

Agilent Technologies U3040A Option S84

User's and Service Guide

Mechanical Switching Test Set



Agilent Technologies

Manufacturing Part Number: U3040-90001

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| | |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| WARNING | Warning denotes a hazard. It calls attention to a procedure which, if not correctly performed or adhered to, could result in injury or loss of life. Do not proceed beyond a warning note until the indicated conditions are fully understood and met. |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

| | |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CAUTION | Caution denotes a hazard. It calls attention to a procedure that, if not correctly performed or adhered to, could result in damage to or destruction of the product. Do not proceed beyond a caution sign until the indicated conditions are fully understood and met. |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Definitions

- *Specifications* describe the performance of parameters covered by the product warranty (temperature –0 to 50 °C, unless otherwise noted.)
- *Typical* describes additional product performance information that is not covered by the product warranty. It is performance beyond specification that 80% of the units exhibit with a 95% confidence level over the temperature range 20 to 30 °C. Typical performance does not include measurement uncertainty.
- *Nominal* values indicate expected performance or describe product performance that is useful in the application of the product, but is not covered by the product warranty.
- *Characteristic Performance* describes performance parameter that the product is expected to meet before it leaves the factory, but is not verified in the field and is not covered by the product warranty. A characteristic includes the same guard bands as a specification.

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Contents

U3040A Option S84

Introduction

This document describes how to use and service the U3040AS84 Mechanical Switching Test Set. The general use for this product is RF switching path applications.

Figure 1 U3040AS84



Description

The Agilent U3040AS84 is a Mechanical Switching Test Set (DC to 40 GHz) based on the L4491A RF Switch Platform. Eight individual 1x4 switches allow the user to select eight input ports allowing the user to increase the DUT output to a full 32-Port network analyzer solution.

The U3040AS84 can be used with the U3024AH10 and N5244A or N5245A. For further information refer to the U3040AC01 Product Note for connection setup using the U3024AH10 and the N5244A or N5245A.

The mechanical switches provide low insertion loss for the best dynamic range performance, but have slower switching speed and limited life when compared to solid-state switches. The operational frequency range of the extension test set is DC to 40 GHz.

The N5244/45A PNA-X Network Analyzer will be referred to throughout this document as the PNA-X. The U3040AS84 will be referred to as the Test Set.

The U3040AS84 can only be controlled using an external GPIB controller or LAN.

When using Agilent IO libraries "Connection Expert Utility," the interface identifies the Test Set as "U3040A" without Option S84. Option S84 will be listed on the serial tag on the rear panel.

Verifying the Shipment

To verify the contents shipped with your product, refer to the "Box Content List" included with the shipment.

Inspect the shipping container. If the container or packing material is damaged, it should be kept until the contents of the shipment have been checked mechanically and electrically. If there is physical damage refer to ["Contacting Agilent" on page 41](#). Keep the damaged shipping materials (if any) for inspection by the carrier and an Agilent Technologies representative.

General Performance

The U3040AS84 specifications have been leveraged from the 87104D Multiport Electromechanical Switch.

It is not intended to specify as an overall level system performance. A functional certificate is supplied for the U3040AS84.

There are no internal adjustment in the U3040AS84, therefore an annual calibration is not required.

CAUTION Refer to the standard instrument documentation for damage limits to the ports. Verify that your test setup will not cause those limits to be exceeded.

Mounting Kits

The Test Set available options:

- U3040AC01-002 Connects the U3040AS84 to the U3024AH10, includes cables and locking feet for two U3040AS84's (U3040-60002).
- U3040AS84-1CP Rack Mount Kit with Handles (5063-9222)
- U3040AS84-1CM Rack Mount Kit without Handles (5063-9215)
- U3040AS84-1CN Front Handle Kit (5063-9228)

Power Requirements

Verify that the required ac power is available at all necessary locations before installing the Test Set to the PNA.

- 100/120/220/240 V (50/60 Hz)
- The instruments can operate with mains supply voltage fluctuations up to $\pm 10\%$ of the nominal voltage.
- Air conditioning equipment (or other motor-operated equipment) should not be placed on the same ac line that powers the Test Set.

CAUTION This product has an autoranging line voltage input. Be sure the supply voltage is within the specified range.

Environmental Requirements

Refer to the PNA-X standard documentation for environmental requirements.

Environmental Tests

The U3040AS84 complies with all applicable safety and regulatory requirements for the intended location of use.

Operating Environment

- Operating Ambient: Temperature 0 to 55 °C
- The instrument can safely operate in a relative humidity of 80% for temperatures to 31 degrees C, decreasing linearly to 50% relative humidity at 40 degrees C.

Equipment Heating and Cooling

If necessary, install air conditioning and heating to maintain the ambient temperature within the appropriate range. Air conditioning capacity must be consistent with the rating listed in the PNA standard documentation.

CAUTION When installing this product in a cabinet, the convection into and out of the product must not be restricted. The ambient temperature (outside the cabinet) must be less than the maximum operating temperature of the product by 4°C for every 100 watts dissipated in the cabinet. If the total power dissipated in the cabinet is greater than 800 watts, then forced convection must be used.

Required Conditions for Accuracy Enhanced Measurement

Accuracy-enhanced (error-corrected) measurements require the ambient temperature of the PNA-X and Test Set to be maintained within ± 1 °C of the ambient temperature at calibration.

