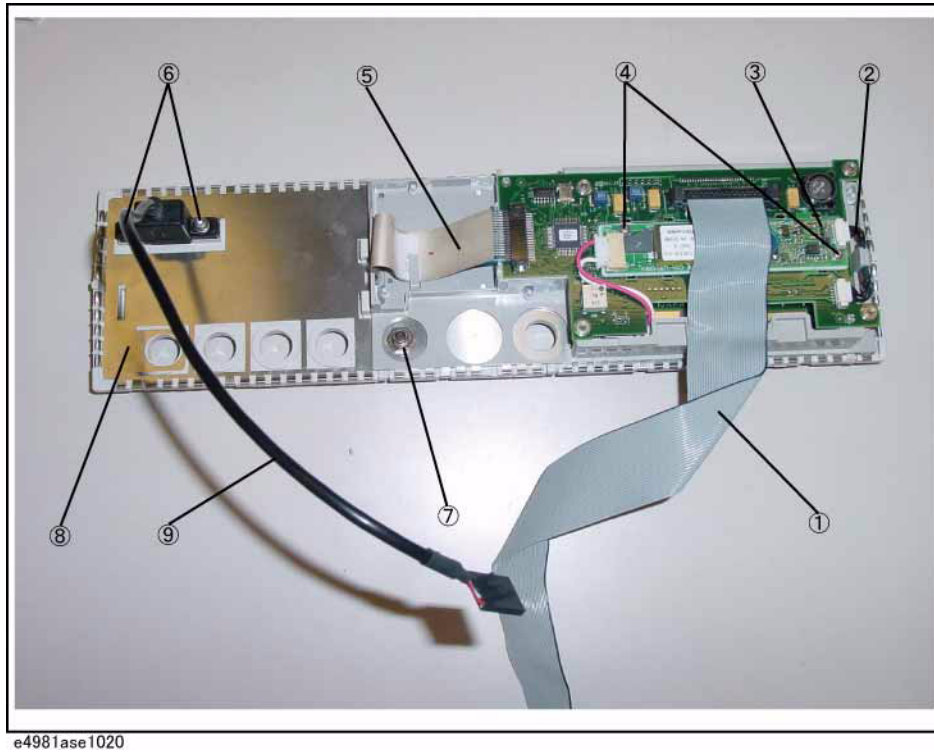
Replaceable Parts
Replaceable Parts List

Table 5-13 E4981-62001 Sub-Assembly

Ref. Desig.	Agilent Part Number	Qty.	Description
1	E4980-25001	1	INSULATOR
	0950-4111	1	INVERTER
	0515-0658	2	SCREW-MACH M2.0 x L6 PAN T6
2	N1912-60002	1	DISPLAY INTERFACE
3	N1912-40002	1	DISPLAY SUPPORT
4	2090-0825	1	DISPLAY
	E4980-25003	2	LCD GASKET SHORT
	E4980-25004	2	LCD GASKET LONG
	N1912-20005	1	WINDOW,EMI SHIELD
5	0515-0661	4	SCREW-MACH M2.0 x L14 PAN T6
6	E4980-07006	1	EMI SHIELD FRONT
	N1912-20001	1	KEY FLEX CIRCUIT
7	E4980-40004	1	KEYPAD
8	E4980-40005	1	FRONT PANEL
9	N1912-61002	1	CABLE ASSY BACKLIGHT
10	1510-0130	1	BINDING POST SGL
	3050-2229	1	WASHER-SPR-WAVY 6.4-MM-ID
	2950-0006	1	NUT-HEX-DBL-CHAM 1/4-32-THD
11	E4980-87008	1	TERMINAL LABEL
12	E4980-87009	1	GND LABEL

Front Panel and Inverter Assembly

Figure 5-13 Front Panel and Inverter Assembly



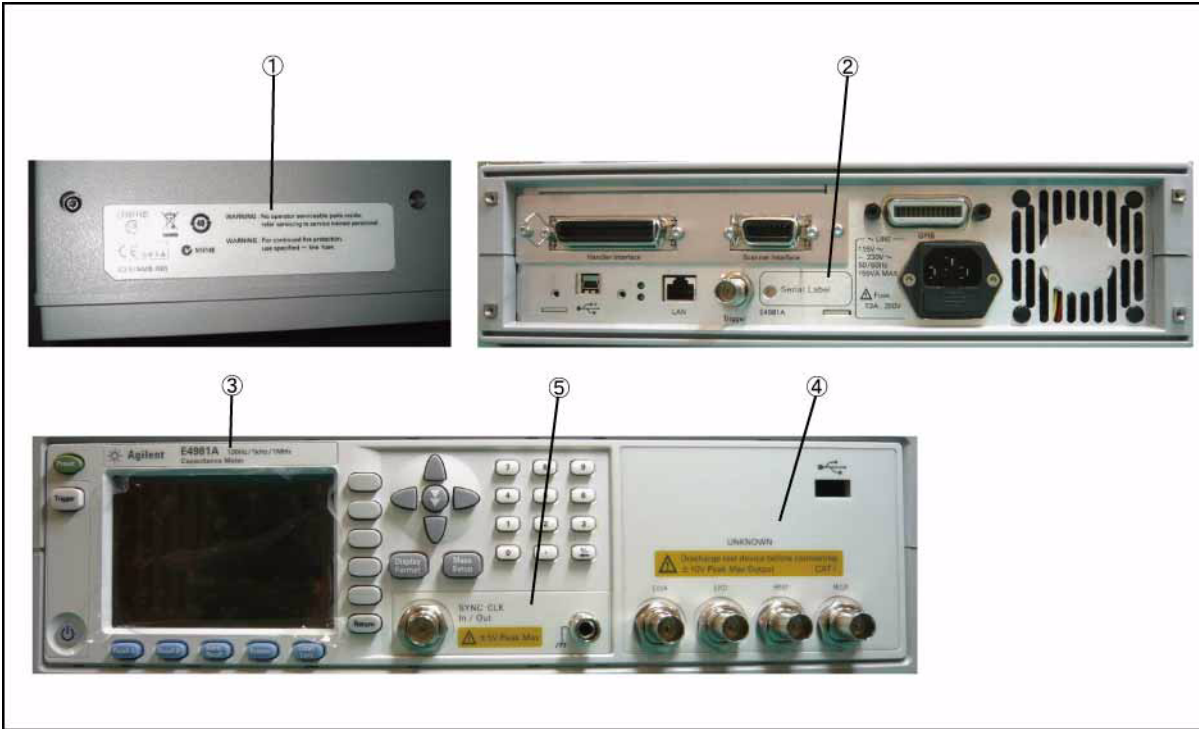
e4981ase1020

Table 5-14 Front Panel and Inverter Assembly

Ref. Desig.	Agilent Part Number	Qty.	Description
1	E4980-61620	1	CABLE ASSY LVDS
2	N1912-61002	1	CABLE ASSY BACKLIGHT
3	0950-4111	1	INVERTER
	E4980-25001	1	INSULATOR
4	0515-0658	1	SCREW-MACH M2.0 x L6 PAN T6
5	N1912-20001	1	KEY FLEX CIRCUIT
6	0515-0374	2	SCREW-MACH M3.0 x L10 PAN T10
7	2950-0006	1	NUT-HEX-DBL-CHAM 1/4-32-THD
	3050-2229	1	WASHER-SPR-WAVY 6.4-MM-ID
	1510-0130	1	BINDING POST SGL
8	E4980-07006	1	EMI SHILD FRONT
9	E4980-61626	1	BULKHEAD USB CABLE

Label Assembly

Figure 5-14 Label Assembly



e4981ase1002
 Table 5-15 Label Assembly

Ref. Desig.	Agilent Part Number	Qty.	Description
1	E4980-87005	1	GND LABEL
2	9320-6627	1	BNC LABEL
3	E4980-87007	1	NAME LABEL (Option 001)
	E4980-87011	1	NAME LABEL (Option 002)
4	E4980-87008	1	TERMINAL LABEL
5	E4980-87009	1	GND LABEL

Bumpers & Handle Assembly

Figure 5-15

Bumpers & Handle Assembly



e4981ase1009

Table 5-16

Bumpers & Handle Assembly

Ref. Desig.	Agilent Part Number	Qty.	Description
1	E4980-45001	1	HANDLE
2	34480-46001	1	FRONT BUMPER
3	34480-46002	1	REAR BUMPER

Replaceable Parts
Replaceable Parts List

Other Parts

Table 5-17 **Other Parts**

Agilent Part Number	Qty.	Description
E4981-901x0 ^{*1}	1	SERVICE GUIDE
82357-61601	1	USB CABLE

*1. The number indicated by "x" in the part number of the manual, 0 for the first edition, is incremented by 1 each time a revision is made. The latest edition comes with the product.

6 Replacement Procedure

This chapter provides procedure for removing and replacing the major assemblies in the E4981A.

Replacing an Assembly

The following steps show the sequence for replacing an assembly in a E4981A Capacitance Meter.

1. Identify the faulty group. Refer to Chapter 4, “Troubleshooting.”
2. Order a replacement assembly. Refer to Chapter 5, “Replaceable Parts.”
3. Replace the faulty assembly and determine what adjustments are necessary. Refer to This chapter and Chapter 7, “Post-Repair Procedures.”
4. Perform the necessary adjustments. Refer to Chapter 3, “Adjustment.”
5. Perform the necessary performance tests. Refer to Chapter 2, “Performance Test.”

WARNING

These servicing instructions are for use by qualified personnel only. To avoid electrical shock, do not perform any servicing unless you are qualified to do so.

WARNING

The opening of covers or removal of parts is likely to expose dangerous voltages. Disconnect the instrument from its power supply.

CAUTION

Many of the assemblies in this instrument are very susceptible to damage from ESD(electrostatic discharge). Perform the following procedures only at a static-safe workstation and wear a grounding strap.

Tightening Torque of Screws

Please refer to the following table for the tightening torque of screws if no torque is specified by this chapter.

Used Tool	Type	Recommended Torque
Torque Screwdriver	T6	0.34 N-m (3.0 lb-in)
Torque Screwdriver	T8	0.59 N-m (5.2 lb-in)
Torque Screwdriver	T10	1.02 N-m (9.0 lb-in)
Torque Screwdriver	T20	2.37 N-m (21.0 lb-in)
Box Torque Wrench	7 mm	0.98 N-m (8.7 lb-in)
Box Torque Wrench	3/8 in.	1.97 N-m (17.4 lb-in)
Box Torque Wrench	5/8 in.	1.97 N-m (17.4 lb-in)

Required Tools

The following tools are required for repair of E4981A.

Table 6-1 Required Tools

Assembly	Torque screwdriver				Cutting plier	Flat edge driver	Box torque wrench		
	T6	T8	T10	T20			7 mm	3/8 in.	5/8 in.
3/4 Rack Module Top				√					
PSU Deck Assembly				√					
PSU Assembly			√	√					
Front Chassis Assembly				√					
Front Panel Assembly				√					√
A34 Analog Board				√					√
Interface Board			√	√					
PPMC PCA		√	√	√					
A31 Digital Board		√	√	√					√
Rear Chassis Assembly				√					
Plate Assembly				√					
Fan Assembly				√	√	√			
GPIB Assembly			√	√			√		
Power Inlet Assembly			√	√	√				
USB Assembly			√	√					
Binding Post Assembly				√				√	
Inverter Assembly	√			√					√
Display Support	√			√					√
LCD and Display Interface Board	√			√					√
Front Panel, Key Pad, and Key Flex Circuit	√		√	√				√	√

3/4 Rack Module Top Replacement

Tools Required

- Torque screwdriver, TORX T20

Removal Procedure

Refer to Figure 6-1, Figure 6-2 and for this procedure.

- Step 1.** Disconnect the power cable from the E4981A.
- Step 2.** Remove the handle, front bumper and rear bumper. (item 1, 2, 3)

NOTE To remove the handle, rotate the handle to a vertical position and pull the arms outwards.

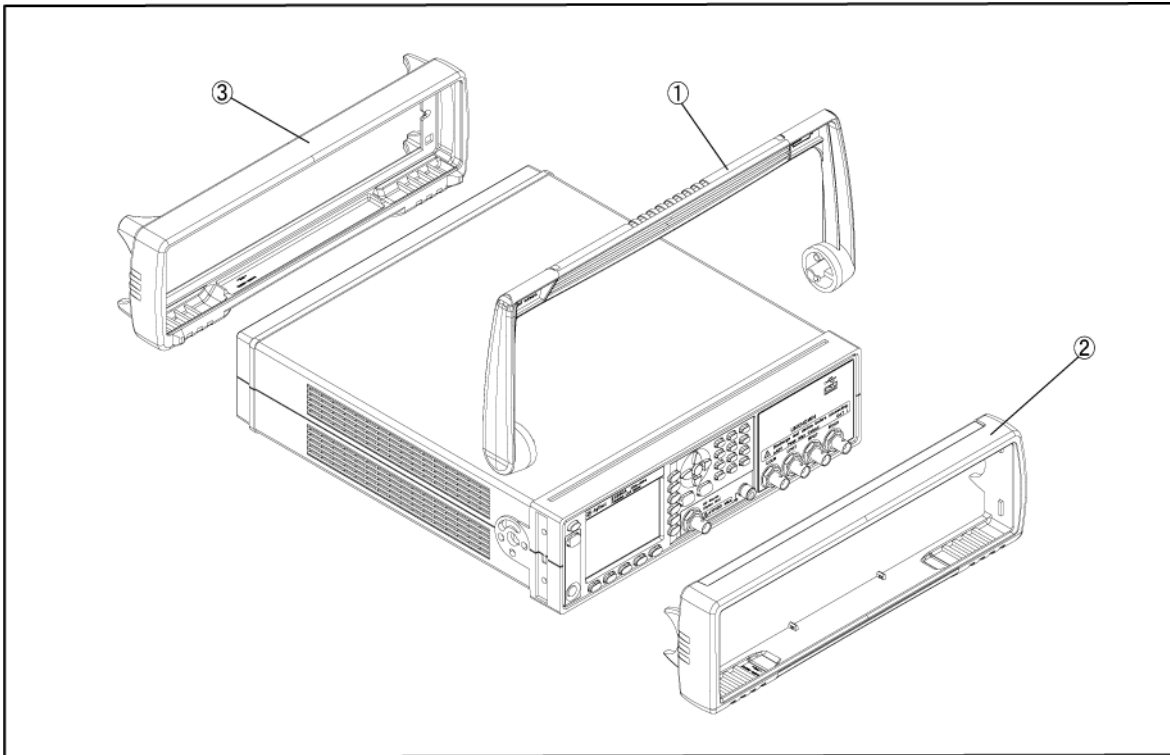
- Step 3.** Work the six TORX T20 screws (item 4) loose from the bottom.
- Step 4.** Remove the 3/4 Rack Module Top.

