



Agilent Technologies
E8483A Microwave Switch/
Attenuator Driver Module
Service Manual

Serial Numbers

This manual applies directly to Agilent E8483A Microwave Switch/Attenuator Driver modules with serial numbers US41000101 and above.



Agilent Technologies



Manual Part Number: E8483-90010
Printed in U.S.A. E0601

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AGILENT TECHNOLOGIES WARRANTY STATEMENT

AGILENT PRODUCT: E8483A Microwave Switch/Attenuator Driver Module

DURATION OF WARRANTY: 3 years

1. Agilent Technologies warrants Agilent hardware, accessories and supplies against defects in materials and workmanship for the period specified above. If Agilent receives notice of such defects during the warranty period, Agilent will, at its option, either repair or replace products which prove to be defective. Replacement products may be either new or like-new.

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4. Agilent products may contain remanufactured parts equivalent to new in performance or may have been subject to incidental use.

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Agilent Technologies

E8483A Microwave Switch/Attenuator Driver Module Service Manual

Edition 1

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Documentation History

All Editions and Updates of this manual and their creation date are listed below. The first Edition of the manual is Edition 1. The Edition number increments by 1 whenever the manual is revised. Updates, which are issued between Editions, contain replacement pages to correct or add additional information to the current Edition of the manual. Whenever a new Edition is created, it will contain all of the Update information for the previous Edition. Each new Edition or Update also includes a revised copy of this documentation history page.

Edition 1 June, 2001

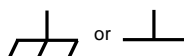
Safety Symbols



Instruction manual symbol affixed to product. Indicates that the user must refer to the manual for specific WARNING or CAUTION information to avoid personal injury or damage to the product.



Indicates the field wiring terminal that must be connected to earth ground before operating the equipment — protects against electrical shock in case of fault.



Frame or chassis ground terminal—typically connects to the equipment's metal frame.



Alternating current (AC)



Direct current (DC).



Warning. Risk of electrical shock.

WARNING

Calls attention to a procedure, practice, or condition that could cause bodily injury or death.

CAUTION

Calls attention to a procedure, practice, or condition that could possibly cause damage to equipment or permanent loss of data.

WARNINGS

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

Ground the equipment: For Safety Class 1 equipment (equipment having a protective earth terminal), an uninterruptible safety earth ground must be provided from the mains power source to the product input wiring terminals or supplied power cable.

DO NOT operate the product in an explosive atmosphere or in the presence of flammable gases or fumes.

For continued protection against fire, replace the line fuse(s) only with fuse(s) of the same voltage and current rating and type. DO NOT use repaired fuses or short-circuited fuse holders.

Keep away from live circuits: Operating personnel must not remove equipment covers or shields. Procedures involving the removal of covers or shields are for use by service-trained personnel only. Under certain conditions, dangerous voltages may exist even with the equipment switched off. To avoid dangerous electrical shock, DO NOT perform procedures involving cover or shield removal unless you are qualified to do so.

DO NOT operate damaged equipment: Whenever it is possible that the safety protection features built into this product have been impaired, either through physical damage, excessive moisture, or any other reason, REMOVE POWER and do not use the product until safe operation can be verified by service-trained personnel. If necessary, return the product to Agilent for service and repair to ensure that safety features are maintained.

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

DO NOT substitute parts or modify equipment: Because of the danger of introducing additional hazards, do not install substitute parts or perform any unauthorized modification to the product. Return the product to Agilent for service and repair to ensure that safety features are maintained.



Manufacturer's Name: Agilent Technologies, Incorporated
Manufacturer's Address: 815 – 14th St. SW
Loveland, Colorado 80537
USA

Declares, that the product

Product Name: Microwave Switch/Attenuator Driver Module
Model Number: E8483A
Product Options: *This declaration covers all options of the above product(s).*

Conforms with the following European Directives:

The product herewith complies with the requirements of the Low Voltage Directive 73/23/EEC and the EMC Directive 89/336/EEC (including 93/68/EEC) and carries the CE Marking accordingly.

Conforms with the following product standards:

EMC	Standard	Limit
	IEC 61326-1:1997+A1:1998 / EN 61326-1:1997+A1:1998 CISPR 11:1990 / EN 55011:1991 IEC 61000-4-2:1995+A1:1998 / EN 61000-4-2:1995 IEC 61000-4-3:1995 / EN 61000-4-3:1995 IEC 61000-4-4:1995 / EN 61000-4-4:1995 IEC 61000-4-5:1995 / EN 61000-4-5:1995 IEC 61000-4-6:1996 / EN 61000-4-6:1996 IEC 61000-4-11:1994 / EN 61000-4-11:1994	Group 1 Class A 4kV CD, 8kV AD 3 V/m, 80-1000 MHz 0.5kV signal lines, 1kV power lines 0.5 kV line-line, 1 kV line-ground 3V, 0.15-80 MHz Dips: 30% 10ms; 60% 100ms Interrupt > 95% @5000ms
	Canada: ICES-001:1998 Australia/New Zealand: AS/NZS 2064.1	

The product was tested in a typical configuration with Agilent Technologies test systems.

Safety IEC 61010-1:1990+A1:1992+A2:1995 / EN 61010-1:1993+A2:1995
Canada: CSA C22.2 No. 1010.1:1992
UL 3111-1: 1994

14 June 2001

Date

Ray Corson

Product Regulations Program Manager

For further information, please contact your local Agilent Technologies sales office, agent or distributor.
Authorized EU-representative: Agilent Technologies Deutschland GmbH, Herrenberger Strabe 130, D 71034 Böblingen, Germany

Notes:

Chapter 1

General Information

Introduction

This manual contains information required to test, troubleshoot, and repair the Agilent E8483A Microwave Switch/Attenuator Driver module (see Figure 1-1). For more information on the module operation, see *Agilent E8483A Microwave Switch/Attenuator Driver Module User's Manual*.

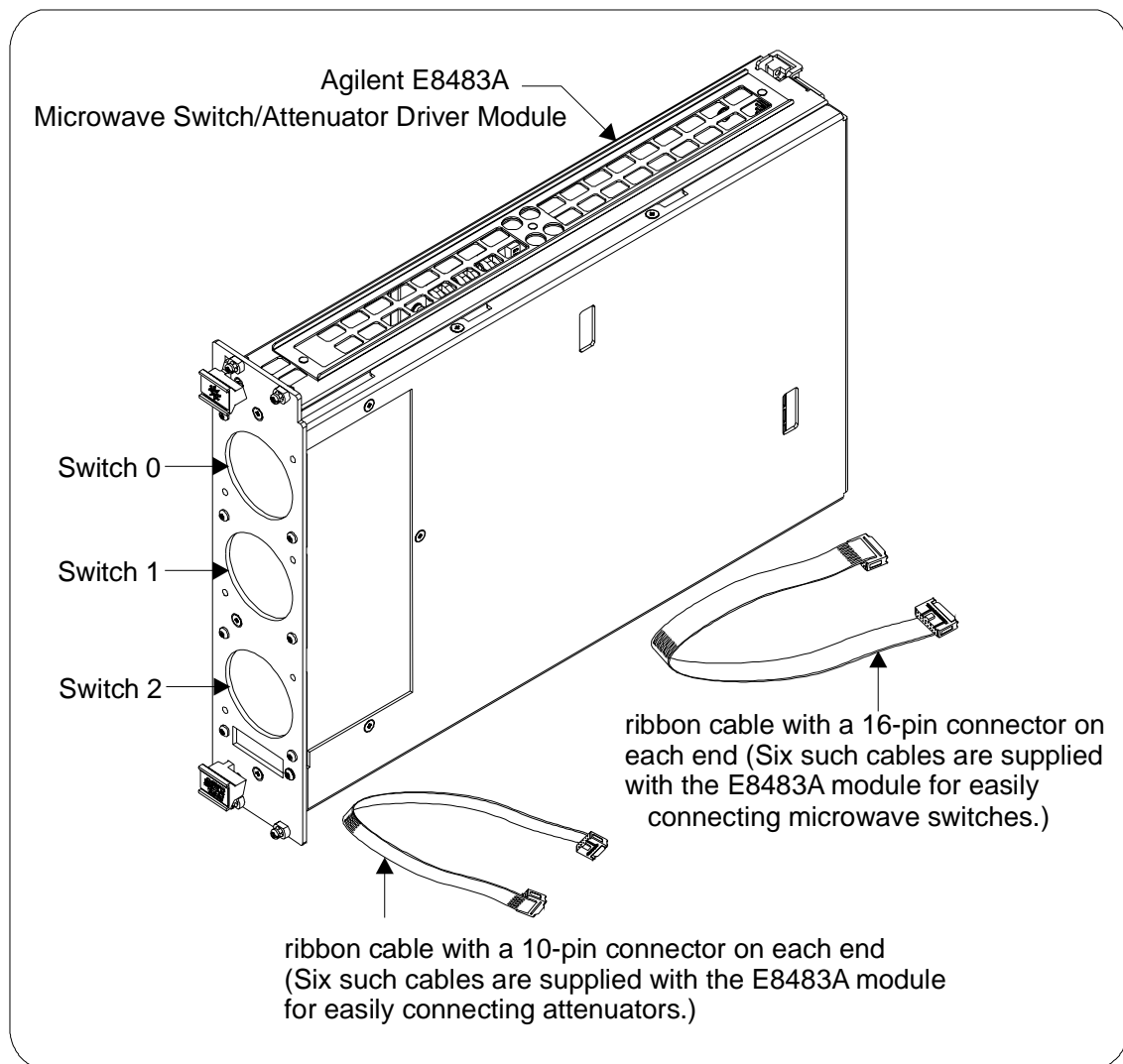


Figure 1-1. Agilent E8483A Microwave Switch/Attenuator Driver Module

Contacting Agilent Technologies

Any maintenance or repair of this product must be performed by qualified personnel. Contact your customer engineer through your local Agilent Technologies Service Center for repair and service.