Dimensions and Space Requirements

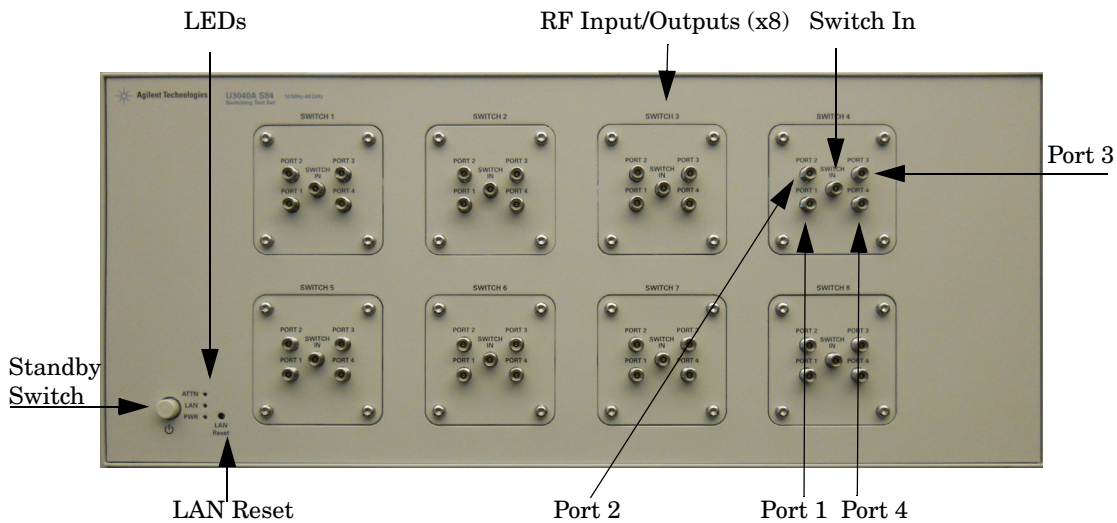
Standard installation of the Test Set and PNA-X includes configuration and installation on a customer provided lab bench or table top of adequate size and strength.

Table 1 Test Set Dimensions

| Item | Weight |
|--------|--------------------|
| Width | 42.5 cm (16.73 in) |
| Depth | 58 cm (22.83 in) |
| Height | 17.78 cm (7in) |
| Weight | 9 kg (19.84 lb) |

Front and Rear Panel Features

Figure 2 Front Panel



Standby Switch

Note that this switch is Standby only, not a line switch. The main power cord can be used as the system disconnecting device. It disconnects the mains circuits from the mains supply.

LAN Reset

The LAN reset button restores the instrument's default LAN configuration.

RF Input/Output

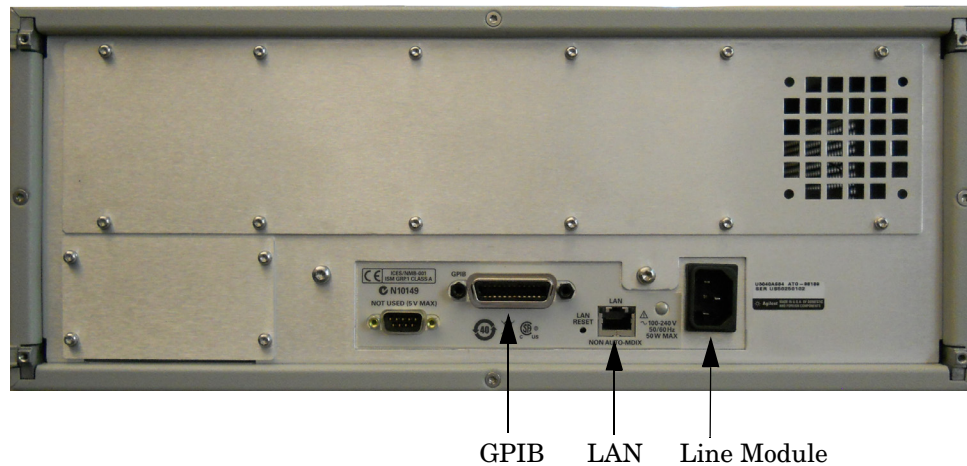
- 8 (1 x 4) Switches

Instrument State LEDs

When the power is applied to the U3040AS84, the instrument enters its power-on sequence which requires several seconds to complete. The LEDs provide information on the state of the instrument during power-on and during upgrades of the instrument firmware. [Table 2](#) identifies the instrument states based on the color and functioning of the LEDs.

Table 2 LED Definitions and Instrument States

| LED | Color | Instrument State |
|--------------------|------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ATTN LAN PWR | Off Green Green | Instrument in “ready” state LAN connection established - instrument has an IP address Firmware download complete |
| ATTN LAN PWR | flashing flashing Green | Power-on/boot-up. ATTN and LAN will flash red and then green during the power-on self-test. |
| ATTN LAN PWR | Off Red Green | No LAN connection due to: - disconnected LAN cable - failure to acquire and IP address - waiting for DHCP-assigned address |
| ATTN LAN PWR | Green (flashing) Green Green | Instrument Busy State - firmware download (LAN LED red if download over GPIB) - lengthy instrument operation in progress |
| ATTN LAN PWR | Red (flashing) Green Green | Instrument programming error or self-test error. Error queue is read using <code>SYSTEM:ERRor?</code> |
| ATTN LAN PWR | Off Green (flashing) Green | Instrument identification. Activated from instrument Web interface: ON: <u>Turn on Front Panel Interface Indicator</u> OFF: <u>Turn off Front Panel Interface Indicator</u> |

Figure 3 Rear Panel**GPIB Connector**

This connector allows the Test Set to be connected directly to a controller.

LAN

The instrument is controlled over Local Area Network (LAN).

Line Module

The line module contains the power cord receptacle. The line fuse, as well as a spare, reside within the line module.

Install the instrument so that the detachable power cord is readily identifiable and is easily reached by the operator. The detachable power cord is the instrument disconnecting device. It disconnects the mains circuits from the mains supply before other parts of the instrument. The front panel switch is only a standby switch and is not a LINE switch. Alternatively, an externally installed switch or circuit breaker (which is readily identifiable and is easily reached by the operator) may be used as a disconnecting device.

CAUTION Always use the three-prong ac power cord supplied with this product. Failure to ensure adequate grounding by not using this cord may cause damage to the product.

WARNING **This is a Safety Class I Product (provided with a protective earthing ground incorporated in the power cord). The mains plug shall be only be inserted in a socket outlet provided with a protective earth contact. Any interruption of the protective conductor inside or outside of the product is likely to make the product dangerous. Intentional interruption is prohibited.**

Specifications

Specifications described in this document are provided from the 87104D Operation and Service manual (87104-90001). Refer to the 87104D documentation on agilent.com for complete product performance and specifications.