Replacement Procedure

- Step 1.** Reverse the order of the removal procedure.

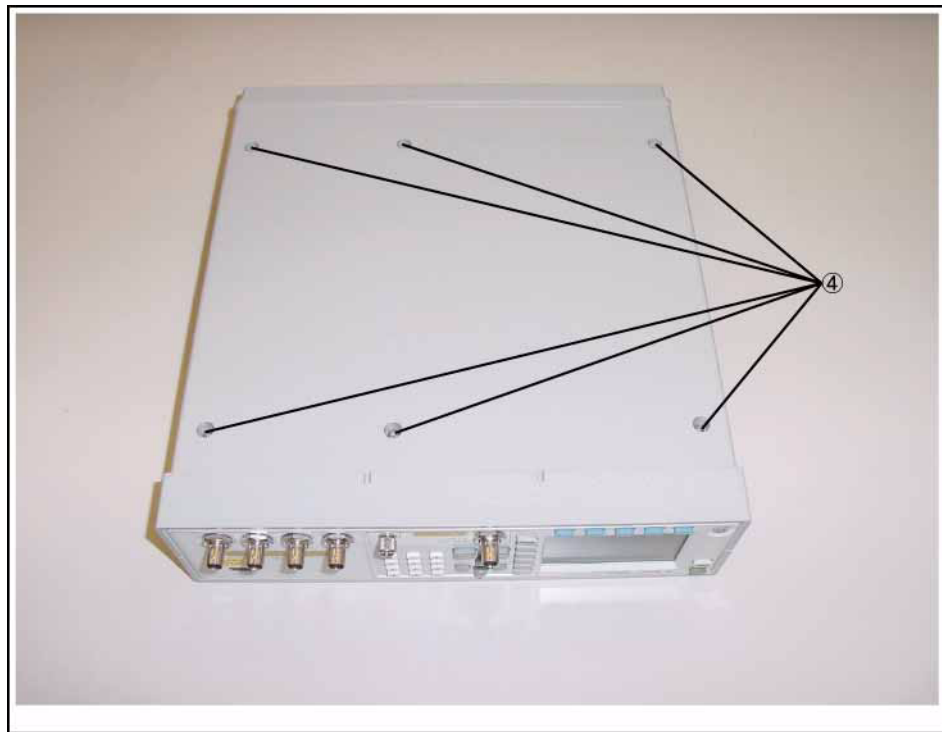
NOTE Fasten the 3/4 Rack Module Top from the Rack Module Bottom in the specified order. (Figure 6-3)

Figure 6-1 3/4 Rack Module Top Removal (1 of 2)



e4981ase1021

Figure 6-2 3/4 Rack Module Top Removal (2 of 2)



e4981ase1022

Replacement Procedure
3/4 Rack Module Top Replacement

Figure 6-3

Screw Fastening Sequence



e4981ase1023

PSU Deck Assembly Removal

Tools Required

- Torque screwdriver, TORX T20

Removal Procedure

Refer to Figure 6-4 and for this procedure.

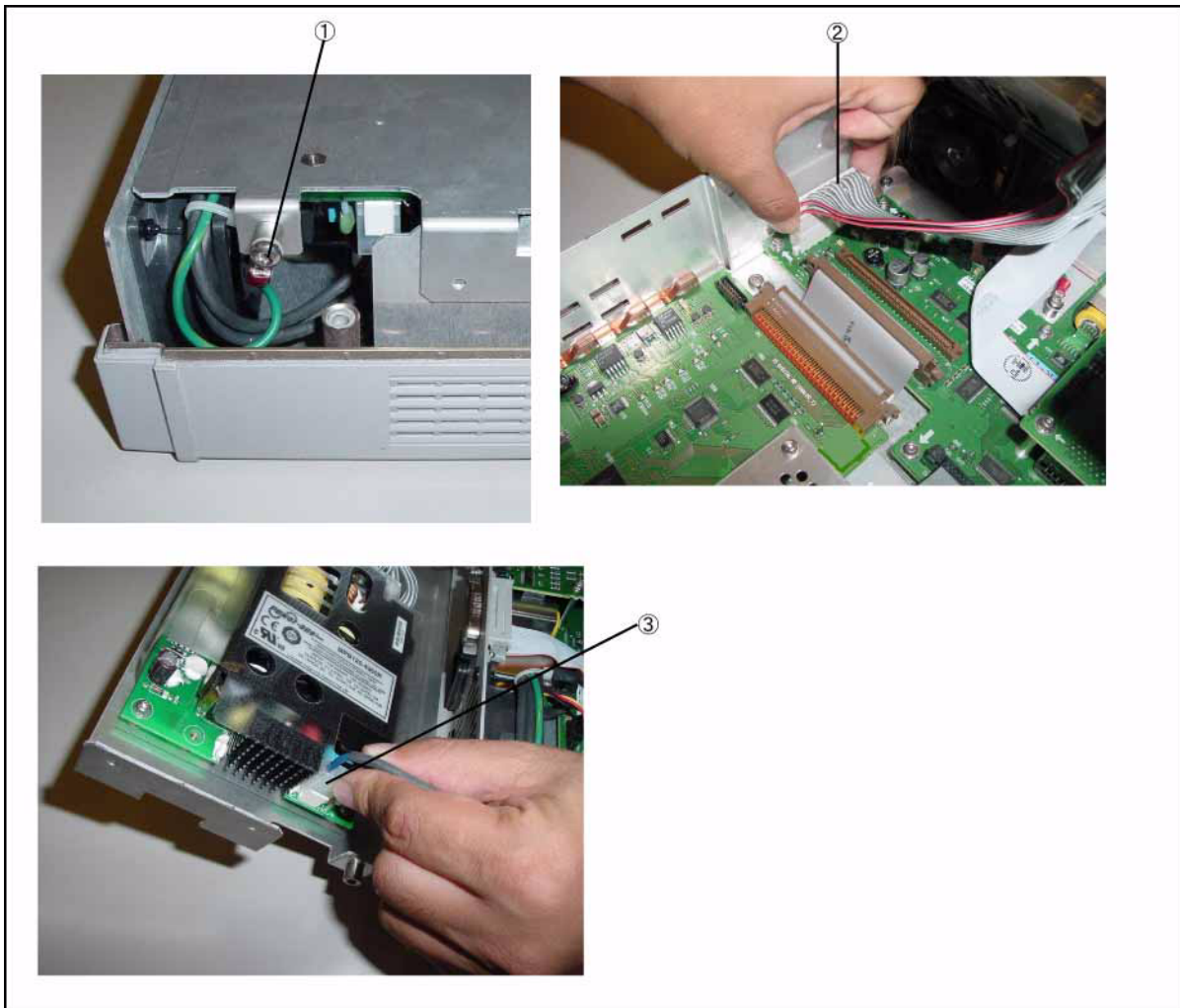
- Step 1.** Remove the 3/4 rack module top as described in “3/4 Rack Module Top Replacement” on page 92.
- Step 2.** Remove a TORX T20 screw (item 1) fastening the ground cable.
- Step 3.** Lift the PSU Deck Assembly vertically from the Rear Chassis Assembly.
- Step 4.** Disconnect the secondary cable (item 2) from the A31 Digital Board.
- Step 5.** Disconnect the Primary cable (item 3) from the PSU Assembly.

Replacement Procedure

- Step 1.** Reverse the order of the removal procedure.

Replacement Procedure
PSU Deck Assembly Removal

Figure 6-4 PSU Deck Assembly Removal



e4981ase1024

PSU Assembly Replacement

Tools Required

- Torque screwdriver, TORX T10
- Torque screwdriver, TORX T20

Removal Procedure

Refer to Figure 6-5 and for this procedure.

- Step 1.** Remove the 3/4 rack module top as described in “3/4 Rack Module Top Replacement” on page 92.
- Step 2.** Remove the PSU Deck Assembly as described in “PSU Deck Assembly Removal” on page 95.
- Step 3.** Uncross the insulator (item 1) with the PSU Assembly.
- Step 4.** Disconnect the secondary cable (item 2) from the PSU Assembly.

NOTE

Be careful not to break the hook of connector.

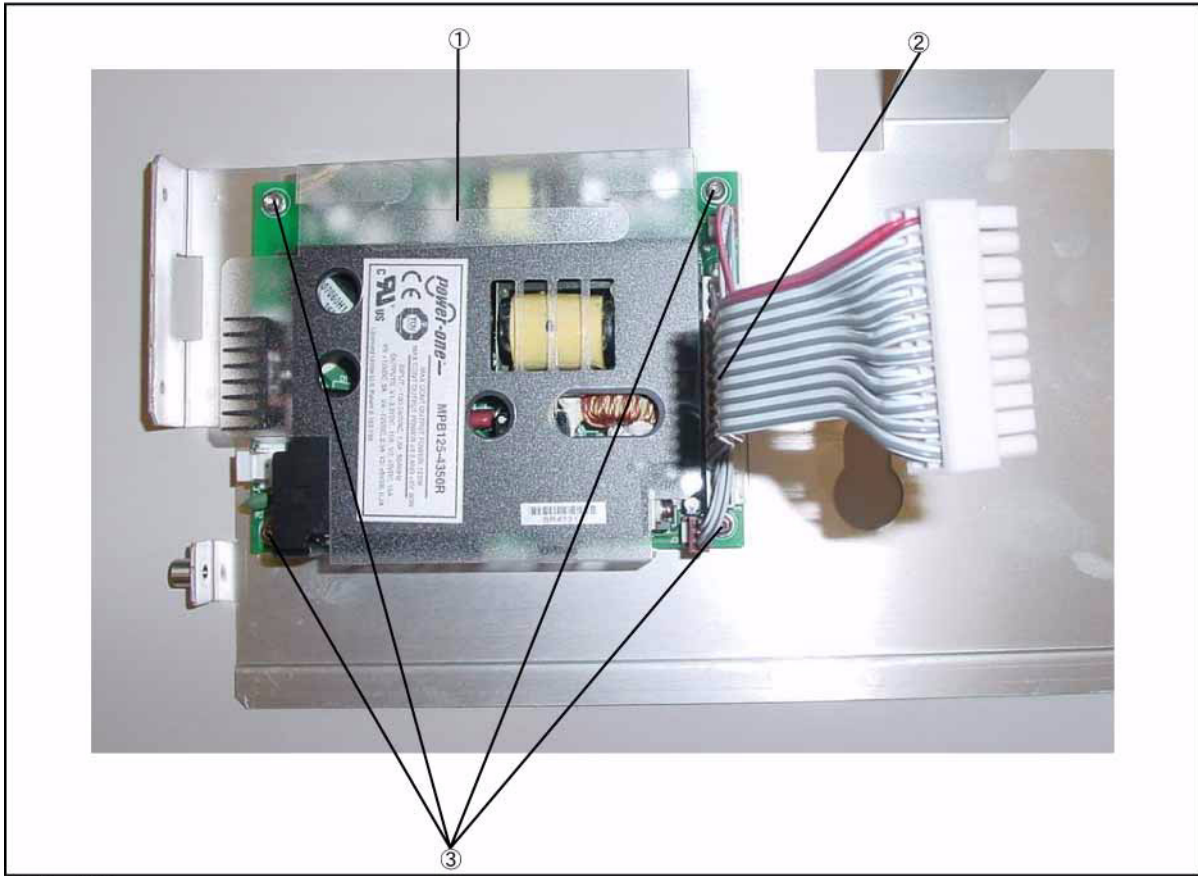
- Step 5.** Remove the four TORX T10 screws (item 3) fastening the PSU Deck.

Replacement Procedure

- Step 1.** Reverse the order of the removal procedure.

Replacement Procedure
PSU Assembly Replacement

Figure 6-5 PSU Assembly Replacement



e4981ase1025

Front Chassis Assembly Removal

Tools Required

- Torque screwdriver, TORX T20

Removal Procedure

Refer to Figure 6-6 and for this procedure.