- To find a list of your local Sales and Service Offices, go to the main Agilent Customer web site (<http://www.agilent.com/find/assist>).
- The Agilent Calibration and Repair Services web site (<http://www.agilent.com/find/repair>) describes Agilent calibration and repair services.
- The Agilent Parts web site (<http://www.parts.agilent.com/>) shows how to order replacement parts from Agilent.

Safety Considerations

This product is a Safety Class I instrument that is provided with a protective earth terminal when installed in the mainframe. The instrument, mainframe, and all related documentation should be reviewed for familiarization with safety markings and instructions before operation or service.

Refer to the WARNINGS page (page 6) in this manual for a summary of safety information. Safety information for testing and service follows and is also found throughout this manual.

This section contains WARNINGS which must be followed for your protection and CAUTIONS which must be followed to avoid damage to the equipment when performing instrument maintenance or repair.

WARNING **SERVICE-TRAINED PERSONNEL ONLY.** The information in this manual is for service-trained personnel who are familiar with electronic circuitry and are aware of the hazards involved. To avoid personal injury or damage to the instrument, do not perform procedures in this manual or do any servicing unless you are qualified to do so.

CHECK MAINFRAME POWER SETTINGS. Before applying power, verify that the mainframe setting matches the line voltage and that the correct fuse is installed. An uninterruptible safety earth ground must be provided from the main power source to the supplied power cord set.

GROUNDING REQUIREMENTS. Interruption of the protective (grounding) conductor (inside or outside the mainframe) or disconnecting the protective earth terminal will cause a potential shock hazard that could result in personal injury. (Grounding one conductor of a two-conductor outlet is not sufficient protection.)

IMPAIRED PROTECTION. Whenever it is likely that instrument protection has been impaired, the mainframe must be made inoperative and be secured against any unintended operation.

REMOVE POWER IF POSSIBLE. Some procedures in this manual may be performed with power supplied to the mainframe while protective covers are removed. Energy available at many points may, if contacted, result in personal injury. (If maintenance can be performed without power applied, the power should be removed.)

WARNING **USING AUTOTRANSFORMERS.** If the mainframe is to be energized via an autotransformer (for voltage reduction), make sure the common terminal is connected to neutral (that is, the grounded side of the main's supply).

CAPACITOR VOLTAGES. Capacitors inside the mainframe may remain charged even when the mainframe has been disconnected from its source of supply.

USE PROPER FUSES. For continued protection against fire hazard, replace the line fuses only with fuses of the same current rating and type (such as normal blow, time delay, etc.). Do not use repaired fuses or short-circuited fuseholders.

SHOCK HAZARD. Only service-trained personnel who are aware of the hazards involved should install, remove, or configure the Microwave Switch/Attenuator Driver module. Use only wire rated for the highest input voltage. Before you remove any installed module, disconnect AC power from the mainframe and from other modules that may be connected to the module.

CHANNEL WIRING INSULATION. All channels that have a common connection must be insulated so that the user is protected from electrical shock. This means wiring for all channels must be insulated as though each channel carries the voltage of the highest voltage channel.

CAUTION **MAXIMUM POWER.** The maximum power that may be applied to any SMA input connector is 1 W (CW).

CONNECTING +24V. For the Microwave Switch, the mainframe backplane +24V is fused at 1.2 A. The total current drawn by all coaxial switches connected to the Microwave Switch/Attenuator Driver module must not exceed the fuse rating of the supplies (mainframe and/or external) used.

STATIC ELECTRICITY. Static electricity is a major cause of component failure. To prevent damage to the electrical components in the Microwave Switch/Attenuator Driver module, observe anti-static techniques whenever removing a module from the mainframe or whenever working on a module.

Inspection/Shipping

This section contains initial (incoming) inspection and shipping guidelines for the E8483A Microwave Switch/Attenuator Driver module.

Initial Inspection

Use the following steps as guidelines to perform initial (incoming) inspection for the E8483A module.

WARNING

To avoid possible hazardous electrical shock, do not perform electrical tests if there are signs of shipping damage to the shipping container or to the instrument.

1. Inspect the shipping container for damage. If the shipping container or cushioning material is damaged, contact Agilent Technologies (see page 10).
2. Check the shipping contents and verify they are complete. Normally, an E8483A module with twelve cables (see Figure 1-1) and a User's Manual should be included. If the contents are incomplete or with mechanical damage/defect, contact Agilent Technologies (see page 10).
3. Install the E8483A module in a VXI mainframe. Refer to the *Agilent E8483A Microwave Switch/Attenuator Driver Module User's Manual* for more information.
4. Perform the Functional Verification Test and the Power Circuitry & Drive Circuitry Verification Tests (optional). Refer to *Chapter 2* of this manual.
5. If any of the tests do not pass, refer to page 36 in *Chapter 3* for troubleshooting. If the module needs to be shipped to Agilent for service or repair, see Figure 1-2 for instructions on repackaging the module for shipment.
6. If all verification tests pass, the module is ready for use.

Shipping Guidelines

If the instrument is to be shipped to Agilent for service or repair, follow the procedures in Figure 1-2.

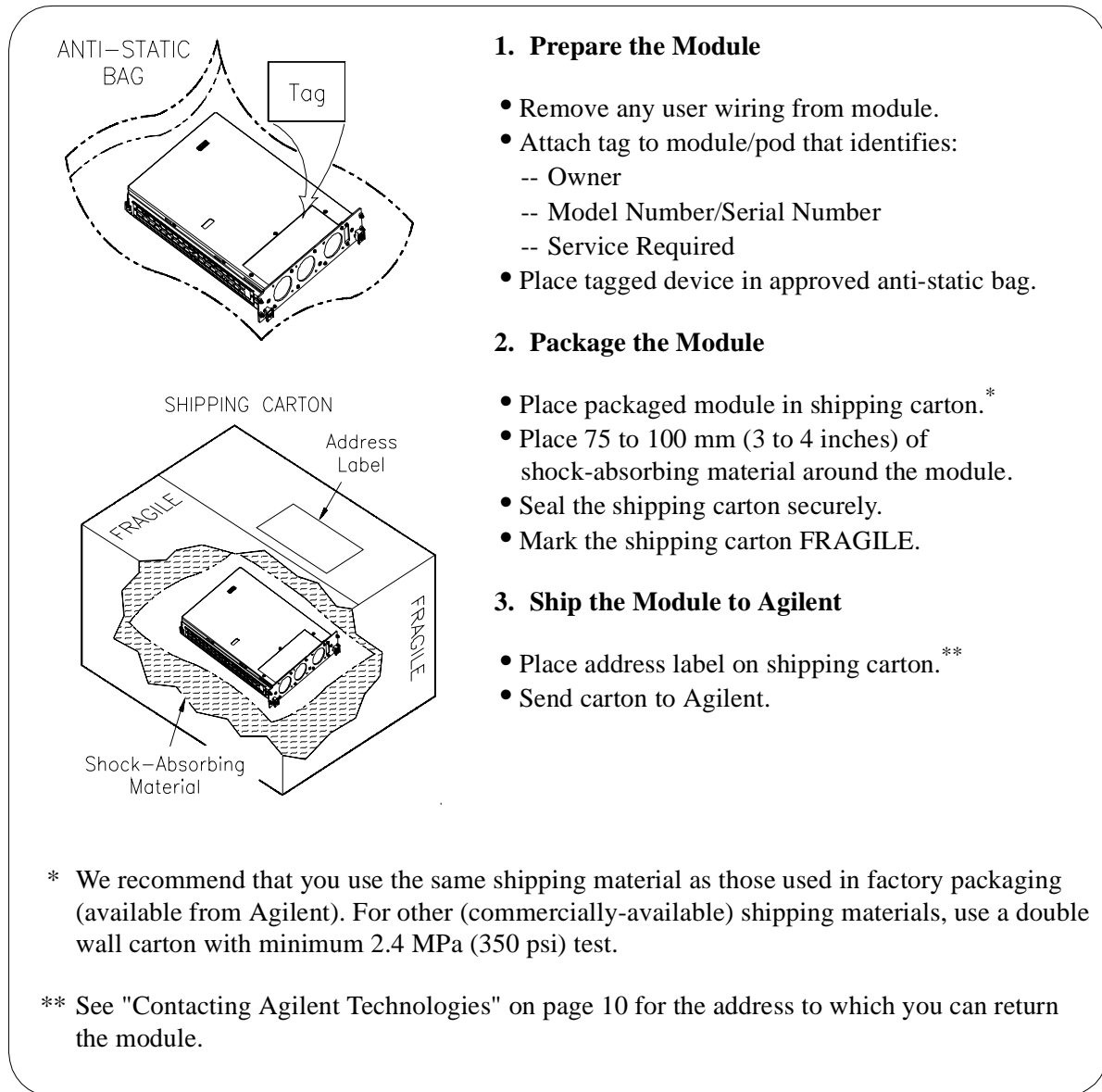


Figure 1-2. Packaging/Shipping Guidelines

Agilent E8483A Module Description

The Agilent E8483A Microwave Switch/Attenuator Driver module is supplied with an E1406A command module driver and a *VXIplug&play* driver. These drivers make the E8483A appear as an "instrument" which takes up two slots of a C-Size VXIbus mainframe. Each module is assigned an error queue, input and output buffers, and a status register.