Supplemental and typical characteristics are intended to provide typical information, but not warranted performance parameters.

Maximum Power Rating

Into internal termination:

- 1 W CW
- 50 W peak, 10us max pulse width, not to exceed 1 W average

Into thru path:

- Hot switching: 2 W CW
- 100W peak, 10us max pulse width, not to exceed 2 W average

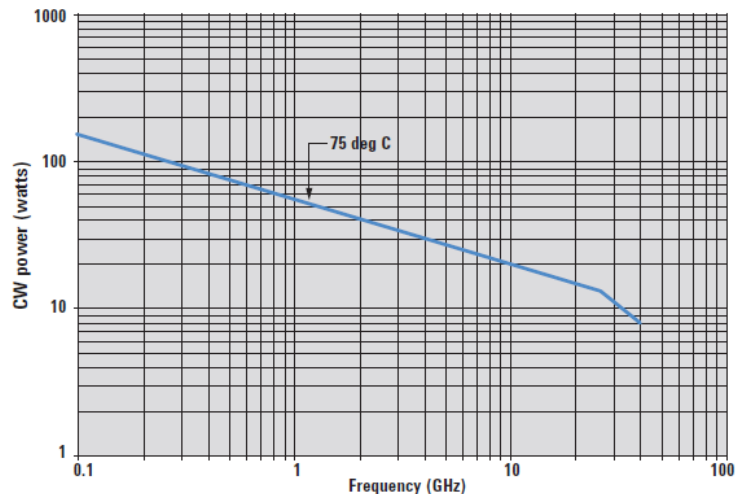
Reference Conditions

Power Handling at 25° C is 100 W at 4 GHz.

Into internal termination:

- Cold switching only (no hot switching)
- Ambient temperature of 75 °C or less
- Sea level, 0.88 derating at 15,000 ft.
- Load VSWR < 1.2 (see graph for derating above 1.2 VSWR)

Figure 4 Maximum Incident CW Power (cold switching) vs. Frequency



Indicator Specifications

Into internal termination:

- Maximum withstand voltage: 60 V
- Maximum current capacity: 150 mA
- Maximum “ON” resistance: 2.5 Ω
- Maximum “OFF” resistance: 10 G Ω

Figure 5 Power Derating Factor versus VSWR

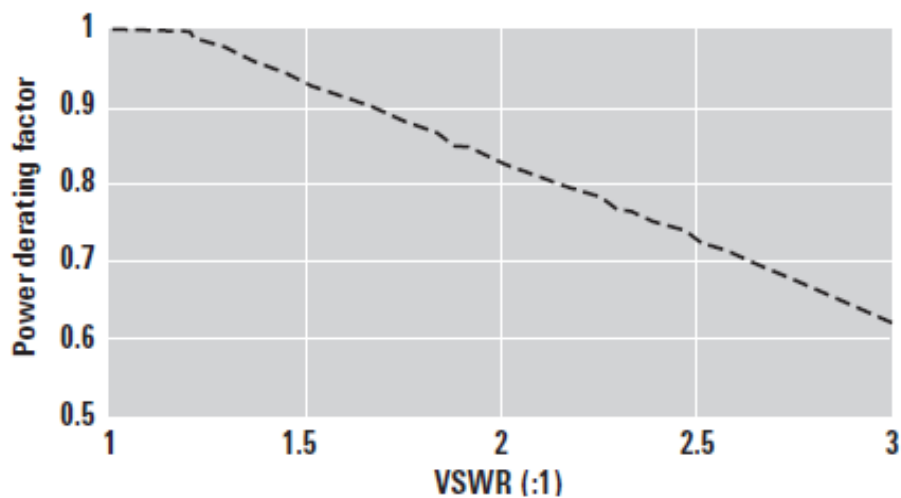


Table 3 U3040A S85

| Frequency Range | DC to 40 GHz |
|---------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| Insertion Loss Figure 6 on page 11 | 0.3 dB + 0.015 x frequency (GHz), DC to 26.5 GHz 0.030 x frequency (GHz) – 0.1 dB, 26.5 to 40 GHz |
| Isolation Figure 7 on page 11 | 80 dB minimum, 12 to 15 GHz 70 dB minimum, 15 to 20 GHz 65 dB minimum, 20 to 40 GHz |
| SWR | 1.3 maximum, DC to 4 GHz 1.35 maximum, 4 to 12.4 GHz 1.5 maximum, 12.4 to 18 GHz 1.7 maximum, 18 to 26.5 GHz 1.95 maximum, 26.5 to 40 GHz |
| Repeatability (Up to 5 million cycles measured at 25°C) | 0.03 dB maximum |
| Connectors | 2.92 (f) |