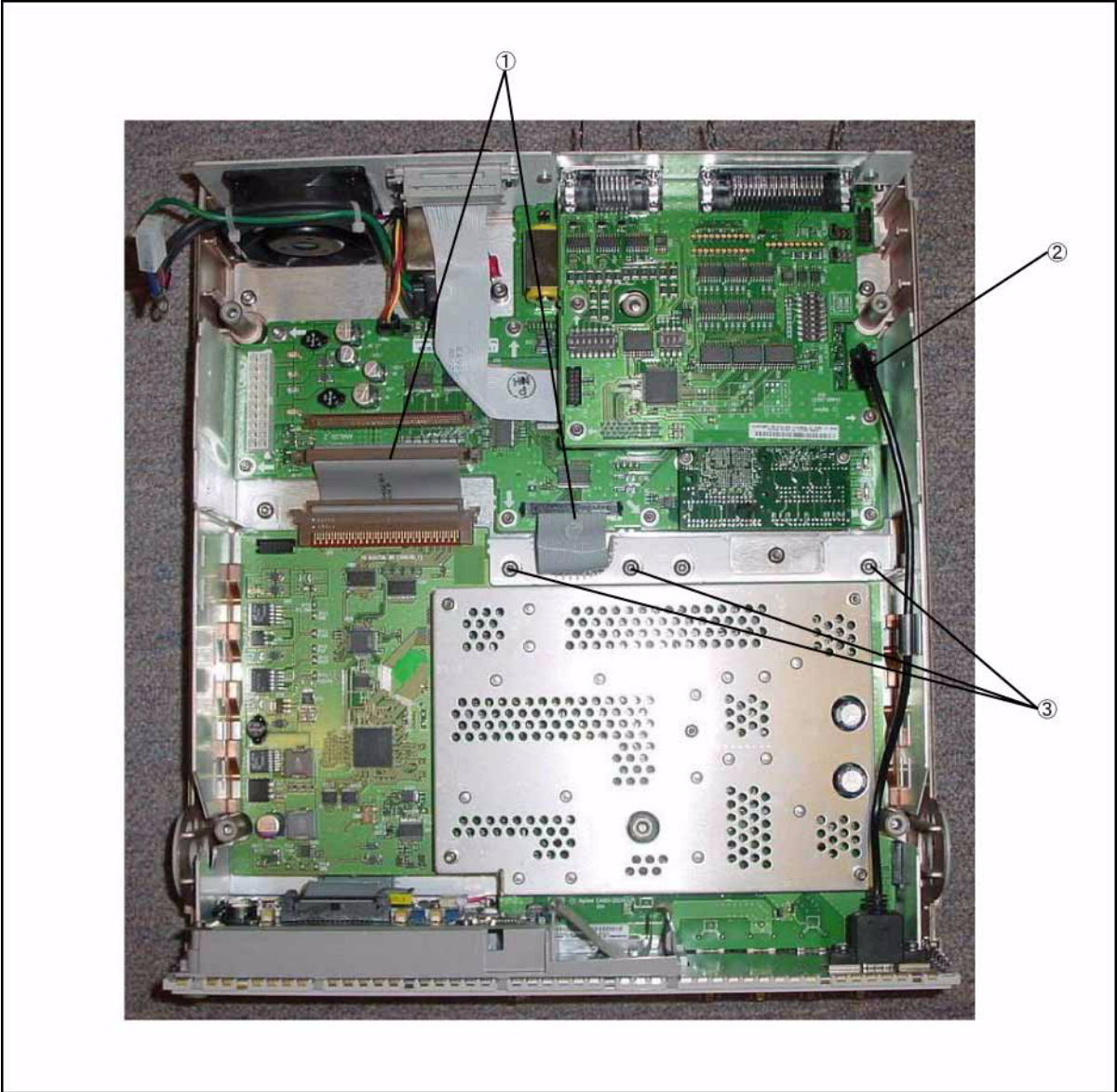
- Step 1.** Remove the 3/4 rack module top as described in “3/4 Rack Module Top Replacement” on page 92.
- Step 2.** Remove the PSU Deck Assembly as described in “PSU Deck Assembly Removal” on page 95.
- Step 3.** Disconnect the two cables (item 1) from the A34 Analog Board.
- Step 4.** Disconnect the USB cable (item 2) from the Interface Board.
- Step 5.** Remove the three TORX T20 screws (item 3) fastening the Front Chassis Assembly.

Replacement Procedure

- Step 1.** Reverse the order of the removal procedure.

Replacement Procedure
Front Chassis Assembly Removal

Figure 6-6 Front Chassis Assembly Removal



e4981ase1026

Front Panel Assembly Removal

Tools Required

- Torque screwdriver, TORX T20
- Box torque wrench, 5/8 inch

Removal Procedure

Refer to Figure 6-7 and for this procedure.

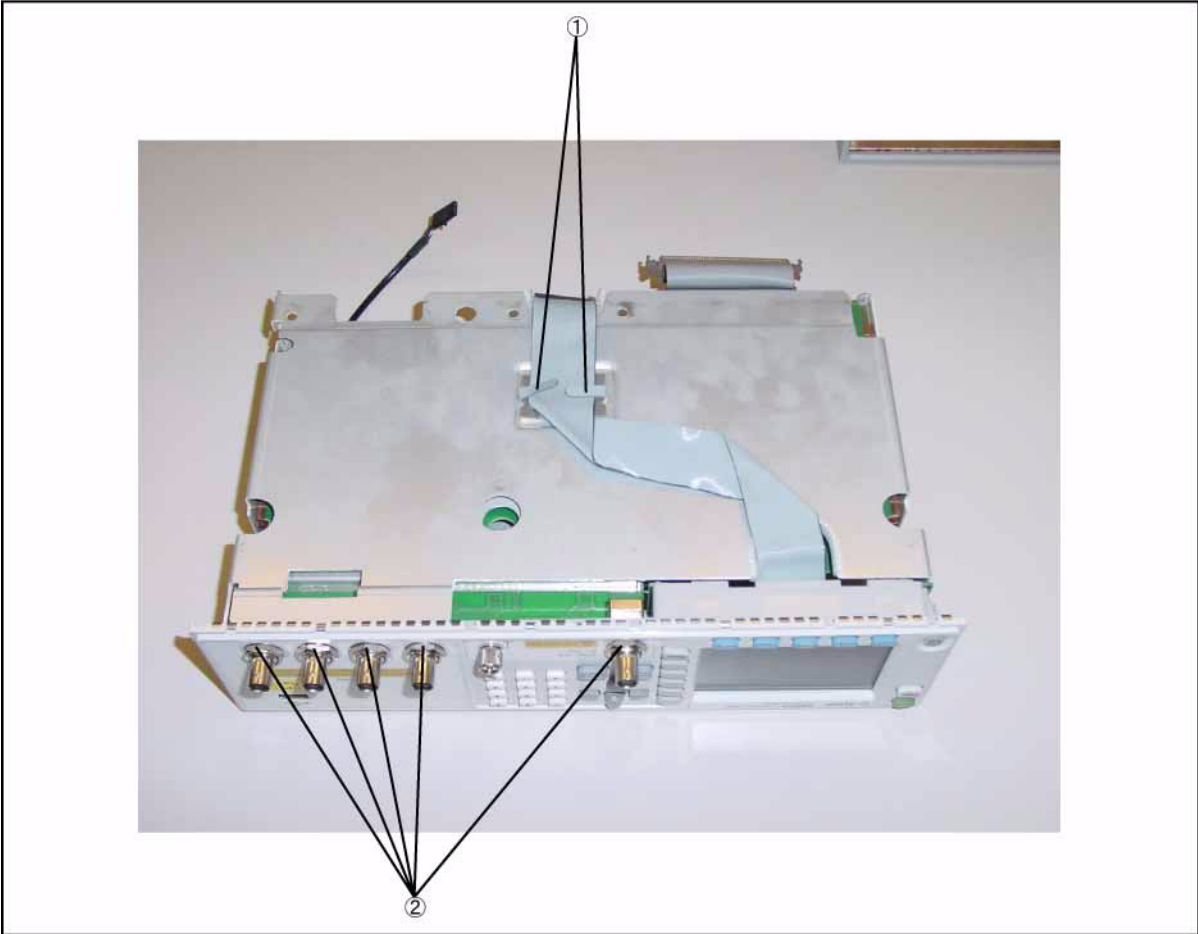
- Step 1.** Remove the 3/4 rack module top as described in “3/4 Rack Module Top Replacement” on page 92.
- Step 2.** Remove the PSU Deck Assembly as described in “PSU Deck Assembly Removal” on page 95.
- Step 3.** Remove the Front Chassis Assembly as described in “Front Chassis Assembly Removal” on page 99.
- Step 4.** Release the cable from the cable clamp (item 1).
- Step 5.** Remove the five 5/8 inch nuts and washers (item 2) fastening the BNC connector.
- Step 6.** Remove the A34 Analog Board from Front Panel.

Replacement Procedure

- Step 1.** Reverse the order of the removal procedure.

Replacement Procedure
Front Panel Assembly Removal

Figure 6-7 **Front Panel Assembly Removal**



e4981ase1027

A34 Analog Board Assembly Replacement

Tools Required

- Torque screwdriver, TORX T20
- Box torque wrench, 5/8 inch

Removal Procedure

Refer to Figure 6-8 and for this procedure.

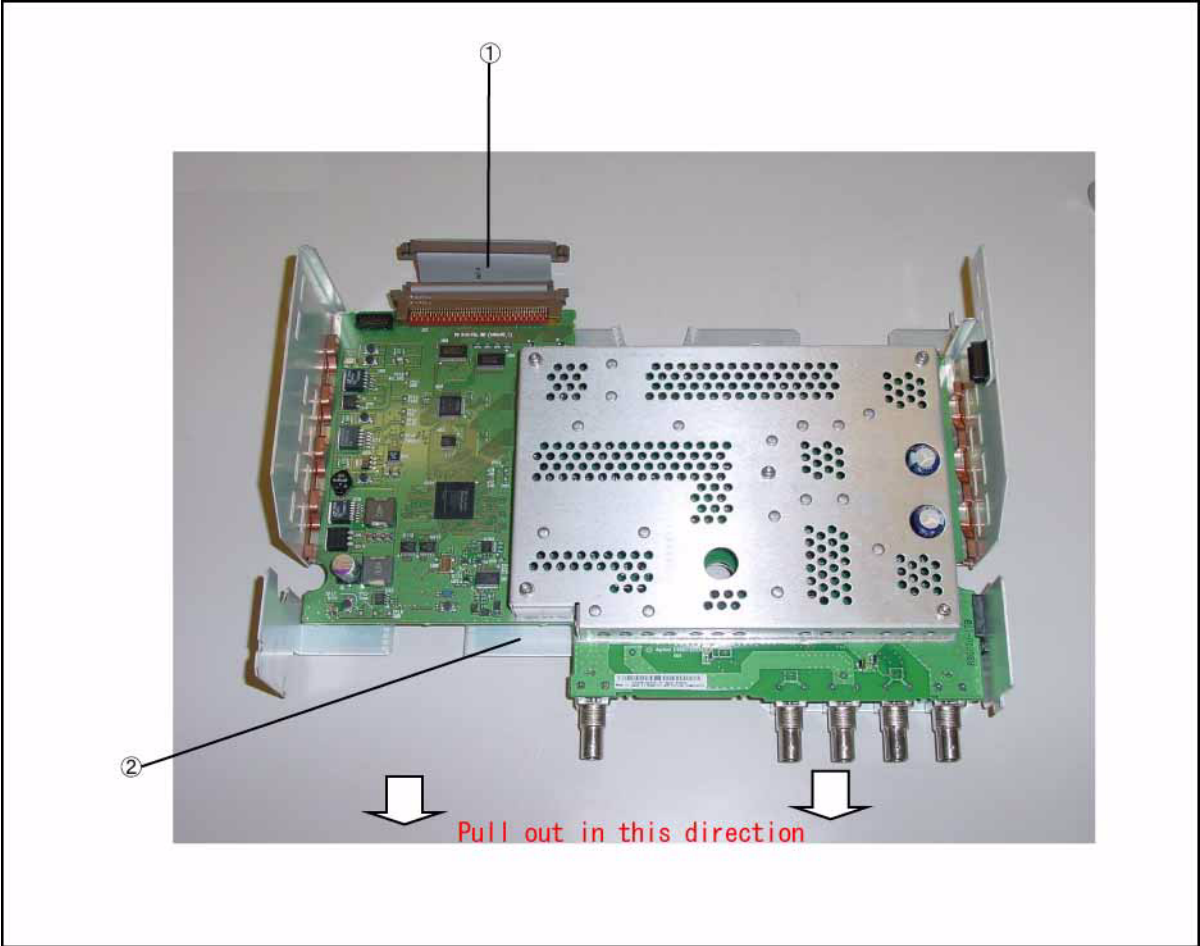
- Step 1.** Remove the 3/4 rack module top as described in “3/4 Rack Module Top Replacement” on page 92.
- Step 2.** Remove the PSU Deck Assembly as described in “PSU Deck Assembly Removal” on page 95.
- Step 3.** Remove the Front Chassis Assembly as described in “Front Chassis Assembly Removal” on page 99.
- Step 4.** Remove the Front Panel Assembly as described in “Front Panel Assembly Removal” on page 101.
- Step 5.** Disconnect the cable from the A34 Analog Board Assembly (item 1).
- Step 6.** Slide the A34 Analog Board Assembly in the direction of an arrow from the Analog Chassis (item 2).

Replacement Procedure

- Step 1.** Reverse the order of the removal procedure.

Replacement Procedure
A34 Analog Board Assembly Replacement

Figure 6-8 A34 Analog Board Assembly Replacement



e4981ase1028

Interface Board Assembly Replacement

Tools Required

- Torque screwdriver, TORX T10
- Torque screwdriver, TORX T20

Removal Procedure

Refer to Figure 6-9 and for this procedure.