NOTE *Instruments are based on the logical addresses of the plug-in modules. See Agilent E8483A Microwave Switch/Attenuator Driver Module User's Manual to set the logical address (factory setting is 120) for the module to create an instrument.*

Module Block Diagram

The Agilent E8483A Microwave Switch/Attenuator Driver Module can be used for driving up to six microwave switches and/or step attenuators which should be ordered separately. The recommended switches are Agilent 87104A/B/C and 87106A/B/C series microwave switches. The recommended attenuators are Agilent 84904K/L, 84906K/L, and 84907K/L series step attenuators.

Up to three microwave switches can be directly installed on the E8483A module (labeled with Switch 0, Switch 1 and Switch 2 as shown in Figure 1-3). Together with the external connections, totally up to six microwave switches and/or step attenuators can be controlled by the module at a time. To make your connections more easily, the six ribbon cables for switches (each with 16-pin connectors on both ends) and six ribbon cables for attenuators (each with 10-pin connectors on both ends) are provided along with the module. See the *Agilent E8483A Microwave Switch/Attenuator Driver Module User's Manual* for more connecting information.

As shown in Figure 1-4, the E8483A driver board contains the control, drive and power circuitry for controlling up to six multiport microwave switches and/or step attenuators. The power circuitry (with short circuit protection) can simultaneously provide 1.2 A at 24 Volts to all contacts for control of the switches and attenuators, so no external power supply is needed.

When shipped from the factory, the E8483A module is configured to drive six microwave switches. If the attenuators are to be controlled by the E8483A, you should change the default configuration to what each connector is really connected with. See the *Agilent E8483A Microwave Switch/Attenuator Driver Module User's Manual* for more configuration information.

NOTE *DO NOT connect a microwave switch and an attenuator to the connectors within the same group. That is, if a microwave switch is connected to the 16-pin connector (i.e. Group 0), then you can not connect an attenuator to the 10-pin connector of the same group (i.e., Group 0). Otherwise, there may cause damage to the module. See Agilent E8483A Microwave Switch/Attenuator Driver Module User's Manual for more information.*