Figure 6 Insertion Loss vs Frequency

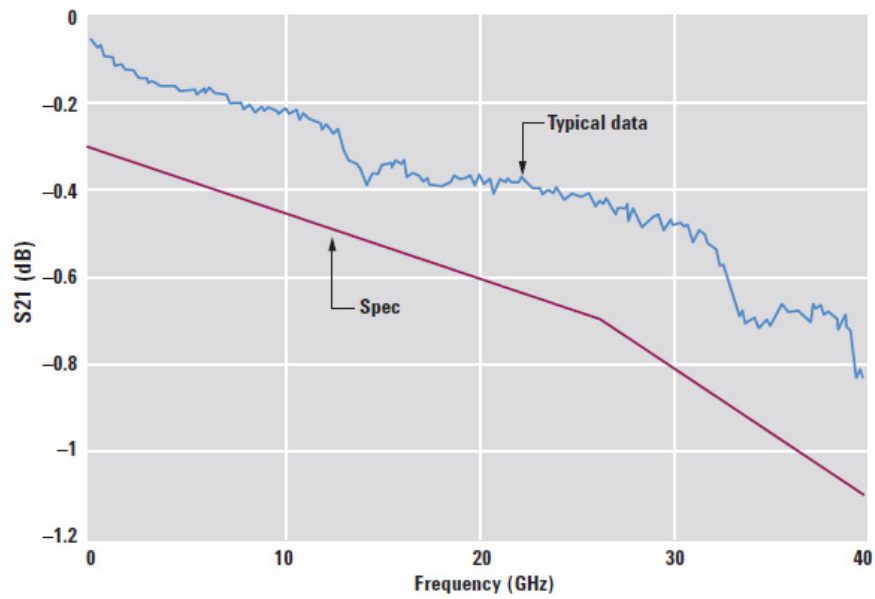
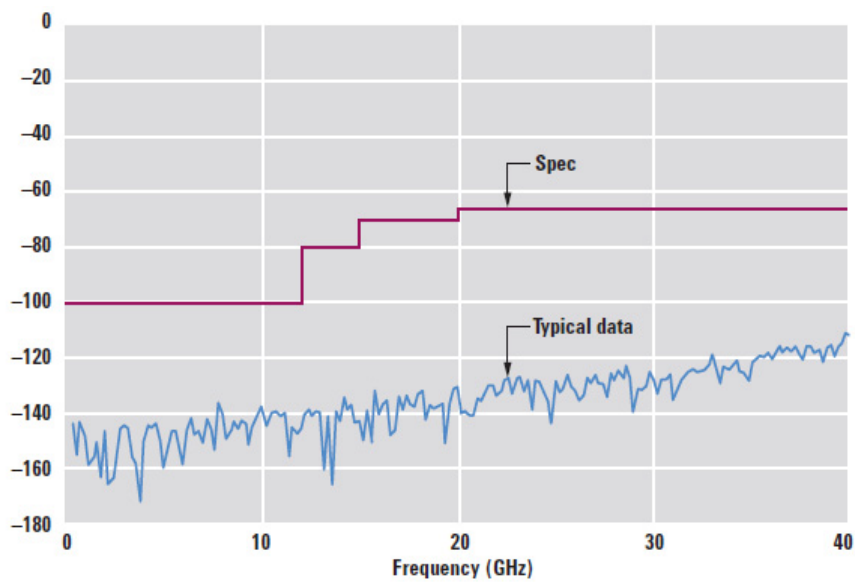


Figure 7 Isolation Loss vs Frequency



Instrument Setup

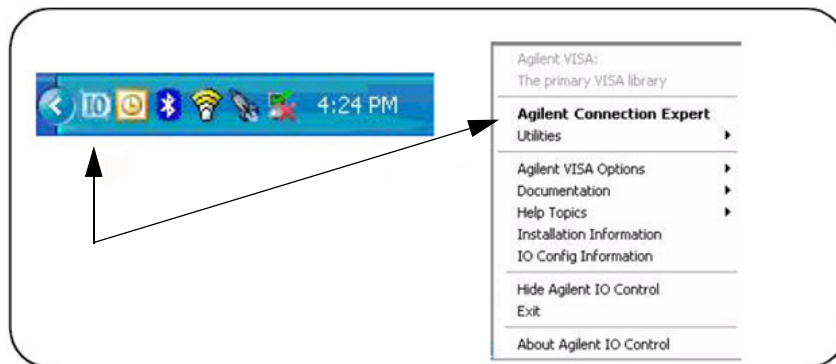
LAN and GPIB Interface

This section contains information for configuring the U3040A LAN and GPIB interfaces using Agilent IO Libraries “Connection Expert Utility”.

Configuring the LAN Interface

1. Connect the Test Set to the PC.
2. Turn On the Test Set.
3. Select **IO Control** icon > **Agilent Connection Expert** from the application window.

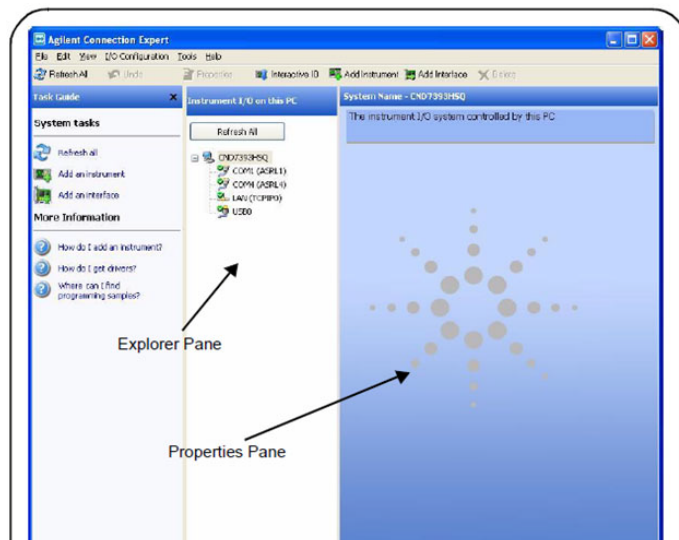
Figure 8 Agilent Connection Expert



Locating the Instrument

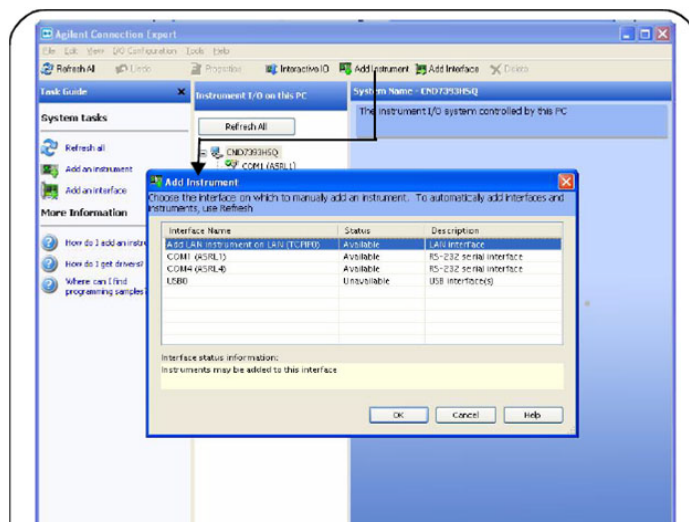
Agilent Connection Expert opens with a “Welcome Screen,” and a window similar to that shown in [Figure 8](#). The available computer interfaces are configured during installation of the Agilent IO Libraries and are displayed in the left column (Explorer Pane). The properties of the configured interface are displayed in the right column (Properties Pane).