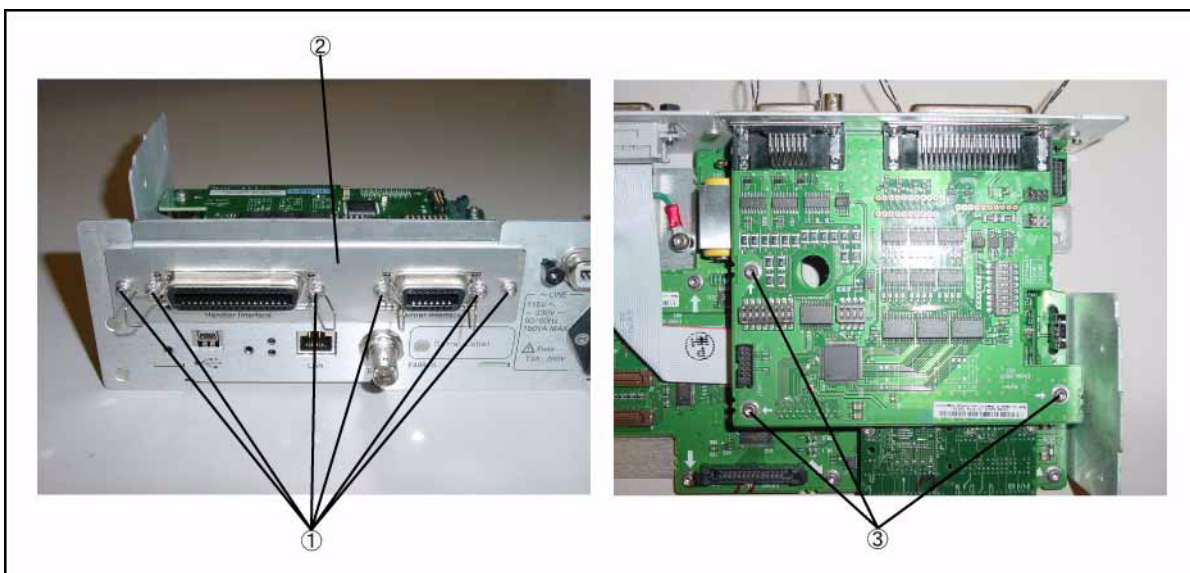
- Step 1.** Remove the 3/4 rack module top as described in “3/4 Rack Module Top Replacement” on page 92.
- Step 2.** Remove the PSU Deck Assembly as described in “PSU Deck Assembly Removal” on page 95.
- Step 3.** Remove the six TORX T10 screws (item 1) fastening the Rear Chassis.
- Step 4.** Remove the panel (item 2) from the Rear Chassis.
- Step 5.** Remove the three TORX T10 screws (item 3) fastening the Interface Board.

Replacement Procedure

- Step 1.** Reverse the order of the removal procedure.

NOTE Fasten the Interface Board and Panel Assembly from the Rear Chassis in the specified order. (Figure 6-10)

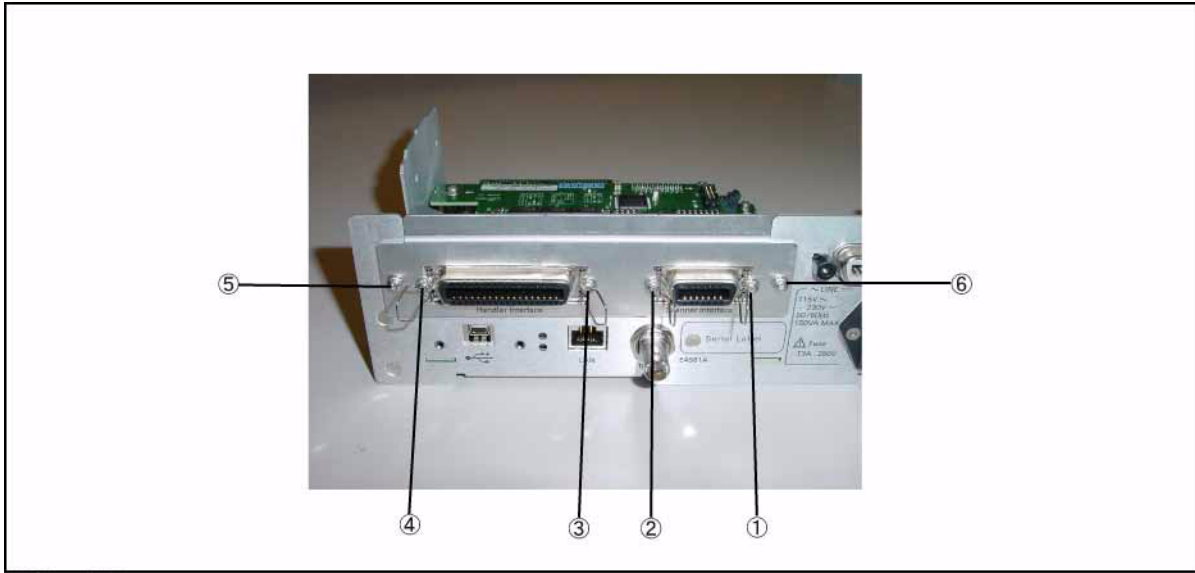
Figure 6-9 Interface Board Assembly Replacement



e4981ase1029

Replacement Procedure
Interface Board Assembly Replacement

Figure 6-10 Screw Fastening Sequence



e4981ase1030

PPMC PCA Replacement

Tools Required

- Torque screwdriver, TORX T8
- Torque screwdriver, TORX T10
- Torque screwdriver, TORX T20

Removal Procedure

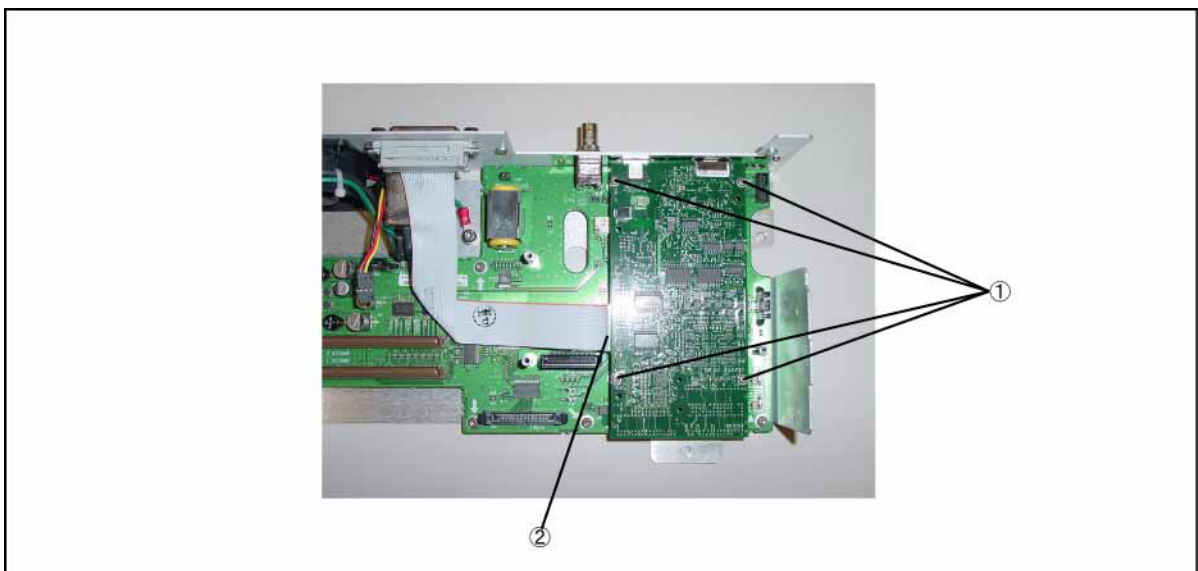
Refer to Figure 6-11 and for this procedure.

- Step 1.** Remove the 3/4 rack module top as described in “3/4 Rack Module Top Replacement” on page 92.
- Step 2.** Remove the PSU Deck Assembly as described in “PSU Deck Assembly Removal” on page 95.
- Step 3.** Remove the Interface Board Assembly as described in “Interface Board Assembly Replacement” on page 105.
- Step 4.** Remove the four TORX T8 screws (item 1) fastening the A31 Digital Board Assembly.
- Step 5.** Disconnect the cable from the GPIB Assembly (item 2).
- Step 6.** Remove the CPU Board Assembly.

Replacement Procedure

- Step 1.** Reverse the order of the removal procedure.

Figure 6-11 PPMC PCA Replacement



e4981ase1031

A31 Digital Board Assembly Replacement

Tools Required

- Torque screwdriver, TORX T8
- Torque screwdriver, TORX T10
- Torque screwdriver, TORX T20
- Box torque wrench, 5/8 inch

Removal Procedure

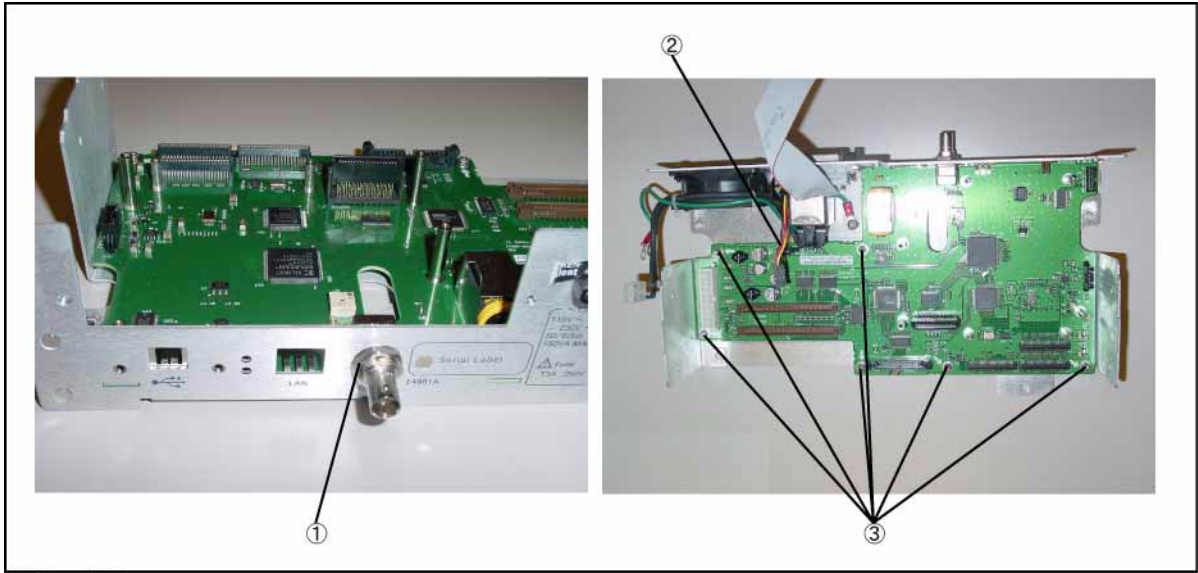
Refer to Figure 6-12 and for this procedure.

- Step 1.** Remove the 3/4 rack module top as described in “3/4 Rack Module Top Replacement” on page 92.
- Step 2.** Remove the PSU Deck Assembly as described in “PSU Deck Assembly Removal” on page 95.
- Step 3.** Remove the Interface Board Assembly as described in “Interface Board Assembly Replacement” on page 105.
- Step 4.** Remove the PPMC PCA as described in “PPMC PCA Replacement” on page 107.
- Step 5.** Remove a 5/8 inch nut (item 1) fastening the Rear Chassis Assembly.
- Step 6.** Disconnect the Fan cable from the A31 Digital Board Assembly (item 2).
- Step 7.** Remove the six TORX T10 screws (item 3) fastening the Rear Chassis Assembly.
- Step 8.** Remove the Digital Board Assembly.

Replacement Procedure

- Step 1.** Reverse the order of the removal procedure.

Figure 6-12 A31 Digital Board Assembly Replacement



e4981ase1032

Rear Chassis Assembly Removal

Tools Required

- Torque screwdriver, TORX T20

Removal Procedure

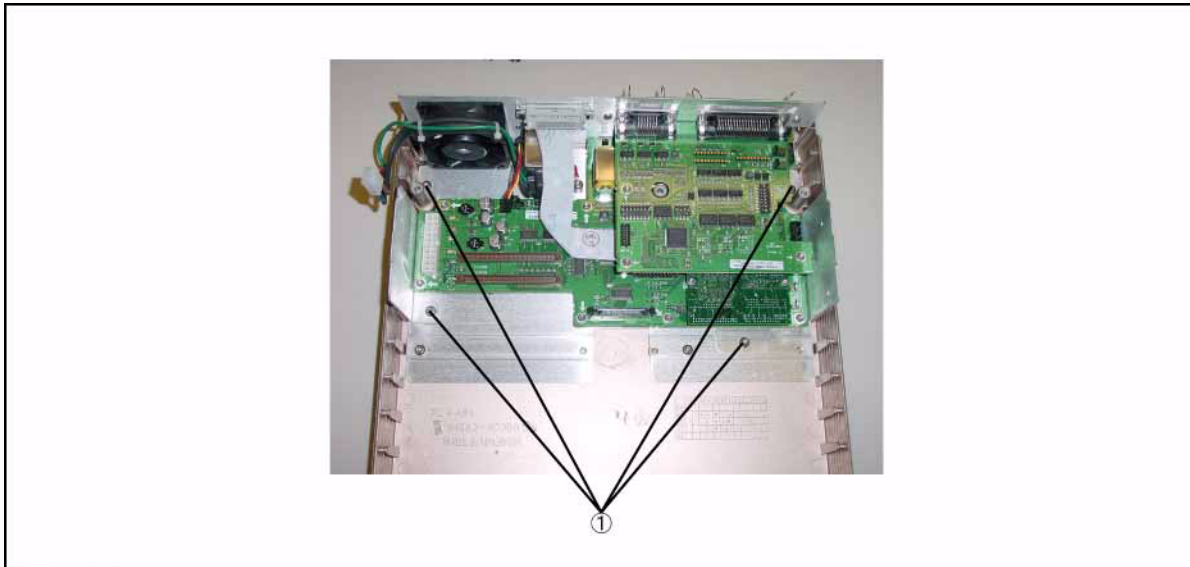
Refer to Figure 6-13 and for this procedure.