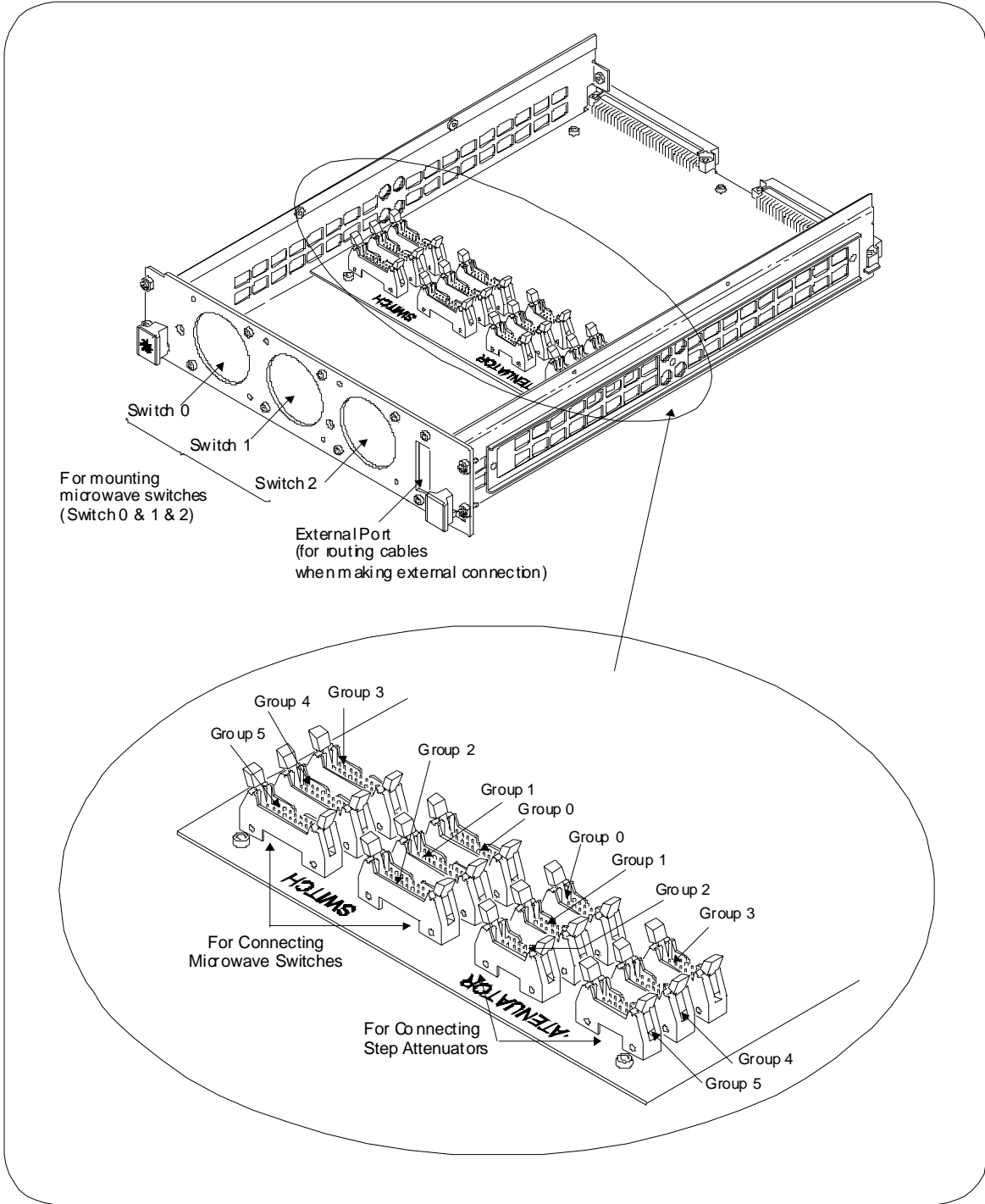


Figure 1-3. Agilent E8483A Module Connectors Diagram

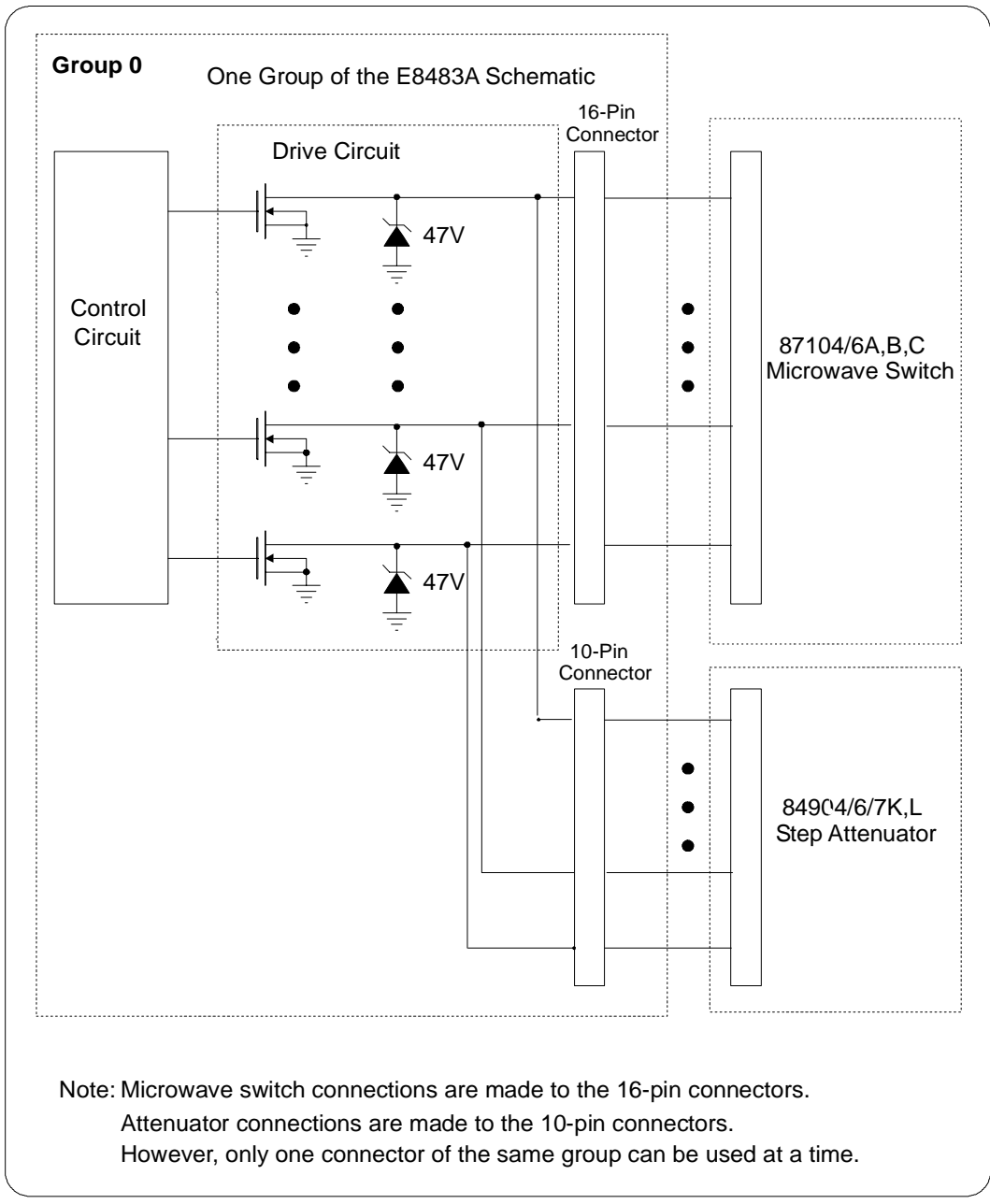


Figure 1-4. Agilent E8483A Microwave Switch/Attenuator Driver Module Block Diagram

Module Specifications

Specifications are listed in Appendix A of this manual. These specifications are the performance standards or limits against which the modules may be tested.

Module Serial Numbers

Devices covered by this manual are identified by Agilent Technologies product number E8483A followed with a ten-character serial number (as listed on the title page). Agilent uses a two-part serial number in the form US00000000. The first 2-letter indicates the country in which the product was manufactured (US = United States). The last 8-digit is unique and assigned sequentially for that particular product number. The serial number plate is located on the right-hand shield near the backplane connectors.

Module Options

There are no electrical or mechanical options available for the E8483A Microwave Switch/Attenuator Driver module.

Chapter 2

Verification Tests

Introduction

The purpose of the functional verification tests described in this chapter is to provide a relatively fast and easy way to verify that the Agilent E8483A Microwave Switch/Attenuator Driver module is operational. For more in-depth, higher confidence level test procedures, use the power circuitry and drive circuitry verification tests in this chapter. The verification tests include:

- Functional Verification Test: Self-Test
- Power Circuitry Verification Test
- Drive Circuitry Verification Test

General Test Requirements

Before performing the verification tests, you should check the requirements and assumptions in this section.

Recommended Test Equipment

Table 2-1 lists the test equipment recommended for testing and servicing the module. Essential requirements for each piece of test equipment are described in the Requirements column.

Table 2-1. Recommended Test Equipment

Instrument	Requirements	Recommended Model	Use ^a
Controller, GPIB	GPIB compatibility as defined by IEEE Standard 488-1987 and the identical ANSI Standard MC1.1: SH1, AH1, T2, TE0, L2, LE0, SR0, RL0, PP0, DC0, DT0, and C1, 2, 3, 4, 5.	IBM Compatible PC with Agilent 82350 GPIB card installed	F, P, D, T
Mainframe	Compatible with E8483A module	Agilent E8401A/03A/04A/08A	F, P, D, T
Command Module	Compatible with E8483A module	Agilent E1406A	F, P, D, T
DC Power Supply	Deliver + 5 Vdc voltage	Agilent 6237B	D, T
Resistor	10 Ohms, 2.5 Watt		D, T
Digital Multimeter	DC voltage (up to + 30 V)	Agilent 3458A or Agilent 34401A	P, D, T

a. F = Functional Verification Test, P = Power Circuitry Verification Test, D= Drive Circuitry Verification Test, T = Troubleshooting

NOTE *The verification tests, troubleshooting and repair procedures are written for the recommended test equipment. Substituting alternate test equipment may require that some procedures be modified.*

Test Conditions/ Procedures

You should complete the verification tests at least once a year. For heavy use or severe operating environments, perform the tests more often.

The verification tests assume that the person performing the tests understands how to operate the mainframe, the switch module, and specified test equipment. The test procedures do not specify equipment settings for test equipment, except in general terms. It is assumed that a qualified, service-trained technician will select and connect the cables, adapters, and probes required for the test.

It is assumed that the temperature is no greater than 25°C and the relative humidity is no greater than 40% (within the specifications as shown in *Appendix A*).

Verification Test Record

The results of each verification test may be recorded in the Performance Test Record (Table 2-4). You can make a copy of this form, if desired.

Verification Tests System Configuration

All verification tests in this chapter assume the following:

- An E1406A command module and an E8483A Microwave Switch/Attenuator Driver module are installed in the mainframe.
- The Agilent SICL Library, VISA extensions, and an Agilent 82350 GPIB card had been installed and properly configured in your computer.
- The computer is connected to the E1406A command module via GPIB interface. The GPIB select code is 7, the GPIB primary address is 09, and the E8483A module is at logical address 120 (secondary address = $120/8 = 15$).
- The E8483A SCPI driver (Revision A.11.01 or later) had been downloaded into the E1406A command module. For access to the most up to date instrument drivers, go to the web site (http://www.agilent.com/find/inst_drivers).
- DMM is an Agilent 3458A.

NOTE *You may need to change the module's address and/or command syntax to perform the tests for your setup. However, substituting alternate configuration may require that some procedures be modified. See Agilent E8483A Microwave Switch/Attenuator Driver Module User's manual for information on address selection, cabling guidelines, and the related SCPI commands.*

Functional Verification Test

The Functional Verification Test for the E8483A Microwave Switch/Attenuator Driver module consists of sending the self-test command (*TST?) and checking the response. This test can be used at any time to verify that the device is connected properly and is responding to basic commands. However, the test does not ensure that the module can drive the microwave switches or step attenuators properly.

Test Procedure

1. Verify that the E8483A module is properly installed in the mainframe and the mainframe has passed its power-on sequence test.
2. Verify that the computer is properly connected to the mainframe via GPIB interface.
3. Send the *TST? command to the E8483A module (GPIB primary address is 09 and secondary address is 120/8 = 15) from *Agilent VISA Assistant* application program.
4. A "+0" returned means no self-test failure, while any non-zero error code returned indicates a self-test failure. See Table 2-2 below for the description of self-test error codes.

NOTE

Test failures can be caused by improper cabling, improper selection of the interface select code, primary, and/or secondary address setting. Verify proper connection and address selection before troubleshooting. As required, see the Agilent E8483A Microwave Switch/Attenuator Driver Module User's manual for more information on module installation, address selection, and the related SCPI commands.

Corrective Action

An non-zero error code is returned when the module self-test fails. The meaning of each code is given in Table 2-2. If a self-test failure occurs, recycle power and repeat the self-test procedure as shown above. If the problem reoccurs, the module requires to be repaired. Contact Agilent Technologies for repair and service (see page 10).

Table 2-2. Self-test Error Codes

Error ^a	Description (probable Causes)
+0	Self-test passes.
+ss01	Firmware error.
+ss02	Bus error (problem communicating with the module).
+ss03	Incorrect ID information in ID register.
+ss05	Card data register incorrect (hardware and firmware with different values).
+ss10	Interrupt expected but not received.
+ss11	Card busy time incorrect.

a. ss = card number (with leading zero deleted, the typical is 1)

Power Circuitry Verification Test

The E8483A Microwave Switch/Attenuator Driver module contains the power circuitry (with short circuit protection) which can simultaneously provide 24 Volts power supply to all of the controlled microwave switches/attenuators, so no external power supply is needed.

The procedures in this section is used to verify the power circuitry of the E8483A module using the specifications in *Appendix A* of this manual as the performance standards. This test is suitable for incoming inspection, troubleshooting, and preventive maintenance.

NOTE

To simplify the following test, do not install/connect microwave switches/attenuators to the module. However, the twelve ribbon cables (P/N E8483-61004 and P/N E8483-61001) should be plugged on and pulled out of the module. See Agilent E8483A Microwave Switch/Attenuator Driver Module User's manual for more connecting information.