Figure 9 Explorer and Properties Pane



1. Click **Add Instrument** on the tool bar to search the network for instruments.
2. Select **Add LAN Instrument on LAN (TCP/IP0) > OK**. Agilent Connection Expert performs an automatic find of all instruments on the same subnet as the computer.
3. Select the desired instruments from the list and click **OK**. Communication paths to the instruments are verified and the instruments are added to the configured interface.

Figure 10 Adding Instruments

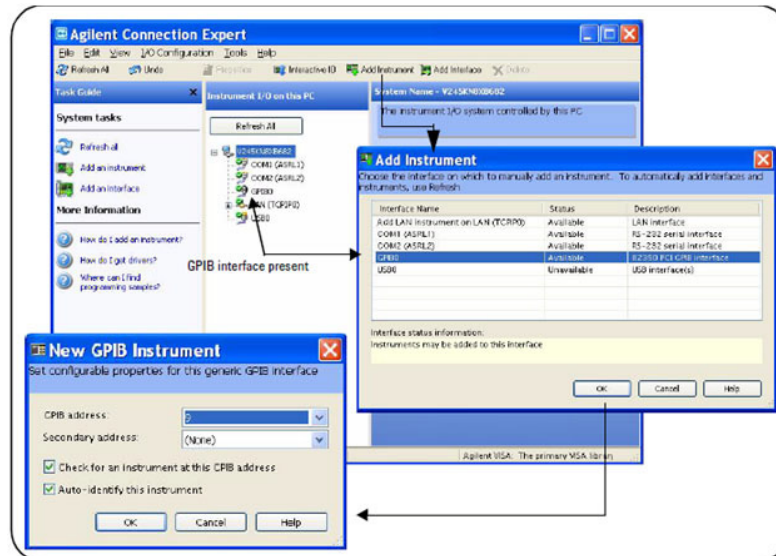


Configuring the GPIB Interface

Programming access to the Test Set is also available through the instrument's GPIB interface. The GPIB connector is located on the rear panel of the instrument.

1. Select the **Agilent Control** icon > **Agilent Connection Expert**. If a GPIB card is installed in your computer, the GPIB interface was configured during installation of the IO libraries and is displayed in the Explorer Pane of the “Welcome” Screen.

Figure 11 Agilent Connection Expert



Adding Instruments to the GPIB Configuration

1. Select **Add Instrument** on the tool bar.
2. Select **GPIB Interface** > **OK**.
3. Select **U3040A's Address** in the GPIB address drop-down list > **OK**.
Factory set address = 12 (default)

Changing the GPIB Address

The U3040A GPIB address can only be changed programmatically. The GPIB address command is:

```
SYSTEM:COMMunicate:GPIB:ADDRESS <address>
```

When the address is changed, the new GPIB address is *not* updated in the Agilent Connection Expert if the instrument was previously configured.

1. From the Agilent Connection Expert application window, highlight the instrument that's address was changed and click **Change Properties** in the Configurable Properties application window, change the address to the new address setting and select **OK**.

Controlling the Test Set

Agilent U3040A is a “slave” instruments. A controller must be used to control the Test Set. There are two methods that can be used to control the Test Set.

- Using LAN connection
- Using GPIB connection

Once the connection between the Controller and the Test Set has been established (LAN or GPIB), the Test Set can be controlled using SCPI commands.

Reset Command

This command resets the instrument.

Syntax

```
*RST
```

Remote Interface Configuration LAN Configuration Commands

Description

This command assigns a static Internet Protocol (IP) address for the U3040A. Contact your network administrator for the valid IP address to use for your instrument.

NOTE If you change the IP address, you must cycle power on the U3040A to activate the new address.

Syntax

```
SYSTem:COMMunicate:LAN:IPADdress <address>
```

```
SYSTem:COMMunicate:LAN:IPADdress?
```

You can also queries the U3040A for the IP address it was assigned to.

Example

The following command sets the IP address:

```
SYST:COMM:IPAD 169.254.149.35
```

The following query returns the IP address currently being used by the instrument (quotes are also returned).

```
SYST:COMM:LAN:IPAD?
```

Typical Response: "169.254.149.35"

Description

This command disable or enable the use of Auto-IP standard to automatically assign an IP address to the U3040A when on a network that does not have DHCP servers.

Syntax

```
SYSTem:COMMunicate:LAN:AUTOip {OFF|0|ON|1}
```

```
SYSTem:COMMunicate:LAN:AUTOip?
```

Example

The following command disable the Auto-IP:

```
SYST:COMM:LAN:AUTOIP OFF
```

The following query returns the current Auto-IP setting:

```
SYST:COMM:LAN:AUTOIP?
```

Typical Response: 0

Description

This command disables or enables the use of the Dynamic Host Configuration Protocol (DHCP).

Syntax

```
SYSTem:COMMunicate:LAN:DHCP {OFF|0|ON|1}
```

```
SYSTem:COMMunicate:LAN:DHCP?
```

When DHCP is enable (factory setting), the instrument will try to obtain an IP address from the DHCP server. If a DHCP server is found, it will assign a Dynamic IP address, Subnet Mask, and Default Gateway to the instrument.

When the DHCP is disable or unavailable, the instrument will use the Static IP address, Subnet Mask, and Default Gateway during power-on.

NOTE If you change the DHCP setting, you must cycle power on the U3040A to activate the new setting.