- Step 1.** Remove the 3/4 rack module top as described in “3/4 Rack Module Top Replacement” on page 92.
- Step 2.** Remove the PSU Deck Assembly as described in “PSU Deck Assembly Removal” on page 95.
- Step 3.** Remove the Front Chassis Assembly as described in “Front Panel Assembly Removal” on page 101.
- Step 4.** Remove the four TORX T20 screws (item 1) fastening the Rear Chassis Assembly.
- Step 5.** Remove the Rear Chassis Assembly.

Replacement Procedure

- Step 1.** Reverse the order of the removal procedure.

Figure 6-13 Rear Chassis Assembly Removal



e4981ase1033

Plate Assembly Replacement

Tools Required

- Torque screwdriver, TORX T20

Removal Procedure

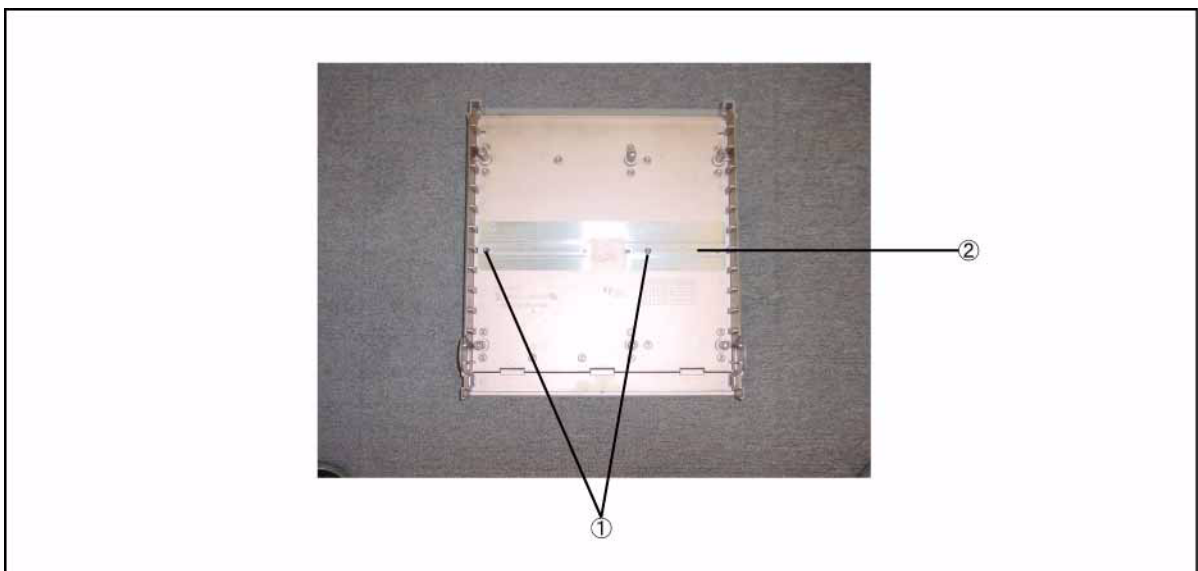
Refer to Figure 6-14 and for this procedure.

- Step 1.** Remove the 3/4 rack module top as described in “3/4 Rack Module Top Replacement” on page 92.
- Step 2.** Remove the PSU Deck Assembly as described in “PSU Deck Assembly Removal” on page 95.
- Step 3.** Remove the Front Chassis Assembly as described in “Front Panel Assembly Removal” on page 101.
- Step 4.** Remove the Rear Chassis Assembly as described in “Rear Chassis Assembly Removal” on page 110.
- Step 5.** Remove the two TORX T20 screws (item 1) fastening the 3/4 Rack Module Bottom Assembly.
- Step 6.** Remove the Plate Assembly (item 2).

Replacement Procedure

- Step 1.** Reverse the order of the removal procedure.

Figure 6-14 Plate Assembly Replacement



e4981ase1034

Fan Assembly Replacement

Tools Required

- Torque screwdriver, TORX T20
- Cutting plier
- Flat edge driver

Removal Procedure

Refer to Figure 6-15 and for this procedure.

- Step 1.** Remove the 3/4 rack module top as described in “3/4 Rack Module Top Replacement” on page 92.
- Step 2.** Remove the PSU Deck Assembly as described in “PSU Deck Assembly Removal” on page 95.
- Step 3.** Cut the two cable ties (item 1).
- Step 4.** Remove a TORX T20 screw (item 2) fastening the ground cable.
- Step 5.** Disconnect the fan cable from the A31 Digital Board Assembly (item 3).
- Step 6.** Push the four rivets (item 4) from the inside, then remove them fastening the Fan Assembly.

NOTE If you cannot push the rivets out easily, push the rivets out using a flat-edge driver.

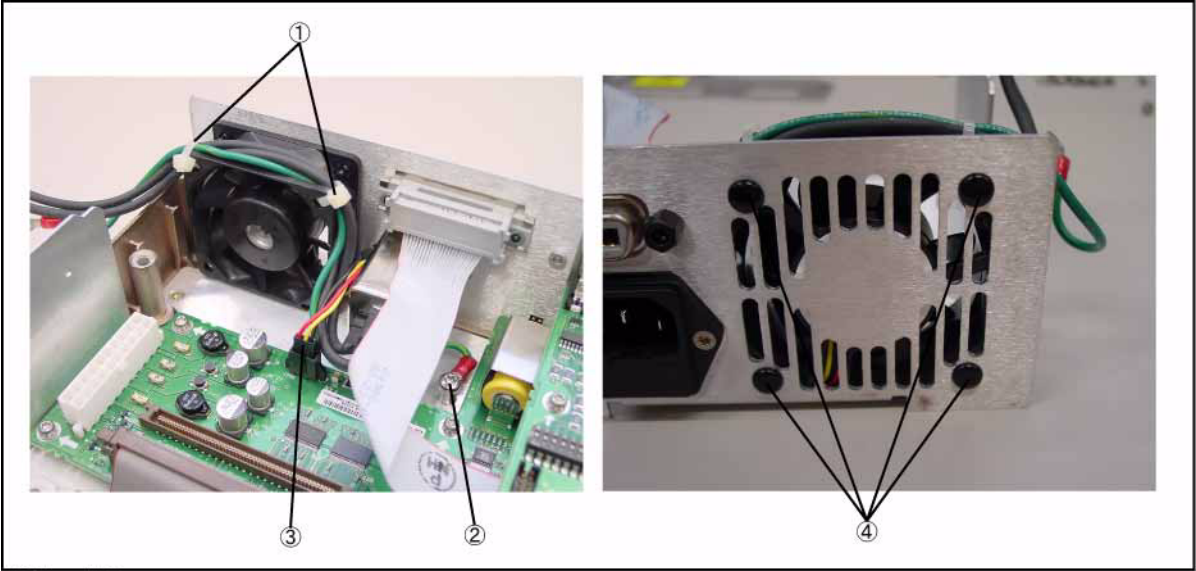
- Step 7.** Remove the Fan Assembly.

Replacement Procedure

- Step 1.** Reverse the order of the removal procedure.

NOTE When you replace the Fan Assembly, use new rivets and cable ties.

Figure 6-15 Fan Assembly Replacement



e4981ase1035

GPIB Assembly Replacement

Tools Required

- Torque screwdriver, TORX T10
- Torque screwdriver, TORX T20
- Box torque wrench, 7 mm

Removal Procedure

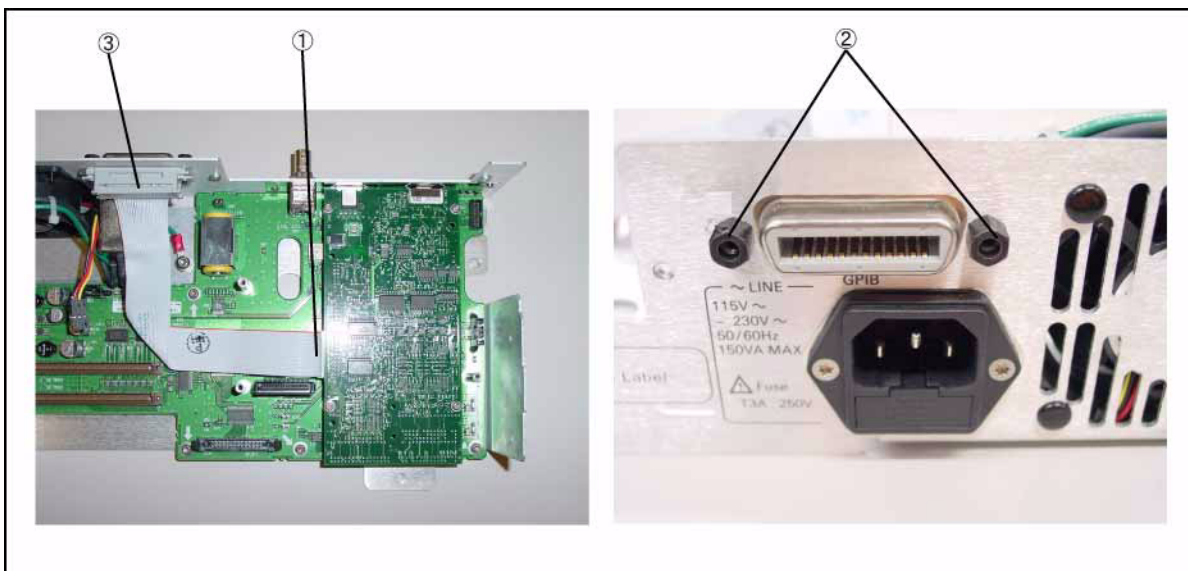
Refer to Figure 6-16 and for this procedure.

- Step 1.** Remove the 3/4 rack module top as described in “3/4 Rack Module Top Replacement” on page 92.
- Step 2.** Remove the PSU Deck Assembly as described in “PSU Deck Assembly Removal” on page 95.
- Step 3.** Remove the Interface Board Assembly as described in “Interface Board Assembly Replacement” on page 105.
- Step 4.** Disconnect the GPIB cable (item 1) from the Rear Panel.
- Step 5.** Remove the two 7mm standoff (item 2) fastening the GPIB Assembly.
- Step 6.** Remove the GPIB Assembly (item 3).

Replacement Procedure

- Step 1.** Reverse the order of the removal procedure.

Figure 6-16 GPIB Assembly Replacement



e4981ase1036

Power Inlet Assembly Replacement

Tools Required

- Torque screwdriver, TORX T10
- Torque screwdriver, TORX T20
- Cutting plier

Removal Procedure

Refer to Figure 6-17 and for this procedure.

- Step 1.** Remove the 3/4 rack module top as described in “3/4 Rack Module Top Replacement” on page 92.
- Step 2.** Remove the PSU Deck Assembly as described in “PSU Deck Assembly Removal” on page 95.
- Step 3.** Cut the two cable ties (item 1).
- Step 4.** Remove the two TORX T10 screws (item 2) fastening the Inlet Assembly.
- Step 5.** Remove the Inlet Assembly from the Rear Panel.
- Step 6.** Detach the fuse box (item 3) from the Inlet Assembly and remove the fuse.

Replacement Procedure

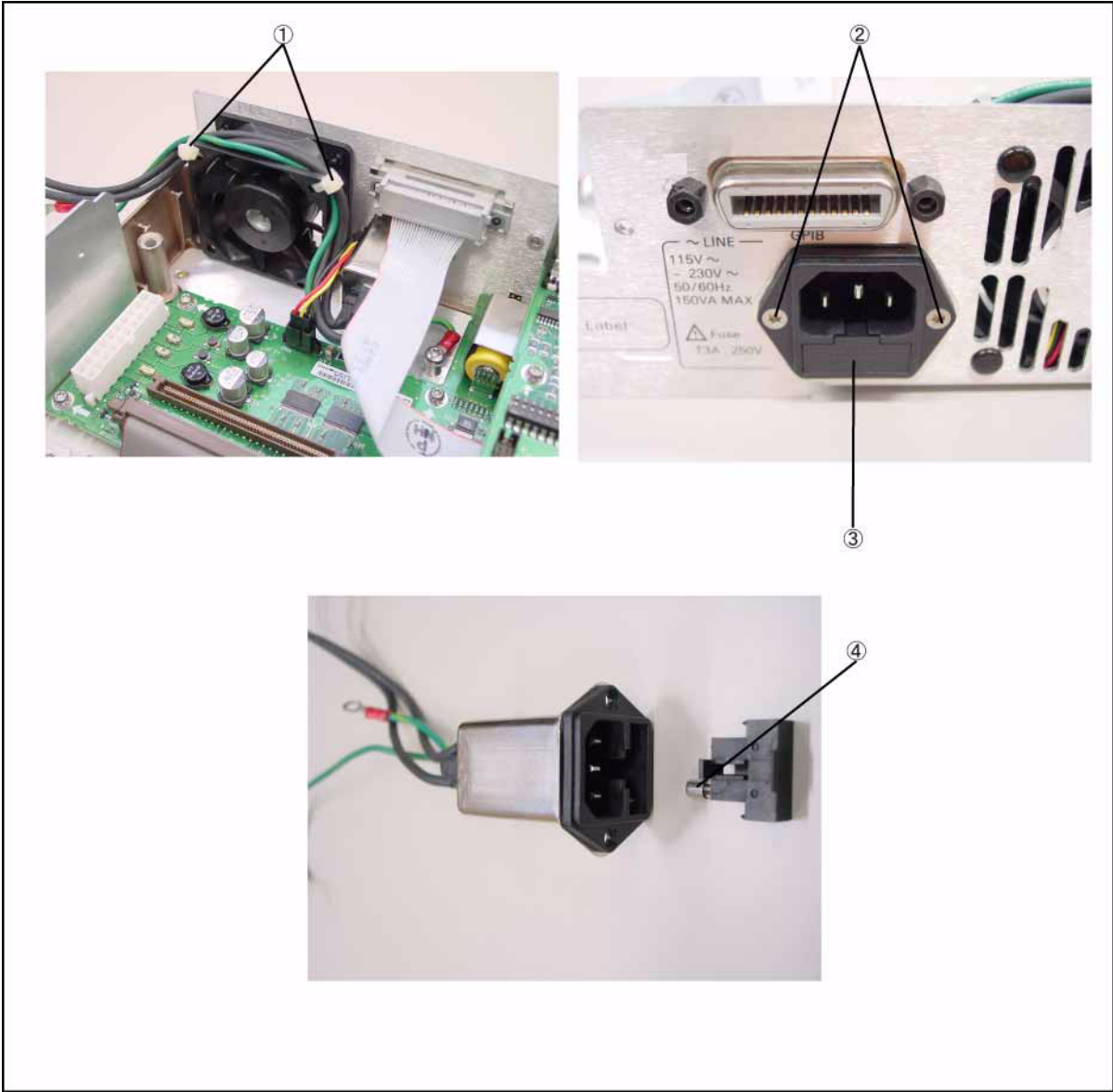
- Step 1.** Reverse the order of the removal procedure.