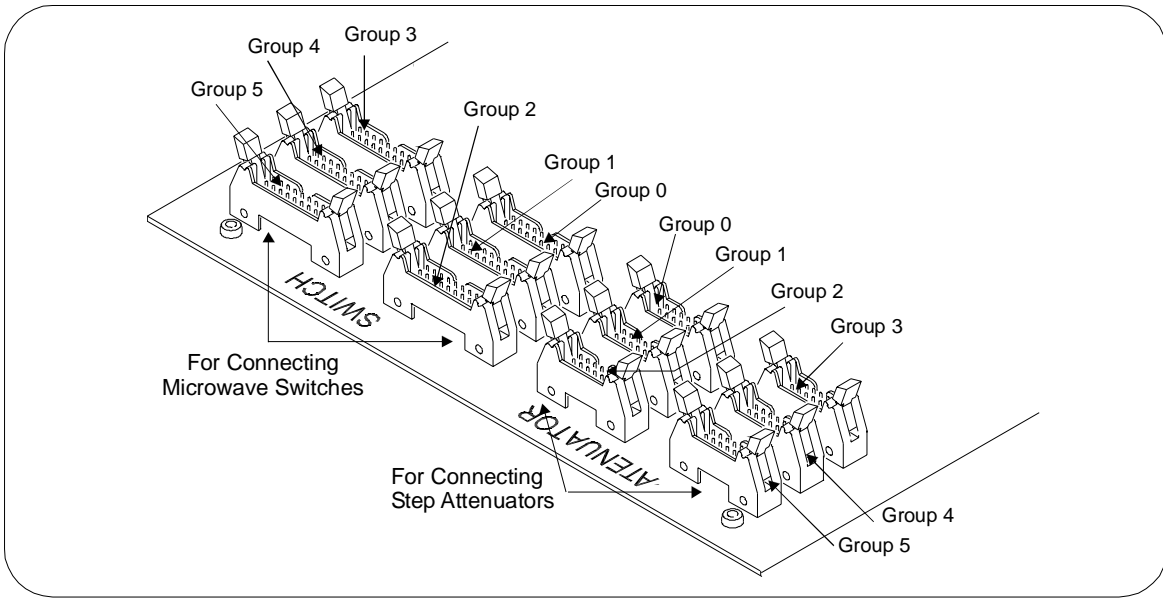
Test Procedure

1. Verify that the E8483A module with the twelve ribbon cables (P/N E8483-61004 and P/N E8483-61001) is properly installed in the mainframe and the mainframe has passed its power-on sequence test.
2. Verify that the computer is properly connected to the mainframe via GPIB interface.
3. Measure power supply voltage for a 16-pin connector (Switch Group 0).
 - Connect DMM (Agilent 3458A) HI to pin 1 of the ribbon cable connector (Switch Group 0), and connect the DMM LO to pin 15 of the same ribbon cable connector (see Figure 2-2). See Figure 2-1 for the connector location and pinout information.
 - Power on the DMM, and set the DMM to DCV, autorange.
 - Observe the DMM display and record the reading in Table 2-4.

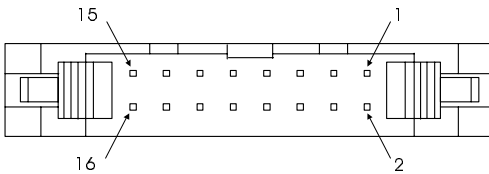
NOTE

As required, see the Agilent 3458A Multimeter Operating, Programming, and Configuration Manual for more configuration information.

4. Repeat Step 3 for Switch Groups 1, 2, 3, 4 and 5 connectors (16-pin) with the following change:
 - Connect the DMM to the Switch Group connector under test.
5. Repeat Steps 3 & 4 for Attenuator Groups 0 through 5 (10-pin connectors) with the following change:
 - Connect the DMM HI to pin 10 and DMM LO to pin 3 of the Attenuator Group connector under test.



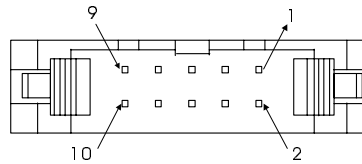
One of the Six Connectors for Microwave Switches



Pins	Function
1	+24 Vdc
2	Ind. Comm.
3	Path 1*
4	Ind. 1
5	Path 2
6	Ind. 2
7	Path 3
8	Ind.3
9	Path 4*
10	Ind. 4
11	Path 5
12	Ind. 5
13	Path 6
14	Ind. 6
15	Common Ground
16	Open all paths

* Paths 1 and 4 not connected for 87104A,B,C

One of the Six Connectors for Attenuators



Pins	Function
1	Section 1 Thru Line
2	Section 1 Attn Card
3	Common Ground
4	Section 3 Thru Line
5	Section 2 Thru Line
6	Section 4 Thru Line*
7	Section 4 Attn Card*
8	Section 2 Attn Card
9	Section 3 Attn Card
10	+24 Vdc

* Section 4 not connected for 84907K/L.

Figure 2-1. Group 0 - 5 Connectors Pinout

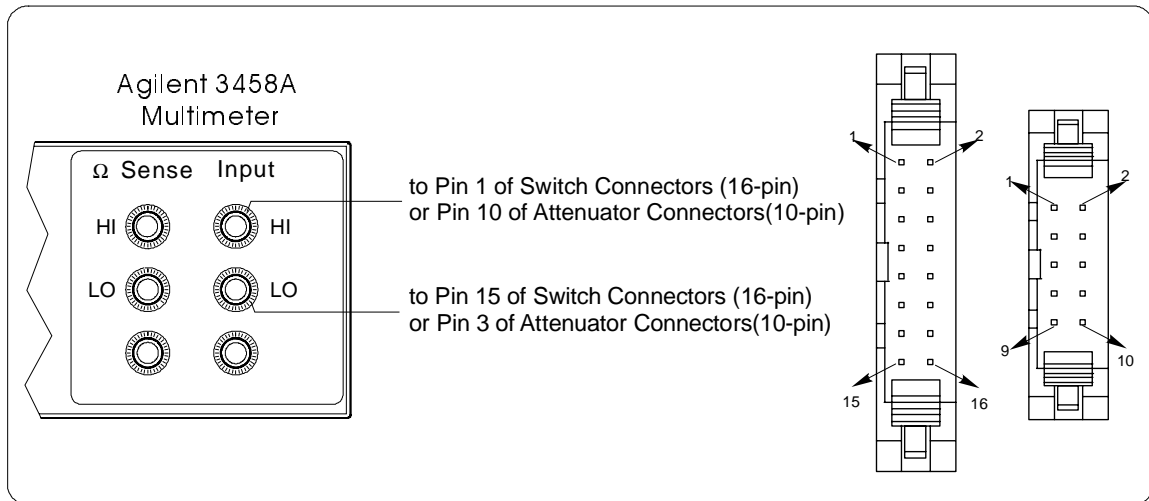


Figure 2-2. Power Supply Voltage Test

Corrective Action

As shown in *Appendix A*, the power supply voltage for any Group connector of the E8483A module is about + 24 Vdc (the worst case should be no less than +20 Vdc). If the voltage is out of the limit, the power circuitry may be defective.

According to the repair strategy for the E8483A module (see page 33), you may need to replace entire printed circuit assembly board (P/N E8483-60001) if the module performance is out of the specification limit.

WARNING

Any maintenance and repair of the module must be performed by qualified personnel. Contact Agilent Technologies (see page 10) for repair and service as required.

Drive Circuitry Verification Test

The Agilent E8483A Microwave Switch/Attenuator Driver module is designed to drive the Agilent 87104A/B/C and 87106A/B/C series microwave switches, and/or the Agilent 84904K/L, 84906K/L, and 84907K/L series step attenuators. The most likely specification that affects the module's control of switches/attenuators properly, is the output voltage of the drive circuitry on the E8483A module.

NOTE *For more information on the microwave switches and the step attenuators, see the corresponding Technical Data Sheets.*

Since the connector with the same Group name (six 16-pin connectors for Switches & six 10-pin connectors for Attenuators) uses the same one drive circuitry, testing the six groups of 16-pin switch connectors is sufficient to identify a defective drive circuitry on the PCA board.

The verification test in this section is to test the output voltage on each drive pin of the Switch Group connectors. It is sufficient for identifying a defective drive circuitry. According to the specifications of the those switches/attenuators, the drive voltage should be no greater than 0.8 V when an RF path is closed.

Test Requirements

To simplify the test, do not install/connect microwave switches/attenuators to the module. However, you should:

- Configure the module as six Agilent 87106A microwave switches being connected to the module by SCPI command.
- Verify that the SW/ATN Identifier Switch on the E8483A module are set properly (factory default setting).
- Verify that the six 16-pin ribbon cables (P/N E8483-61004) are properly plugged on the module's 16-pin connectors and pulled out of the module.
- Require a +5 V Power Supply and a 10 Ω , 2.5 Watt (or greater) resistor to perform the test.

NOTE *See Agilent E8483A Microwave Switch/Attenuator Driver Module User's manual for more configuration information and the related SCPI commands as required.*

NOTE *In the following procedures, all commands sending to the E8483A module (GPIB primary address is 09 and secondary address is 120/8 = 15) are from the VISA Assistant Application Program.*

Test Procedure

1. Verify that the E8483A module with the six 16-pin ribbon cables plugged (P/N E8483-61004) is properly installed in the mainframe and the mainframe has passed its power-on sequence test.
2. Verify that the computer is properly connected to the mainframe via GPIB interface.
3. Connect the DC Power Supply (Agilent 6237B), the DMM (Agilent 3458A) and the 10 ohm resistor as shown in Figure 2-3. Set the DC power supply to deliver + 5 Vdc.
4. Configure the module as to six Agilent 87106 Microwave Switches being connected by sending SCPI command
SYST:COPT 1, "AGT87106,AGT87106,AGT87106,AGT87106,AGT87106,AGT87106"
to the module.
5. Measure drive circuitry output voltage for channel 00 (Group 0).
 - Connect DMM HI to pin 3 of Switch Group 0 connector, and connect the DMM LO to pin 15 of the same connector as shown in Figure 2-3. See Figure 2-1 for the connector location and pinout information. See Table 2-3 for the maps of channel numbers to connector pins.
 - Power on the DMM, and set the DMM to DCV, autorange.
 - Send *RST to the E8483A module to open all channels.
 - Send CLOS (@ss00) to the module to close channel 00.
 - Read the DMM display and record the reading in Table 2-4.
 - Send OPEN (@ss00) to the module to open channel 00.
 - Read the DMM display and verify that an open circuit is indicated (≈ 5 V).