Example

The following command disables DHCP:

```
SYST:COMM:LAN:DHCP OFF
```

The following query returns the current DHCP setting:

```
SYST:COMM:LAN:DHCP?
```

Typical Response: 0

Description

This command assigns the IP address of the Domain Name System (DNS) server. Contact your network administrator to determine if DNS is being used and for the correct address.

Syntax

```
SYSTem:COMMunicate:LAN:DNS <address>
```

```
SYSTem:COMMunicate:LAN:DNS?
```

NOTE If you change the DNS address, you must cycle power on the U3040A to activate the new address.

Example

The following command sets the DNS address:

```
SYST:COMM:LAN:DNS 198.105.232.4
```

The following query returns the DNS address currently being used by the instrument (the quotes are also returned).

```
SYST:COMM:LAN:DNS?
```

Typical Response: "198.105.232.4"

Description

This command assigns a Domain Name to the U3040A. The Domain Name is translated into an IP address.

Syntax

```
SYSTem:COMMunicate:LAN:DOMain "<name>"
```

```
SYSTem:COMMunicate:LAN:DOMain?
```

NOTE If you change the Domain Name, you must cycle power on the U3040A to activate the new address.

Example

The following command defines the Domain Name:

```
SYST:COMM:LAN:DOM www.agilent.com
```

The following query returns the Domain Name currently being used by the instrument:

```
SYST:COMM:LAN:DOM?
```

Typical response: www.agilent.com

Description

This command assigns a Default Gateway for the U3040A. The specified IP Address sets the Default Gateway which allows the instrument to communicate with systems that are not on the local subnet. Thus, this is the Default Gateway where packets are sent which are destined for a device not on the local subnet, as determined by the Subnet Mask setting. Contact your network administrator to determine if a gateway is being used and for the correct address.

Syntax

```
SYSTEM:COMMunicate:LAN:GATEway <address>
```

```
SYSTEM:COMMunicate:LAN:GATEway?
```

Example

The following command sets the Default Gateway address:

```
SYST:COMM:LAN:GATEWAY 255.255.20.11
```

The following query returns the Default Gateway address currently being used by the instrument (the quotes are also returned).

```
SYST:COMM:LAN:GATEWAY?
```

Typical Response: "255.255.20.11"

Description

This command assigns a Host Name to the U3040A. The Host Name is the host portion of the domain name, which is translated into an IP address.

Syntax

```
SYSTEM:COMMunicate:LAN:HOSTname "<name>"
```

```
SYSTEM:COMMunicate:LAN:HOSTname?
```

NOTE If you change the Domain Name, you must cycle power on the U3040A to activate the new address.

Example

The following command defines a Host Name:

```
SYST:COMM:LAN:HOST "LAB1-L4491A"
```

The following query returns the Host Name currently being used by the instrument (the quotes are also returned):

```
SYST:COMM:LAN:HOST?
```

Typical Response: "LAB1-L4491A"

GPIB Configuration Commands

Description

This command assigns a GPIB address to the U3040A.

Syntax

```
SYSTem:COMMunicate:GPIB:ADDRess <address>
```

```
SYSTem:COMMunicate:GPIB:ADDRess?
```

NOTE If you change the GPIB address, you must cycle power on the U3040A to activate the new address.

Example

The following command sets the GPIB address to 10:

```
SYST:COMM:GPIB:ADDR 10
```

The following query returns the current GPIB address:

```
SYST:COMM:GPIB:ADDR?
```

Typical Response: 10

Controlling Test Set Switch Settings

Description

This command executes the specified factory defined sequence from the non-volatile memory. If the specified sequence name not currently stored in the memory, due to corrupted program or accidentally deleted, an error will be generated.

Syntax

ROUTe:SEQuence:TRIGger <command>

Parameters

Refer to [Table 4](#) for commands used to control the Test Set's programmable attenuator.

Table 4 Switch Control Commands

| Definition Name | SCPI Command |
|-------------------------|-------------------------|
| Top Level SCPI Commands | 2nd Level SCPI Commands |
| Switch1_Port1 | :ROUT:CLOS(@1162); |
| Switch1_Port2 | :ROUT:CLOS(@1163); |
| Switch1_Port3 | :ROUT:CLOS(@1165); |
| Switch1_Port4 | :ROUT:CLOS(@1166); |
| Switch2_Port1 | :ROUT:CLOS(@1142); |
| Switch2_Port2 | :ROUT:CLOS(@1143); |
| Switch2_Port3 | :ROUT:CLOS(@1145); |
| Switch2_Port4 | :ROUT:CLOS(@1146); |
| Switch3_Port1 | :ROUT:CLOS(@1252); |
| Switch3_Port2 | :ROUT:CLOS(@1253); |
| Switch3_Port3 | :ROUT:CLOS(@1255); |
| Switch3_Port4 | :ROUT:CLOS(@1256); |
| Switch4_Port1 | :ROUT:CLOS(@1272); |
| Switch4_Port2 | :ROUT:CLOS(@1273); |
| Switch4_Port3 | :ROUT:CLOS(@1275); |
| Switch4_Port4 | :ROUT:CLOS(@1276); |
| Switch5_Port1 | :ROUT:CLOS(@1172); |
| Switch5_Port2 | :ROUT:CLOS(@1173); |
| Switch5_Port3 | :ROUT:CLOS(@1175); |