NOTE

Do not forget to insert the fuse in the new Inlet Assembly.

Replacement Procedure
Power Inlet Assembly Replacement

Figure 6-17 Power Inlet Assembly Replacement



e4981ase1037

USB Assembly Replacement

Tools Required

- Torque screwdriver, TORX T10
- Torque screwdriver, TORX T20

Removal Procedure

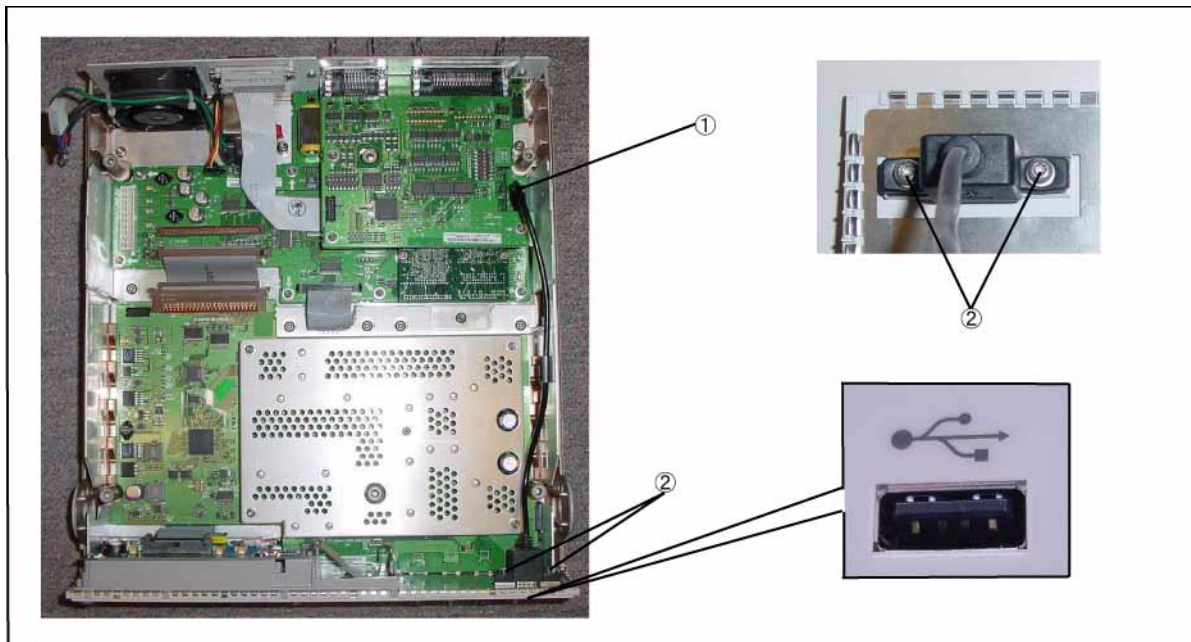
Refer to Figure 6-18 and for this procedure.

- Step 1.** Remove the 3/4 rack module top as described in “3/4 Rack Module Top Replacement” on page 92.
- Step 2.** Remove the PSU Deck Assembly as described in “PSU Deck Assembly Removal” on page 95.
- Step 3.** Disconnect the USB Cable (item 1) from the A31 Digital Board Assembly.
- Step 4.** Remove the two TORX T10 screws (item 2) fastening the Front Panel Assembly.
- Step 5.** Remove the USB Assembly from the Front Panel.

Replacement Procedure

- Step 1.** Reverse the order of the removal procedure.

Figure 6-18 USB Assembly Replacement



e4981ase1038

Binding Post Assembly Replacement

Tools Required

- Torque screwdriver, TORX T20
- Box torque wrench, 3/8 inch

Removal Procedure

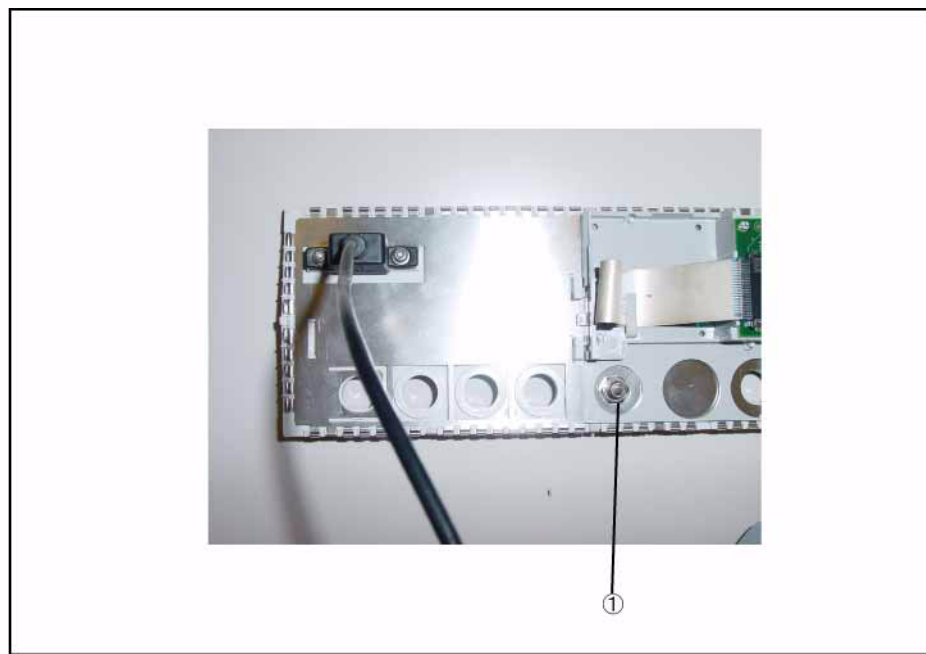
Refer to Figure 6-19 and for this procedure.

- Step 1.** Remove the 3/4 rack module top as described in “3/4 Rack Module Top Replacement” on page 92.
- Step 2.** Remove the PSU Deck Assembly as described in “PSU Deck Assembly Removal” on page 95.
- Step 3.** Remove the Front Panel Assembly as described in “Front Panel Assembly Removal” on page 101.
- Step 4.** Remove the 3/8 inch nut and washer (item 1) fastening the Binding Post Assembly.
- Step 5.** Slide the Binding Post Assembly from the Front Panel Assembly.

Replacement Procedure

- Step 1.** Reverse the order of the removal procedure.

Figure 6-19 Binding Post Assembly Replacement



Inverter Assembly Replacement

Tools Required

- Torque screwdriver, TORX T6
- Torque screwdriver, TORX T20
- Box torque wrench, 5/8 inch

Removal Procedure

Refer to Figure 6-20 and for this procedure.

- Step 1.** Remove the 3/4 rack module top as described in “3/4 Rack Module Top Replacement” on page 92.
- Step 2.** Remove the PSU Deck Assembly as described in “PSU Deck Assembly Removal” on page 95.
- Step 3.** Remove the Front Panel Assembly as described in “Front Panel Assembly Removal” on page 101.
- Step 4.** Disconnect the LCD Cable (item 1) from the Inverter Assembly.
- Step 5.** Disconnect the Cable (item 2) from the Inverter Assembly.
- Step 6.** Remove the two TORX T6 screws (item 3) from the Inverter Assembly.
- Step 7.** Remove the Inverter with the Insulator from the Display Interface Board.

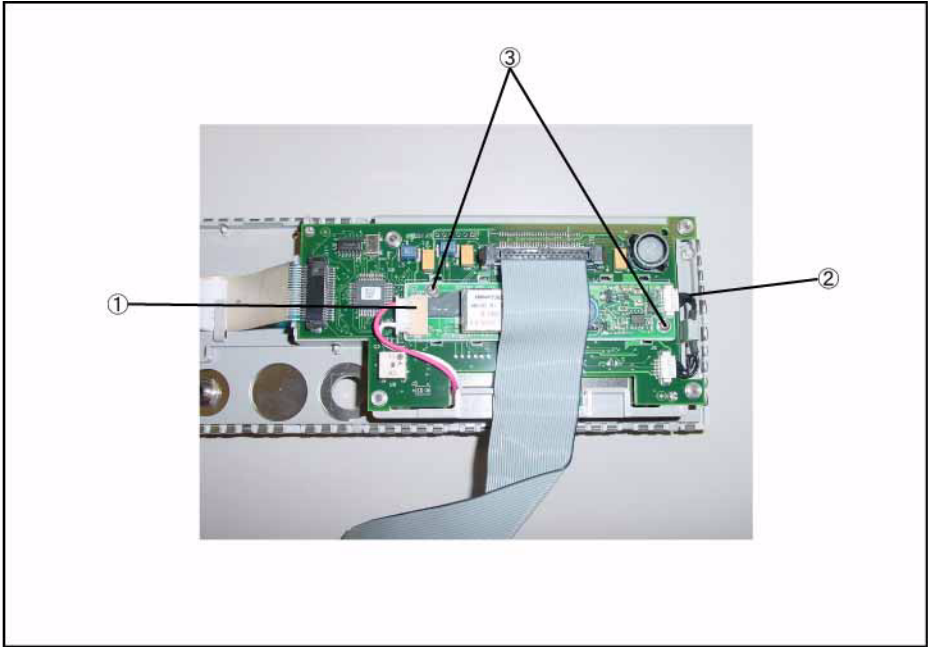
Replacement Procedure

- Step 1.** Reverse the order of the removal procedure.

Replacement Procedure
Inverter Assembly Replacement

Figure 6-20

Inverter Assembly Replacement



e4981ase1040

Display Support Removal

Tools Required

- Torque screwdriver, TORX T6
- Torque screwdriver, TORX T20
- Box torque wrench, 5/8 inch

Removal Procedure

Refer to Figure 6-21 and for this procedure.

- Step 1.** Remove the 3/4 rack module top as described in “3/4 Rack Module Top Replacement” on page 92.
- Step 2.** Remove the PSU Deck Assembly as described in “PSU Deck Assembly Removal” on page 95.
- Step 3.** Remove the Front Panel Assembly as described in “Front Panel Assembly Removal” on page 101.
- Step 4.** Remove the Inverter Assembly as described in “Inverter Assembly Replacement” on page 119.
- Step 5.** Disconnect the Display Cable (item 1) from the Display Interface Board Assembly.
- Step 6.** Release the clamped cable (item 2) from the Display Support (item 5).
- Step 7.** Disconnect the LVDS Cable (item 3) from the Display Interface Board Assembly.
- Step 8.** Disconnect the Backlight Cable (item 4) from the Display Interface Board Assembly.
- Step 9.** Carefully remove the Display Support with the LCD (item 5) from the Front Panel.

NOTE When removing the Display Support (item 5), release the hook (flat cable side) of the Display Support first (item 6), and then carefully release the other hooks of the Display Support (item 7).