NOTE *As required, see the Agilent 3458A Multimeter Operating, Programming, and Configuration Manual for more configuration information.*

6. Repeat Step 5 for channels 01 through 05 (Group 0) drive circuitry output voltage with the following changes:
 - Connect the DMM HI to the channels under test (see Table 2-3 for the maps of channel numbers to connector pins and Figure 2-1 for the connector pinouts).
 - Use CLOS (@ssgp) and OPEN (@ssgp), where ss = card number, gp = channel number (01-05).
7. Repeat Steps 5 & 6 for channels in Groups 1 through 5 with the following changes:
 - Connect the DMM LO to the pin 15 of the Group connector under test and connect the DMM HI to the channel under test within the same group.

-- Use CLOS (@ssgp) and OPEN (@ssgp), where ss = card number, gp = channel number (10-15 for Group 1, 20-25 for Group 2, 30-35 for Group 3, 40-45 for Group 4, and 50-55 for Group 5).

Table 2-3. Map of Channel Numbers to Switch Connector Pins

Pin Numbers	3	5	7	9	11	13
Channel Numbers ^a	g0	g1	g2	g3	g4	g5

a. The channel number is only for Agilent 87106A/B/C. *g* is 0-5 corresponding to the Group numbers of the 16-pin connectors on the E8483A PCA board. See *Agilent E8483A Microwave Switch/Attenuator Driver User's Manual* for more addressing information.

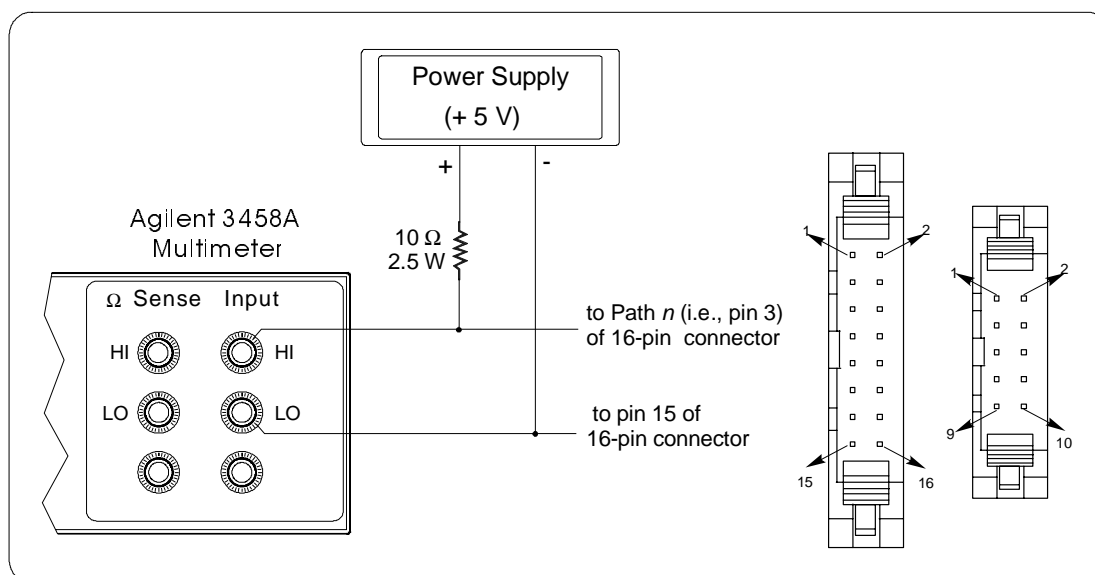


Figure 2-3. Drive Circuitry Output Voltage Test

Corrective Action

The drive circuitry output voltage on any Group connector of the E8483A module should be no greater than +0.8 Vdc when the RF path is closed. If the voltage is out of the voltage limit, the drive circuitry may be defective.

According to the repair strategy for the E8483A module (see page 33), you may need to replace entire printed circuit assembly board (P/N E8483-60001) when any drive circuitry on the board fails the test. However, the sensitivity of the application should be weighed against the cost of replacing the entire PCA board (P/N E8483-60001) with some useful life remaining.

WARNING

Any maintenance and repair of the module must be performed by qualified personnel. Contact Agilent Technologies (see page 10) for repair and service as required.

Verification Test Record

Table 2-4 is a form you can copy and use to record the verification test results for the Agilent E8483A Microwave Switch/Attenuator Driver module. Information concerning test limits, measurement uncertainty, and test accuracy ratio (TAR) is provided below.

NOTE *The accuracy, measurement uncertainty, and TAR values shown in Table 2-4 are valid ONLY for the specific test conditions, test equipment, and assumption described. If you use test equipment and/or change the test conditions, you will need to compute the specific values for your test setup.*

Test Limits

Test limits are defined for Power Circuitry Verification Test and Drive Circuitry Verification Test shown in this chapter. The specifications are single-sided (i.e., there is an upper limit or a lower limit, but not both). In the Verification Test Record, either the Minimum or Maximum column will be blank.

Measurement Uncertainty

For the verification tests in this manual, the measurement uncertainties are based on 90-day accuracy specifications for the Agilent 3458A Digital Multimeter. The calculations are shown below.

Power Circuitry Verification Test

Conditions:

- DC Voltage function, 100 V range
- 90-day specifications
- Worst-case reading = 20 V

$$\begin{aligned} \text{M.U.} &= (6.0 \text{ ppm of Reading} + 0.3 \text{ ppm of Range}) \\ &= (6.0 \times 10^{-6} * 20) + (0.3 \times 10^{-6} * 100) \text{ V} \\ &= 1.5 \times 10^{-4} \text{ V} \end{aligned}$$

Drive Circuitry Verification Test

Conditions:

- DC Voltage function, 10 V range
- 90-day specifications
- Worst-case reading = 0.8 V

$$\begin{aligned} \text{M.U.} &= (4.1 \text{ ppm of Reading} + 0.05 \text{ ppm of Range}) \\ &= (4.1 \times 10^{-6} * 0.8) + (0.05 \times 10^{-6} * 10) \text{ V} \\ &= 3.78 \times 10^{-6} \text{ V} \end{aligned}$$

NOTE *As required, see Agilent 3458A Multimeter Operating, Programming and Configuration Manual.*

Test Accuracy Ratio (TAR)

Test Accuracy Ratios are not defined for single-sided measurements, so all closed-channel resistance and DC isolation measurements have 'NA' (Not Applicable) in the TAR column.

Table 2-4. Verification Test Record (Page 1 of 3)

Model _____	Report Number _____	Date _____
-------------	---------------------	------------

General Information

Test Facility	
Name _____	Phone _____
Address _____	Fax _____
City, State, ZIP _____	e-Mail _____
Customer _____	Tested by _____
Notes	

Test Equipment Used

Description	Model No.	Trace No.	Cal Due Date
1. _____	_____	_____	_____
2. _____	_____	_____	_____
3. _____	_____	_____	_____
4. _____	_____	_____	_____
5. _____	_____	_____	_____
6. _____	_____	_____	_____

Table 2-4. Verification Test Record (Page 2 of 3)

Model _____ Report Number _____ Date _____					
Test Description	Minimum Value	Measured Value	Maximum Value ^a	Measurement Uncertainty	Test Accuracy Ratio (TAR)
Power Circuitry Verification Test (Values in Volts)					
Switch Group 0	20	_____		1.5E-4	NA
Switch Group 1	20	_____		1.5E-4	NA
Switch Group 2	20	_____		1.5E-4	NA
Switch Group 3	20	_____		1.5E-4	NA
Switch Group 4	20	_____		1.5E-4	NA
Switch Group 5	20	_____		1.5E-4	NA
Attenuator Group 0	20	_____		1.5E-4	NA
Attenuator Group 1	20	_____		1.5E-4	NA
Attenuator Group 2	20	_____		1.5E-4	NA
Attenuator Group 3	20	_____		1.5E-4	NA
Attenuator Group 4	20	_____		1.5E-4	NA
Attenuator Group 5	20	_____		1.5E-4	NA

a. Single-sided specification - Maximum Value does not apply for Power Circuitry Verification Test.