Table 4 Switch Control Commands

| Definition Name | SCPI Command |
|--------------------------------|--------------------------------------------------------|
| Top Level SCPI Commands | 2nd Level SCPI Commands |
| Switch5_Port4 | :ROUT:CLOS(@1176); |
| Switch6_Port1 | :ROUT:CLOS(@1152); |
| Switch6_Port2 | :ROUT:CLOS(@1153); |
| Switch6_Port3 | :ROUT:CLOS(@1155); |
| Switch6_Port4 | :ROUT:CLOS(@1156); |
| Switch7_Port1 | :ROUT:CLOS(@1242); |
| Switch7_Port2 | :ROUT:CLOS(@1243); |
| Switch7_Port3 | :ROUT:CLOS(@1245); |
| Switch7_Port4 | :ROUT:CLOS(@1246); |
| Switch8_Port1 | :ROUT:CLOS(@1262); |
| Switch8_Port2 | :ROUT:CLOS(@1263); |
| Switch8_Port3 | :ROUT:CLOS(@1265); |
| Switch8_Port4 | :ROUT:CLOS(@1266); |
| Port1_All | :ROUT:CLOS(@1142,1152,1162,1172,1142,1252,1262,1272); |
| Port2_All | :ROUT:CLOS(@1143,1153,1163,1173, 1243,1253,1263,1273); |
| Port3_All | :ROUT:CLOS(@1145,1155,1165,1175, 1245,1255,1265,1275); |
| Port4_All | :ROUT:CLOS(@1146,1156,1166,1176, 1246,1256,1266,1276); |
| Open_All | :ROUT:CLOS(@1147,1157,1167,1177, 1247,1257,1267,1277); |
| Open_Switch1 | :ROUT:CLOS(@1167); |
| Open_Switch2 | :ROUT:CLOS(@1147); |
| Open_Switch3 | :ROUT:CLOS(@1257); |
| Open_Switch4 | :ROUT:CLOS(@1277); |
| Open_Switch5 | :ROUT:CLOS(@1177); |
| Open_Switch6 | :ROUT:CLOS(@1157); |
| Open_Switch7 | :ROUT:CLOS(@1247); |
| Open_Switch8 | :ROUT:CLOS(@1267); |

NOTE For a complete list of SCPI commands refer to Agilent L449xA RF Switch Platform User's Guide (L4490-90001).

Example

The following SCPI command "Switch1_Port1" selects Switch number 1 and the output Port number 1.

```
ROUT:SEQ:TRIG Switch1_Port1
```

NOTE PNA-X interface controller user command reference to GPIB address Syntax as prefix followed by command. Example: 12 ":ROUT:SEQ:TRIG Port1_All"

In the system configuration the two U3040AS84 instruments must have different GPIB addresses. ROUTe:SEQuence:TRIGger <command>

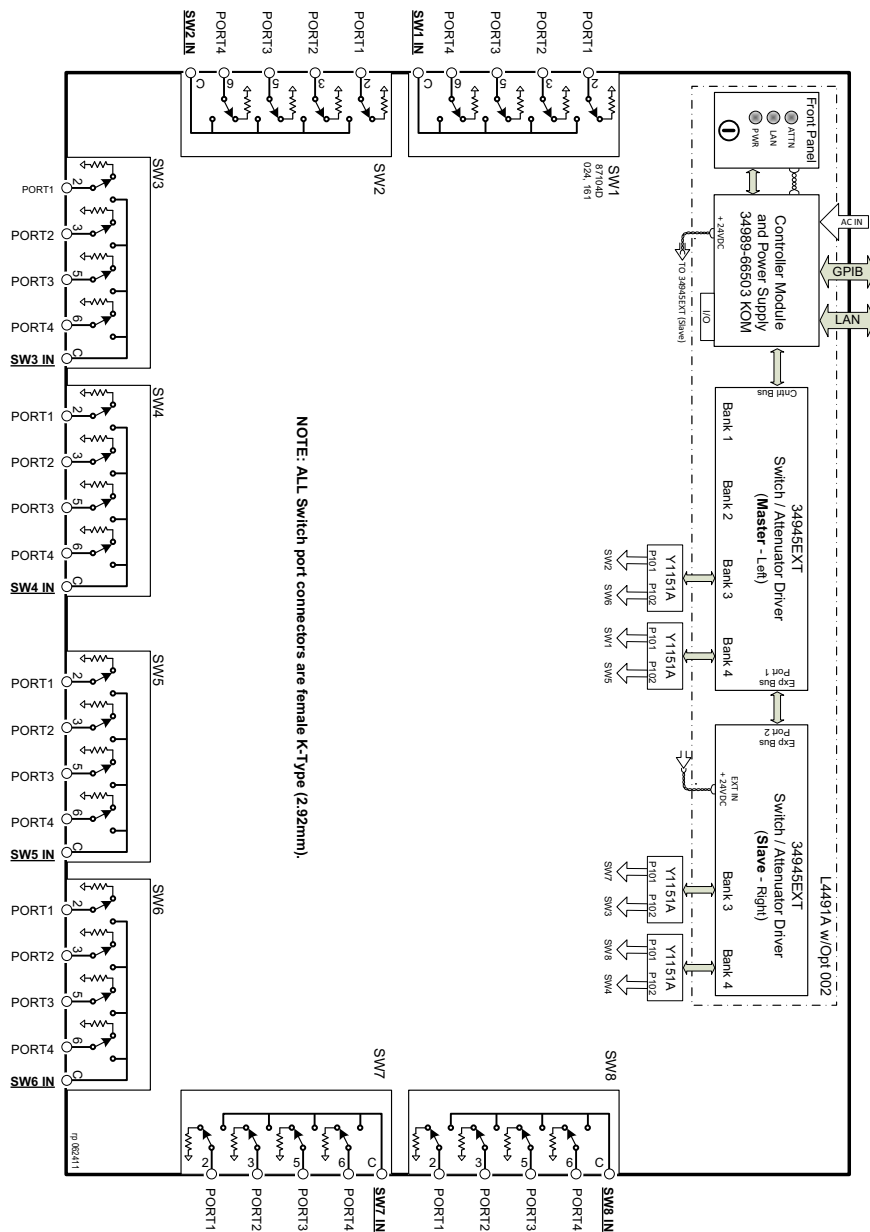
A wait statement is recommended for every switch command.

Theory of Operation

This section provides a general description of the U3040AS84 Mechanical Switching Test Set. This is followed by a more detailed operating theory. The operation of each group is described briefly to the assembly level only. Detailed component level circuit theory is not provided. The Test Set consists of four main components: a controller module, 39495EXT module, distribution board for mechanical switching and eight 1 x 4 coaxial switches.