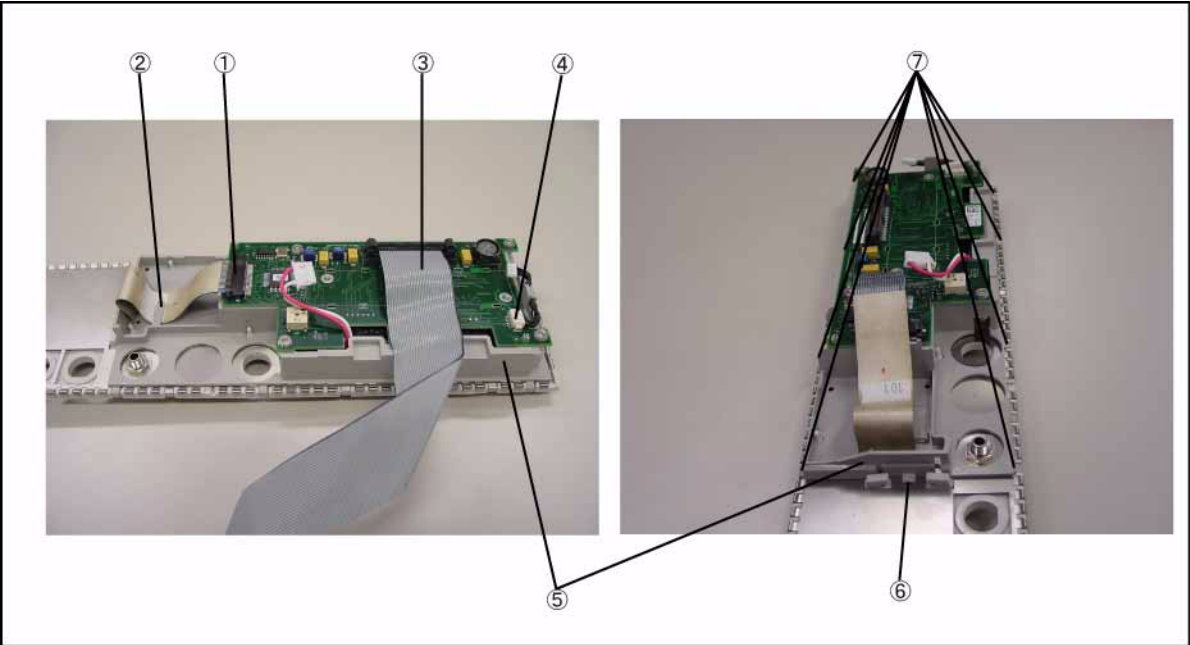
NOTE Be careful not to break the hooks.

Replacement Procedure

- Step 1.** Reverse the order of the removal procedure.

Replacement Procedure
Display Support Removal

Figure 6-21 Display Support Removal



e4981ase1041

LCD and Display Interface Board Replacement

Tools Required

- Torque screwdriver, TORX T6
- Torque screwdriver, TORX T20
- Box torque wrench, 5/8 inch

Removal Procedure

Refer to Figure 6-22 and for this procedure.

- Step 1.** Remove the 3/4 rack module top as described in “3/4 Rack Module Top Replacement” on page 92.
- Step 2.** Remove the PSU Deck Assembly as described in “PSU Deck Assembly Removal” on page 95.
- Step 3.** Remove the Front Panel Assembly as described in “Front Panel Assembly Removal” on page 101.
- Step 4.** Remove the Inverter Assembly as described in “Inverter Assembly Replacement” on page 119.
- Step 5.** Remove the Display Support as described in “Display Support Removal” on page 121.
- Step 6.** Remove the four TORX T6 screws (item 1) fastening the LCD.
- Step 7.** Remove the LCD from the Display Support with the Display Interface Board.
- Step 8.** Carefully remove the Display Interface Board from the Display Support.

Replacement Procedure

- Step 1.** Reverse the order of the removal procedure.

NOTE

When you replace the LCD with a new one, stick new gaskets (P/N : E4980-25003 × 2, E4980-25004 × 2) to surroundings on the LCD Display.

Replacement Procedure
LCD and Display Interface Board Replacement

Figure 6-22 LCD and Display Interface Board Replacement



e4981ase1042

Front Panel, Key Pad and Key Flex Circuit Replacement

Tools Required

- Torque screwdriver, TORX T6
- Torque screwdriver, TORX T10
- Torque screwdriver, TORX T20
- Box torque wrench, 3/8 inch
- Box torque wrench, 5/8 inch

Removal Procedure

Refer to Figure 6-23 and for this procedure.

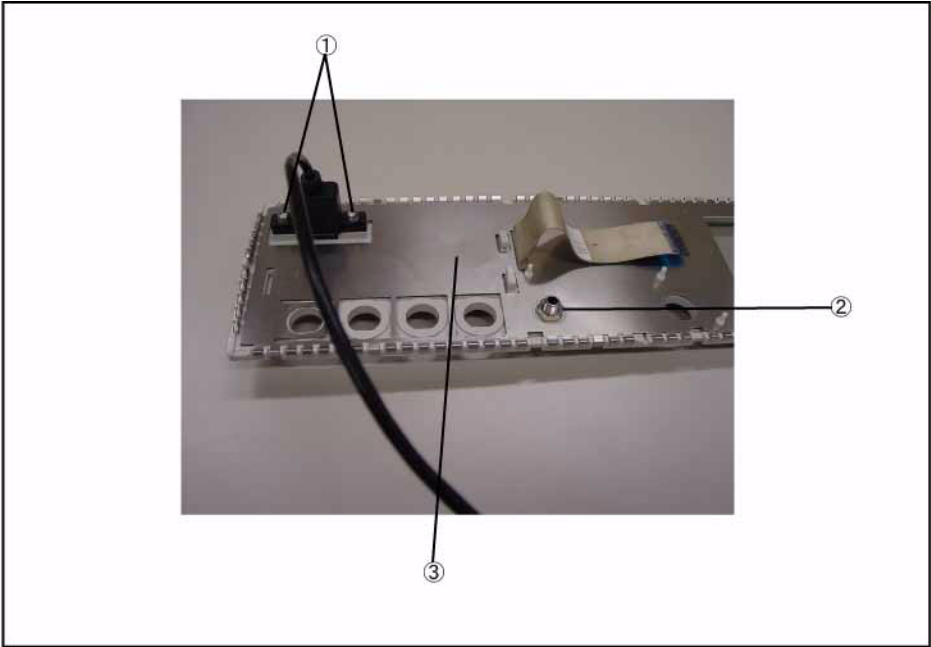
- Step 1.** Remove the 3/4 rack module top as described in “3/4 Rack Module Top Replacement” on page 92.
- Step 2.** Remove the PSU Deck Assembly as described in “PSU Deck Assembly Removal” on page 95.
- Step 3.** Remove the Front Panel Assembly as described in “Front Panel Assembly Removal” on page 101.
- Step 4.** Remove the Inverter Assembly as described in “Inverter Assembly Replacement” on page 119.
- Step 5.** Remove the Display Support as described in “Display Support Removal” on page 121.
- Step 6.** Remove the two TORX T10 screws (item 1) fastening the Front Panel Assembly.
- Step 7.** Remove the USB Assembly from the Front Panel.
- Step 8.** Remove the 3/8 inch nut and washer (item 2) fastening the Binding Post Assembly.
- Step 9.** Slide the Binding Post Assembly from the Front Panel Assembly.
- Step 10.** Remove the Front Panel from the Key Pad, the Window EMI Shield, the Key Flex Circuit and the EMI Shield (item 3).

Replacement Procedure

- Step 1.** Reverse the order of the removal procedure.

Replacement Procedure
Front Panel, Key Pad and Key Flex Circuit Replacement

Figure 6-23 Front Panel, Key Pad and Key Flex Circuit Replacement



e4981ase1043

7**Post-Repair Procedures**

This chapter lists the procedures required to verify the E4981A operation after an assembly is replaced with a new one.

Post-Repair Procedures

Table 7-1 *Post Repair Procedures* lists the required procedures that must be performed after the replacement of an assembly. These are the recommended minimum procedures to ensure that the replacement is successfully completed.

Table 7-1 Post-Repair Procedures

Replaced Assembly or Part	Required Adjustments Correction Constants (CC)	Verification
P1001 INSTALLED OS (E4980-62004)	Perform the following required adjustments using “PPMC” in Spot Adjustment of the program. Power On Test Limit	Inspect the booting process, and power on test result.
A31 Digital Board	Perform the following required adjustments using “Write ID” in Spot Adjustment of the program. Write ID	Inspect the booting process, and power on test result.
A34 Analog Board	Perform the following required adjustments using “A34 Board” in Spot Adjustment of the program. Write Null phase track default data Null DC offset Adjustment Null ADC DC offset Adjustment ADC Linearity Adjustment DC Bias Adjustment DC level V monitor Adjustment (for opt 001) DC level I monitor Adjustment (for opt 001) DC Source Adjustment (for opt 001) DCR Adjustment (for opt 001) Impedance Adjustment AC Level monitor Adjustment OSC Level Adjustment	Inspect the booting process, and power on test result. DC Bias V Level Monitor Accuracy Test (for opt 001) DC Bias I Level Monitor Accuracy Test (for opt 001) AC Signal Level Monitor Accuracy Test Impedance Measurement Accuracy Test DCR Measurement Accuracy Test (for opt 001)
USB Assembly	No adjustment needed	Inspect the booting process, and power on test result. “To Check the Front USB port” on page 56
PSU Assembly	No adjustment needed	Inspect the booting process, and power on test result.
Fan Assembly	No adjustment needed	Inspect the booting process, and power on test result.

Table 7-1 Post-Repair Procedures

Replaced Assembly or Part	Required Adjustments Correction Constants (CC)	Verification
LCD Assembly	No adjustment needed	Inspect the booting process, and power on test result. “To Check the LCD” on page 56
Key Assembly	No adjustment needed	Inspect the booting process, and power on test result. “To Check the Front Panel” on page 56
Interface Board	No adjustment needed	Inspect the booting process, and power on test result. “To Check the Handler Interface Function” on page 60 “To Check the Scanner Interface Function” on page 64

Post-Repair Procedures
Post-Repair Procedures

A **Manual Changes**

This appendix contains the information required to adapt this manual to versions or configurations of the E4981A manufactured earlier than the current printing date of this manual. The information in this manual applies directly to E4981A units with the serial number that is printed on the title page of this manual.

Manual Changes

To adapt this manual to your E4981A, refer to Table A-1 and Table A-2.

Table A-1 Manual Changes by Serial Number

Serial Prefix or Number	Make Manual Changes

Table A-2 Manual Changes by Firmware Version

Version	Make Manual Changes

The ten-character serial number is stamped on the serial number plate (Figure A-1) on the rear panel.

Figure A-1 Serial Number Plate Example



e4981ase1001

B Firmware Update

This appendix describes how to update the E4981A firmware. When you want to update the E4981A firmware, refer to this appendix.

Update the E4981A firmware using USB/GPIB interface

Required Equipment

- E4981A.
- 82357A/B USB/GPIB interface.
- Personal Computer with I/O Libraries Suite (Windows 2000/XP).

How to update E4981A firmware using USB/GPIB interface

The following is the procedure to update the E4981A firmware using USB/GPIB interface.

- Step 1.** Connect the USB/GPIB interface from the USB terminal in your computer to the GPIB terminal in the E4981A rear panel. Then turn the E4981A on.
- Step 2.** Copy the following file from Agilent Technologies web site to the temporary work folder in your computer's HDD.
 - fw_upd.exe
- Step 3.** Execute the **Command Prompt** on your computer.
- Step 4.** Change the current folder to the temporary working folder with the "fw_upd.exe" file using **cd** command.
- Step 5.** Enter **fw_upd.exe GPIB0::17::INSTR** command to execute the firmware update program. The numerical value of "17" in the command is GPIB address of the E4981A. Then, press the Enter key.
- Step 6.** Wait a few minutes until the command prompt is displayed again.
- Step 7.** Press **System** key on the E4981A front panel to check the firmware revision.

Update the E4981A firmware using USB cable

Required Equipment

- E4981A.
- USB cable connecting the E4981A and external controller (with type A/4-prong male or type mini-B/5-prong male connectors depending on device used).
- Personal Computer with I/O Libraries Suite (Windows 2000/XP).

How to update E4981A firmware using USB cable

The following is the procedure to update the E4981A firmware using USB cable.

- Step 1.** Connect the USB cable from the USB terminal in your computer to the USB terminal in the E4981A rear panel. Then turn the E4981A on.
- Step 2.** Copy the following file from Agilent Technologies web site to the temporary work folder in your computer's HDD.
 - fw_upd.exe
- Step 3.** Execute the **Command Prompt** on your computer.
- Step 4.** Change the current folder to the temporary working folder with the "fw_upd.exe" file using **cd** command.
- Step 5.** Enter **fw_upd.exe USB0::2391::2313::MY12345678::0::INSTR** command to execute the firmware update program. The entered value of "2391::2313::MY12345678" in the command is USB ID of the E4981A, and the entered value of "MY12345678" is serial number of the E4981A. Then, press the Enter key.
- Step 6.** Wait a few minutes until the command prompt is displayed again.
- Step 7.** Press **System** key on the E4981A front panel to check the firmware revision.

Firmware Update
Update the E4981A firmware using USB cable

C **Power Requirement**

C. Power Requirement

Replacing Fuse

Fuse Selection

Select proper fuse according to the Table C-1.

Table C-1 Fuse Selection

Fuse Rating/Type	Fuse Part Number
3A 250Vac UL/CSA type Time Delay	2110-1017

Setting up the fuse

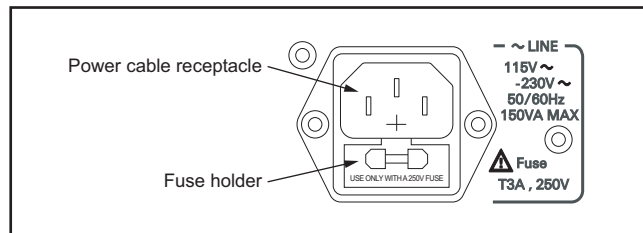
Use the fuse that meets the following specifications.

UL/CSA type, Slo-Blo, 5x20mm miniature fuse, 3A 250V (part number: 2110-1017)

Spare fuses are available from Agilent Technologies sales office. To check or replace the fuse, disconnect the power cable and pull out the fuse holder (refer to Figure C-1) towards you (refer to Figure C-2).