Table 2-4. Verification Test Record (Page 3 of 3)

Model _____ Report Number _____ Date _____

Test No/Description	Minimum Value ^a	Measured Value	Maximum Value	Measurement Uncertainty	Test Accuracy Ratio (TAR)
Drive Circuitry Verification Test (Values in Volts)					
Channel 00		_____	0.8	3.78E-6	NA
Channel 01		_____	0.8	3.78E-6	NA
Channel 02		_____	0.8	3.78E-6	NA
Channel 03		_____	0.8	3.78E-6	NA
Channel 04		_____	0.8	3.78E-6	NA
Channel 05		_____	0.8	3.78E-6	NA
Channel 10		_____	0.8	3.78E-6	NA
Channel 11		_____	0.8	3.78E-6	NA
Channel 12		_____	0.8	3.78E-6	NA
Channel 13		_____	0.8	3.78E-6	NA
Channel 14		_____	0.8	3.78E-6	NA
Channel 15		_____	0.8	3.78E-6	NA
Channel 20		_____	0.8	3.78E-6	NA
Channel 21		_____	0.8	3.78E-6	NA
Channel 22		_____	0.8	3.78E-6	NA
Channel 23		_____	0.8	3.78E-6	NA
Channel 24		_____	0.8	3.78E-6	NA
Channel 25		_____	0.8	3.78E-6	NA
Channel 30		_____	0.8	3.78E-6	NA
Channel 31		_____	0.8	3.78E-6	NA
Channel 32		_____	0.8	3.78E-6	NA
Channel 33		_____	0.8	3.78E-6	NA
Channel 34		_____	0.8	3.78E-6	NA
Channel 35		_____	0.8	3.78E-6	NA
Channel 40		_____	0.8	3.78E-6	NA
Channel 41		_____	0.8	3.78E-6	NA
Channel 42		_____	0.8	3.78E-6	NA
Channel 43		_____	0.8	3.78E-6	NA
Channel 44		_____	0.8	3.78E-6	NA
Channel 45		_____	0.8	3.78E-6	NA
Channel 50		_____	0.8	3.78E-6	NA
Channel 51		_____	0.8	3.78E-6	NA
Channel 52		_____	0.8	3.78E-6	NA
Channel 53		_____	0.8	3.78E-6	NA
Channel 54		_____	0.8	3.78E-6	NA
Channel 55		_____	0.8	3.78E-6	NA

a. Single-sided specification - Minimum Value does not apply for Drive Circuitry Verification Test.

Notes:

Introduction

This chapter contains service information for the Agilent E8483A Microwave Switch/Attenuator Driver module, including repair strategy, ordering replaceable parts, repair/maintenance guidelines, as well as troubleshooting techniques.

WARNING Do not perform any of the service procedures shown unless you are a qualified, service-trained technician, and have read the "Safety Considerations" in Chapter 1.

NOTE *The verification tests, troubleshooting and repair procedures are written for the recommended test equipment as shown in Table 2-1 on page 19 of this manual. Substituting alternate test equipment may require that some procedures be modified.*

Repair Strategy

Agilent recommends replacement of the entire printed circuit assembly (PCA) board for the E8483A Microwave Switch/Attenuator Driver module when any defective is founded on the board. However, the sensitivity of the application should be weighed against the cost of replacing the entire circuit board with some useful life remaining. The replacement parts for the ribbon cables (as shown in Figure 1-1) are also available. Table 3-1 shows the ordering information for the user-replaceable parts. See Figure 3-1 for the PCA diagram of the E8483A module. For more repair information, contact Agilent Technologies (see page 10).

NOTE *The detailed diagrams for the schematics and component locators are not included with the electronic version of this manual. Please order a paper copy of this manual (P/N E8483-90010) if you wish for a paper copy of the schematics and component locators.*

Replaceable Parts

The replaceable parts for Agilent E8483A Microwave Switch/Attenuator Driver module include the PCA board (see Figure 3-1) and the ribbon cables. To order a replaceable PCA board, specify the Agilent part number listed in Table 3-1 and the quantity required. Send your order to Agilent

Technologies. See "Contact Agilent Technologies" in *Chapter 1* for details.

Table 3-1. Agilent E8483A Replaceable PCA

Reference Designator	Part Number	Quantity	Description
A1	E8483-60001	1	E8483A Module PCA board
Cable-SW	E8483-61004	6	A ribbon cable with 16-pin connectors on both ends
Cable-ATN	E8483-61001	6	A ribbon cable with 10-pin connectors on both ends

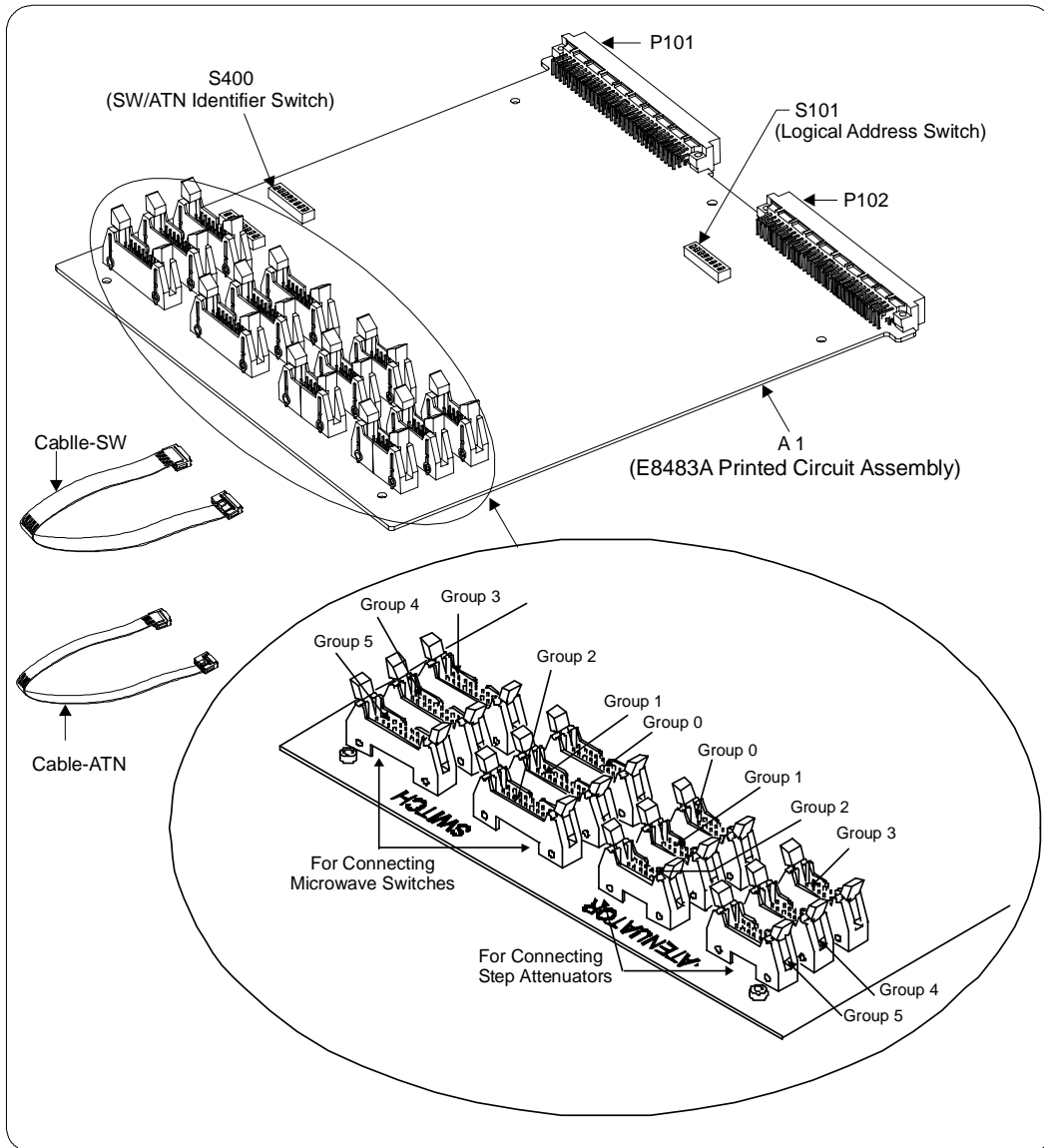


Figure 3-1. Agilent E8483A Print Circuit Assembly Board

Repair/Maintenance Guidelines

This section provides guidelines for repairing and maintaining the Agilent E8483A Microwave Switch/Attenuator Driver module, including:

- ESD precautions
- Cleaning Requirements

ESD Precautions

Electrostatic discharge (ESD) may damage static-sensitive devices in the modules. This damage can range from slight parameter degradation to catastrophic failure. When handling module assemblies, follow these guidelines to avoid damaging components:

- Always use a static-free work station with a pad of conductive rubber or similar material when handling electronic components.
- After you remove an assembly from the module, place the assembly on a conductive surface to guard against ESD damage. Do not stack assemblies.

Cleaning Requirements

Preventive maintenance for the Agilent E8483A module consists of periodically cleaning the module to remove dust and debris that will build up over time. The cleaning interval is dependent on the environment conditions and application. For best results, you should clean the module once a year or more often if the module is used in extremely dusty or very humid area. The front panel and the top/bottom cover can be cleaned with a dry cloth or one slightly dampened with water.

WARNING

To prevent electrical shock, disconnect any AC power from the mainframe and from other modules that may be connected to the Microwave Switch/Attenuator Driver module before cleaning.