Figure C-1

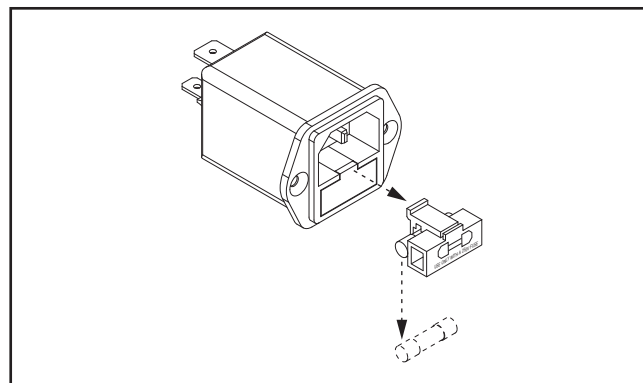
Fuse holder and power cable socket



e4980ase1039

Figure C-2

Removing the fuse



e4980ase1040

Power Requirements

The E4981A requires the following power source.

Voltage : 90 to 132 Vac, 198 to 264 Vac
Frequency : 47 to 63 Hz
Power : 150 VA maximum

Power Cable

In accordance with international safety standards, this instrument is equipped with a three-wire power cable. When connected to an appropriate ac power outlet, this cable grounds the instrument frame.

The type of power cable shipped with each instrument depends on the country of destination.

Power cord list, 16000-99101 shows the power cable options.

WARNING

For protection from electrical shock, the power cable ground must not be defeated. The power plug must be plugged into an outlet that provides a protective earth ground connection.

Power Requirement
Power Requirements

D Error Messages

The Agilent E4981A provides error messages to indicate its operating status. This appendix describes the error messages of the E4981A in alphabetical order.

Error Messages

An error message is displayed in the instrument status display area in the lower-left part of the screen. Pressing the cursor arrow key on the front panel or executing the :DISP:CCL command clears the error message. Moreover, about a specific error message, when a sweep is started again, the display of an error message may disappear. Errors caused by operation of a front panel key simply appear on the display; with a few exceptions, these are not stored in the error queue.

The log of an error message, a maximum of 100 pieces are recorded, and it can go back and check from the oldest error. Executing the :SYST:ERR? command checks error logs. This operation can be performed only by "SCPI" command. It cannot be operated from the front panel.

An error with a positive error number is one uniquely defined for this instrument. On the other hand, an error with a negative error number is basically one defined for common GPIB devices in IEEE488.2.

1 - 100

21

1 MHz opt. not installed

This error occurs when cable correction commands are sent to E4981A with Option 002, via GPIB/LAN/USB. This error is not generated with front panel operation.

A

1103

A1 EEPROM write error

An error is generated while writing data to A1 EEPROM.

Contact Agilent Technology's Sales and Service Office or the company from which you purchased the device.

B

-168

Block data not allowed

A block data element has been received where the E4981A does not accept any block data element.

C

41

Correction Measurement Aborted

This error occurs when the correction data measurement is aborted.

1200

CPU bd FLASH ROM write error

An error is generated while writing data to FLASH.

Contact Agilent Technology's Sales and Service Office or the company from which you purchased the device.

- 1201 **CPU bd EEPROM write error**
An error is generated while writing data to EEPROM.
Contact Agilent Technology's Sales and Service Office or the company from which you purchased the device.
- 100 **Command error**
A comprehensive syntax error has occurred for which the E4981A cannot detect further details of the error. This error code simply indicates the occurrence of a command error that is defined in IEEE488.2,11.5.1.1.4.
- 140 **Character data error**
An error not included in the error numbers between -141 and -149 has occurred during the syntax analysis of a character data element.
- 148 **Character data not allowed**
Character data not allowed for this operation.
- D**
- 104 **Data type error**
The parser has recognized impossible data elements. For example, numeric value or string data is expected, but block data is sent.
- 222 **Data out of range**
A data element (that does not violate the standard) has been received out of the range defined for the E4981A.
- 230 **Data corrupt or stale**
The data is invalid or a newly initiated read operation has not been completed since the latest access.
- E**
- 123 **Exponent too large**
The absolute value of the exponent has exceeded 32,000. (Refer to IEEE488.2,7.7.2.4.1.)
- 170 **Expression error**
An error not included in the error numbers between -171 and -179 has occurred during the syntax analysis of equation data.
- 178 **Expression data not allowed**
An equation data element has been received where the E4981A does not accept any equation data element.
- 200 **Execution error**
A comprehensive execution error has occurred for which the E4981A cannot detect further details. This error code simply indicates the occurrence of an execution error that is defined in IEEE488.2,11.5.1.1.5.

Error Messages
Error number: 1070

F

1070

Fan failed

Cooling fan hardware failure is detected.

Contact Agilent Technology's Sales and Service Office or the company from which you purchased the device.

G

-105

GET not allowed

A group execution trigger (GET) has been received in a program message. (Refer to IEEE488.2,7.7.)

H

-114

Header suffix out of range

The header suffix is out of range.

I

-101

Invalid character

Invalid characters have been found in the program message string. For example, in a correct program message “:CALC1:FORM CP”, an ampersand (&) is inserted by mistake to give “:CALC1:FORM&CP”.

-103

Invalid separator

The parser (syntax analysis program) expects a separator, but a character other than a separator has been sent. For example, although the correct way is to use “;” to separate two sent program messages such as “:CALC1:FORM CP;*OPC?”, the semicolon (;) needed to separate the program messages is missing to give “:CALC1:FORM CP *OPC?”.

-121

Invalid character in number

An invalid character for the data type of the syntax analysis target has been received. For example, alphabetical characters exist in a decimal value or “9” exists in octal data.

-131

Invalid suffix

The suffix does not meet the syntax defined in IEEE488.2,7.7.3.2 or is inappropriate for the E4981A.

-141

Invalid character data

A character data element has been received where the E4981A does not accept any character data element.

-151

Invalid string data

Character string data are expected, but the string data received are invalid for some reason. (Refer to IEEE488.2,7.7.5.2.) For example, the END message is received before the end quotation mark character appears.

- 161 **Invalid block data**
Block data are expected, but the block data received are invalid for some reason. (Refer to IEEE488.2,7.7.6.2.) For example, the END message is received before the length of the block data is reached.
- 171 **Invalid expression**
The equation data element is invalid. (Refer to IEEE488.2,7.7.7.2.) For example, parentheses are not paired or a character violates the standard.
- 213 **Init ignored**
Another measurement has been being executed and the measurement start request (:INITiate[:IMMediate] command) has been ignored.
- 224 **Illegal parameter value**
The parameter received is not correct. For example, though a correct program message was “:CALC1:FORM CP,” a wrong program message, “:CALC1:FORM RP,” was received.
- L**
- 46 **LOAD measurement incomplete**
This error occurs when the cable correction LOAD measurement is incomplete.
- M**
- 43 **Measurement failed**
A measurement failure has occurred during measuring the correction data.
- 109 **Missing parameter**
The number of parameters is less than required by the command. For example, although the :CREJ:LIM command requires one parameter such as “:CREJ:LIM 3”, no parameter is added to give “:CREJ:LIM”.
- 250 **Mass storage error**
An error occurred while accessing the external mass storage device.
- N**
- 83 **No data to load**
There is no setup data for the selected number or no external mass storage device is connected.
- 120 **Numeric data error**
Numeric data is improper.
- 128 **Numeric data not allowed**
A numeric value data element (that does not violate the standard) has been received where the E4981A does not accept any numeric value data element.

Error Messages
Error number: 47

O

47 **OPEN measurement incomplete**

This error occurs when the cable correction OPEN measurement is incomplete.

-321 **Out of memory**

The E4981A has insufficient memory to perform the requested operation.

P

1080 **Power failed**

Power unit hardware failure is detected.

Contact Agilent Technology's Sales and Service Office or the company from which you purchased the device.

-108 **Parameter not allowed**

The number of parameters is larger than required by the command. For example, although the `:CREJ:LIM` command requires one parameter such as "`:CREJ:LIM 3`", two parameters are added to give "`:CREJ:LIM 0,3`".

-112 **Program mnemonic too long**

The length of the header exceeds 12 characters. (Refer to IEEE488.2,7.6.1.4.1.)

Q

-350 **Queue overflow**

The queue contains a certain code other than the code that caused this error. This indicates that an error has occurred due to insufficient space in the queue but has not been recorded.

-400 **Query error**

A comprehensive Query error has occurred for which the E4981A cannot detect further details. This code simply indicates the occurrence of a Query error that is defined in IEEE488.2,11.5.1.1.7 and 6.3.

-410 **Query INTERRUPTED**

This indicates the status that causes an "INTERRUPTED" Query error. (Refer to IEEE488.1,6.3.2.3.) This error occurs, for example, when data byte (DAB) or GET is received after Query but before the response has been completely sent.

-420 **Query UNTERMINATED**

This indicates the status that causes an "UNTERMINATED" Query error. (Refer to IEEE488.2,6.3.2.) This error occurs, for example, when the E4981A is specified as a talker and an incomplete program message is received.

-430 **Query DEADLOCKED**

This indicates the status that causes a "DEADLOCKED" Query error. (Refer to IEEE488.2,6.3.1.7.) This error occurs, for example, when both input and output buffers become full and the E4981A cannot continue processing.

- 440 **Query UNTERMINATED after indefinite response**
In a certain program message, a Query that requests an ambiguous response has not yet been completely executed when a different Query is received. (Refer to IEEE488.2,6.5.7.5.7.)
- R**
- 16 **Reference Measurement Aborted**
This error occurs when REF data measurement is aborted.
- 48 **REF measurement incomplete**
This error occurs when the cable correction REF measurement is incomplete.
- S**
- 82 **Store failed**
This error occurs when external mass storage device fails or internal FLASH ROM hardware fails.
Contact Agilent Technology’s Sales and Service Office or the company from which you purchased the device.
- 102 **Syntax error**
There is a command or data type that cannot be recognized. For example, in the program message “:SYST:PRES”, a colon (:) is inserted by mistake to give “:SYST: :PRES”.
- 134 **Suffix too long**
The length of suffix is long.
- 138 **Suffix not allowed**
A suffix is added to a numeric value element that does not permit a suffix.
- 150 **String data error**
An error not included in the error numbers between -151 and -159 has occurred during the syntax analysis of a string data element.
- 158 **String data not allowed**
A string data element has been received where the E4981A does not accept any string data element. For example, a parameter must be enclosed with double quotation marks (“...”) but they are missing.
- T**
- 124 **Too many digits**
The number of digits of the mantissa of the decimal value data element exceeds 255 except for preceding 0s. (Refer to IEEE488.27.7.2.4.1.)

Error Messages

Error number: -211

-211

Trigger ignored

A trigger command or trigger signal has been received and recognized by the E4981A, but it is ignored due to the timing relationship with the E4981A. For example, this happens when the E4981A's trigger system is not in the Waiting for Trigger state.

-214

Trigger deadlock

Indicates that the **:READ?** command was ignored because the trigger source setting was MAN or BUS.

-223

Too much data

The received block, equation, or string type program data complies with the standard, but the amount of data exceeds the limit that the E4981A can handle due to memory or device-specific conditions related to memory.

U

-113

Undefined header

A header not defined for the E4981A has been received. For example, "***XYZ**", which is not defined for the E4981A, is received.

Warning Message

A warning message is displayed in the instrument status display area in the lower-left part of the display. Pressing any of the front panel keys or executing the :DISP:CCL command clears the message.

This message simply appears on the display since it is not known to remote environments such as GPIB. This message is not displayed when another error message has been already displayed in the instrument message/warning area.

The warning messages for this instrument are as follows.

WARNING: Need corr meas

When the OPEN correction, SHORT correction or LOAD correction is ON, this is displayed when you change the setup of the cable length or measurement frequency shift (1 MHz). In this case, the OPEN correction, SHORT correction and LOAD correction are automatically turned OFF.

WARNING: Need load meas

This is displayed when you turn ON the LOAD correction from the front panel although the setups of the cable length and measurement frequency shift (1 MHz) differ from those when measuring/setting up the LOAD correction data. In this case, the LOAD correction is turned ON, but you need to measure the LOAD correction data again for accurate measurement.

WARNING: Need open meas

This is displayed when you turn ON the OPEN correction from the front panel although the setups of the cable length and measurement frequency shift (1 MHz) differ from those when measuring/setting up the OPEN correction data. In this case, the OPEN correction is turned ON, but you need to measure the OPEN correction data again for accurate measurement.

WARNING: Need short meas

This is displayed when you turn ON the SHORT correction from the front panel although the setups of the cable length and measurement frequency shift (1 MHz) differ from those when measuring/setting up the SHORT correction data. In this case, the SHORT correction is turned ON, but you need to measure the SHORT correction data again for accurate measurement.

WARNING: Out of limit

This is displayed if the correction data is out of the valid range when measuring the correction data. The valid range for each type of correction is as follows.

Type of correction	Valid range
OPEN correction	$ Y < 20 \mu\text{S}$
SHORT correction	$ Z < 20 \Omega$
LOAD correction	$ Z_{\text{ref}} \times 0.9 < Z < Z_{\text{ref}} \times 1.1$

In the above table, Y is the measured admittance value, Z is the measured impedance value, and Zref is the LOAD correction standard definition value.

Error Messages

Error number:

WARNING: Improper high/low limits

The upper limit value is less than the lower limit value. Set the lower limit value to less than the upper limit value.

WARNING: Incompatible state file

The setting file recalled from external mass storage device has been saved using an E4981A with a different firmware version or different options. There may be some parameters set up incorrectly. Check the setting.

This message may appear due to option mismatch, firmware mismatch, check-sum error or state format mismatch.

WARNING: No external clock

This message appears when there is no external reference clock.