Troubleshooting

To troubleshoot an Agilent E8483A Microwave Switch/Attenuator Driver module problem, you should first identify the problem, and then isolate the cause to a user-replaceable assembly.

NOTE *Test failures can be caused by improper cabling and improper configuration. Verify proper connection and configuration before troubleshooting. As required, see the Agilent E8483A Microwave Switch/Attenuator Driver Module User's Manual for more configuration information.*

Identifying the Problem

Table 3-2 lists some common problems, along with symptoms and possible solutions.

NOTE *If the problem can not be identified or traced to a user-replaceable assembly with the following procedures, contact Agilent Technologies for repair and service (see page 10).*

Table 3-2. Agilent E8483A Common Problems

Problem Type	Symptom	Recommended Actions ^a
Self-test Errors	Non-zero error code in response to the *TST? command.	See page 21 in <i>Chapter 2</i> .
Operator Errors	Non-zero error code in response to the SYST:ERR? command.	See <i>Appendix C - Error Messages in the Agilent E8483A Microwave Switch/Attenuator Driver Module User's Manual</i> for module errors and causes.
Catastrophic Failures	Not responding to commands.	See "Testing the Assembly" later in this chapter.
Verification Test Out of Specification	Failing Power Circuitry Verification Test	See page 24 in <i>Chapter 2</i> .
	Failing Drive Circuitry Verification Test	See page 27 in <i>Chapter 2</i> .

a. Verify proper connections and proper configuration before troubleshooting.

Testing the Assembly

You can use the tests and checks in Table 3-3 to identify the problem on the user-replaceable assembly. If there are no apparent problems following the typical checks, run the Verification Tests in Chapter 2 to see if the module is defective. See Figure 3-1 for the locations of the checked components on the E8483A PCA board. The typical checks for the module include the followings.

- Checking for heat damage
- Checking Logical Address Switch setting
- Checking SW/ATN Identifier Switch setting
- Checking connectors contacts

Table 3-3. Agilent E8483A Tests/Checks

Test/Check	Reference Designator	Check:
Heat Damage	N.A.	Discolored PC board Damaged insulation Evidence of arcing
Logical Address Switch	S101	Logical address setting
SW/ATN Identifier Switch	S400	Incorrect setting
Connectors	P101, P102, Six 16-pin Switch connectors, Six 10-pin Attenuator connectors	Bent or damaged connectors

Checking for Heat Damage

Inspect the assembly for signs of abnormal internally generated heat such as discolored printed circuit boards or components, damaged insulation, or evidence of arcing. If there is damage, do not operate the module until you have corrected the problem.

Checking Logical Address Switch

Verify that the logical address switch (S101) is set correctly (factory set at 120). See *Agilent E8483A Microwave Switch/Attenuator Driver Module User's Manual* for more configuration information.

Checking SW/ATN Identifier Switch

Verify that the SW/ATN Identifier Switch (S400) is set correctly (factory set as to be driving six microwave switches). See *Agilent E8483A Microwave Switch/Attenuator Driver Module User's Manual* for more configuration information.

Checking Connectors

Check all connectors on the board (P101, P102, Group 0-5 Switch connectors and Group 0-5 Attenuator connectors as shown in Figure 3-1) for bent pins or damaged contacts. If any of them is damaged, you may have to replace the entire PCA (P/N e8483-60001).

WARNING Any maintenance and repair of the module must be performed by qualified personnel. Contact Agilent Technologies (see page 10) for repair and service as required.

E8483A Module Disassembly

Use the following procedures to disassemble the Agilent E8483A Microwave Switch/Attenuator Driver module (see Figure 3-2).

NOTE

To avoid damage to the screw head slots, use a T10 Torx driver to remove the A1 PCA board and a Pozidriver to remove the top cover. The screws on the front panel are also removed with a Pozidriver if required.

1. To remove the top cover:

- Remove the six Pozidrive screws from the top cover as shown in Figure 3-2.
- Lift the top cover off the module.

2. To remove the A1 assembly board:

- Remove the six T10 Torx screws holding the A1 assembly to the bottom cover as shown in Figure 3-2.
- Slide the A1 assembly in the direction as shown.
- Lift the A1 assembly off the module.

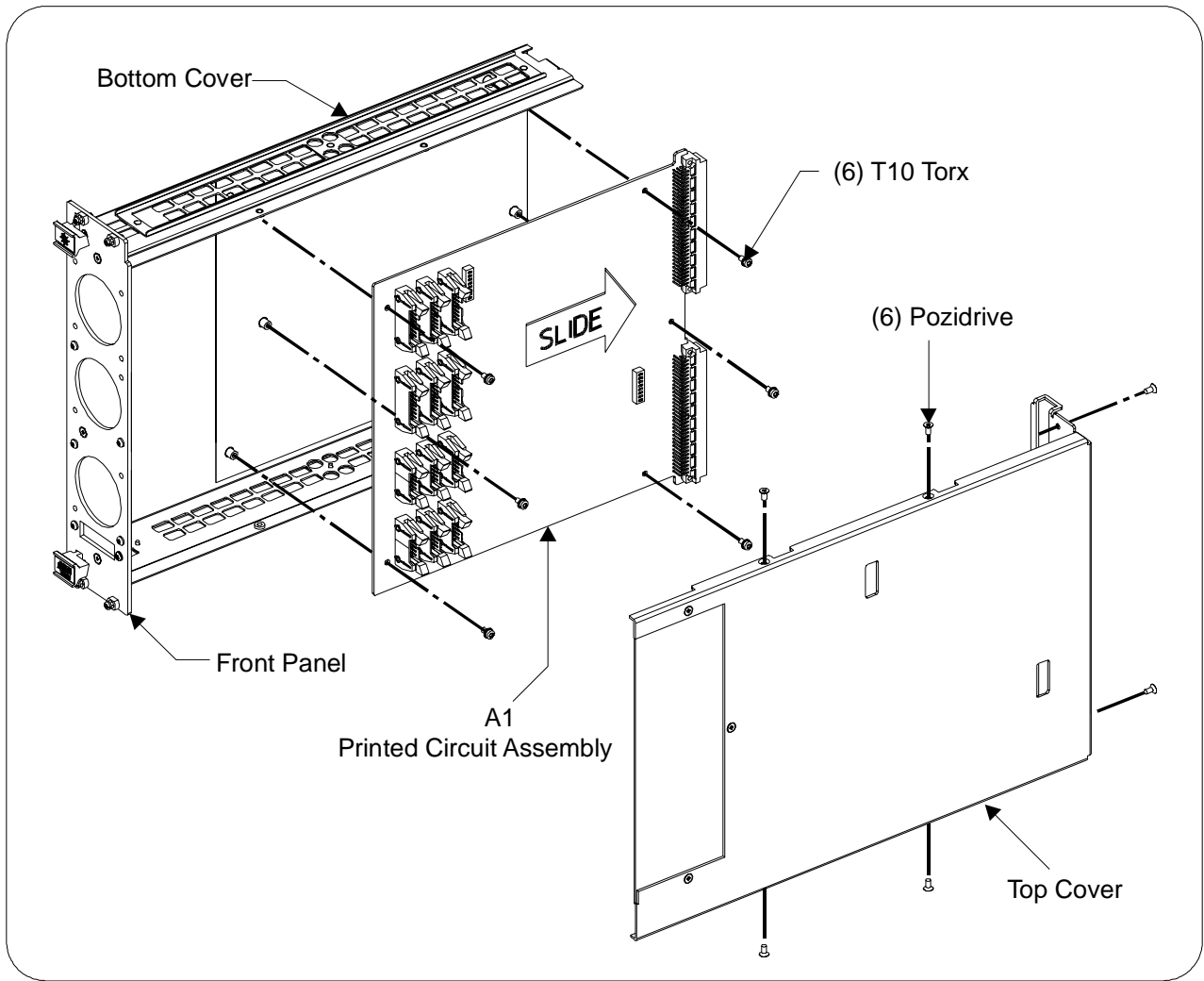


Figure 3-2. Agilent E8483A Module Disassembly

Notes:

Appendix A

E8483A Specifications

ITEMS	SPECIFICATIONS
Drive Output Per Switch ^a :	+5 V or +24 V
Maximum Energizing Voltage ^a :	42 V ac peak
Power Requirements:	Peak Module Current: 0.1 A @ +5 V or 1.2 A @ +24 V Dynamic Module Current ^b : 0.1 A @ +5 V or 1.2 A @ +24 V
Watts/slot:	15 W
Cooling/slot ^b :	0.08 mm H ₂ O @ 1.2 Liter/sec for 10°C rise
Module Size/Device Type:	C-Size 2-Slot, Register based, A16, slave only, P1 and P2 Connectors
Operating Temperature:	0 - 55°C
Operating Humidity:	65% RH, 0 - 40°C

- a. Control circuit can switch a maximum of 1 A per switch. Maximum current also depends on the output capability of the mainframe used.
- b. Power and cooling requirements depend on switches installed or switches/attenuators connected.

Notes:



Agilent Technologies



Manual Part Number: E8483-90010
Printed in U.S.A. E0601