Figure 12 illustrates the components and interconnects of the Switching Test Set.

Figure 12 Block Diagram for the U3040AS84 Test Set



Controller Module

Inside the controller module there are two main components, the AC-DC power supply and controller board. The AC-DC power supply is a 12V/65W power supply that is converted to various voltages by means of DC-DC converter inside the module. It provides regulated voltages to all assemblies in the Test Set as well as following voltages to drive programmable step attenuator in the Test Set. The internal DC voltage has the following specification:

- +24V/0.6A
- +12V/3A fuse
- +5V/1A

The controller board is the “brain” of the Test Set, it handles all the communication between the Controller and the Test Set via LAN or GPIB connectivity. Refer to [“Controlling the Test Set” on page 15](#).

39495EXT Module

There are two external module drives (primary and secondary) that control the eight mechanical switches. The mechanical switch are connected to the Test Set through the distribution board (Y1151A), which is installed on the 34945EXT module.

The 34945EXT is divided into four banks, organized by channel number. Any distribution board may be installed in any bank, and multiple distribution boards of the same type may be installed on the same 34495EXT module.

Distribution Board

The distribution board provides an interface between the 34945EXT module and the programmable step attenuator. Depending on the model number and attenuator, a suitable distribution board will be use.

Functional Tests

Functional testing consists of measuring transmission insertion loss, return loss, and isolation between all ports. For the most accurate measurements, the use of an Agilent PNA Network Analyzer is recommended and its use is assumed in these notes. Familiarity with RF/microwave measurements is also assumed. The use of adapters may be required and their effects should be accounted within the measurements.

Equipment Required

- N5242A or N5244A Network Analyzer (or equivalent)
- 3.5 mm test cables (E7342-60004) or equivalent (x2)
- N4691B Electronic Calibration Module (300 kHz to 26.5 GHz)
3.5 mm, 2-Port or equivalent
- Adapter (85027-60005) 3.5 mm female to female or equivalent (x2)

There are no adjustments required for the Agilent U3040AS84 Test Set.

The U3040AS84 Test Set is designed to be placed near the network analyzer on a bench top.

The instrument should be placed so that the detachable power cord is readily identifiable and is easily reached by the operator. The detachable power cord is the instrument disconnecting device. It disconnects the mains circuits from the mains supply before other parts of the instrument. The front panel switch is only a standby switch and is not a LINE switch. Alternatively, an externally installed switch or circuit breaker (which is readily identifiable and is easily reached by the operator) may be used as a disconnecting device.

1. Connect a GPIB cable from the controller to the rear panel of the network analyzer. Refer to [Figure 3 on page 8](#).
2. After the proper front and rear panel connections have been made, turn on the Test Set using the front panel switch.

NOTE For accurate repeatable measurements, be sure to let the Test Set warm up for at least two hours. For the most stable and accurate measurements, leave the Test Set turned on at all times. Do not touch the power sensor for at least 30 minutes before making measurements.

Set up the network analyzer as follows:

Refer to the standard PNA-X documentation or help menu for adapter removal calibration.

PNA-X Setup

1. Press **[Preset]**.
2. Select **[Start Frequency]** > **[10 MHz]**
3. Select **[Stop Frequency]** > **[26.5 GHz]**
4. Number of Points 201.
5. IF Bandwidth > **[1 kHz]**

Perform a full 2-Port adapter removal calibration at the two test ports of the network analyzer. (Use a 3.5 mm female-to-female adaptor for the transmission calibration).

In this example we are using a 2-Port PNA-X.

Figure 13 Selecting Cal Wizard

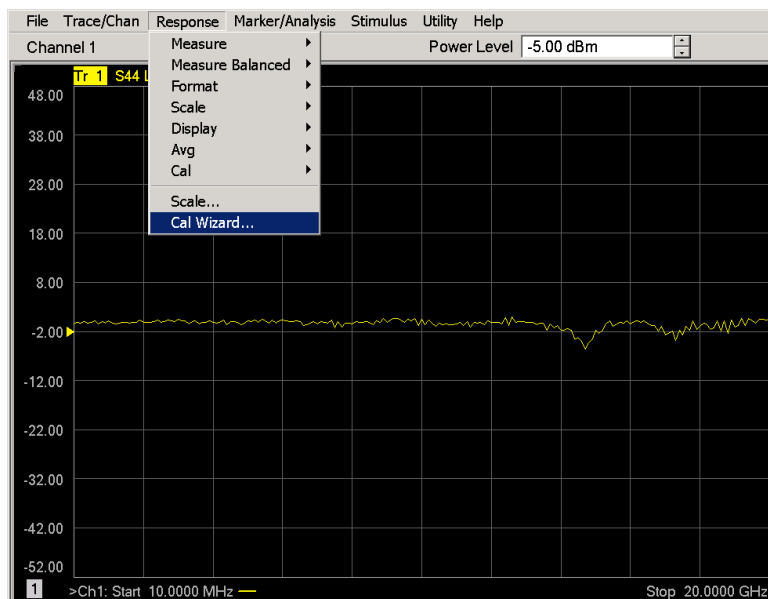


Figure 14 ECal Module

Calibration Wizard: Begin Calibration

SmartCal (GUIDED Calibration): Use Mechanical Standards
 UNGUIDED Calibration (Response, 1-port, 2-port): Use Mechanical Standards
 Use Electronic Calibration (ECal)

Select calibration preference.

 Not sure about preferences?
 Assistance is available in the online Help.

Save this choice and don't show this page next time.

Select Calibration Ports and ECal Module

Cal Type Selection

4 Port ECal
 3 Port ECal
 2 Port ECal
 1 Port ECal

2 Port ECal Configuration

Select 1st Port:

Selected Cal Kit: N4691-60004
 Serial No.: 02429
 Characterization: Factory

Select 2nd Port:

Show Advanced Settings (Orientation & Thru Cal Section)
 Calibrate source and receiver power

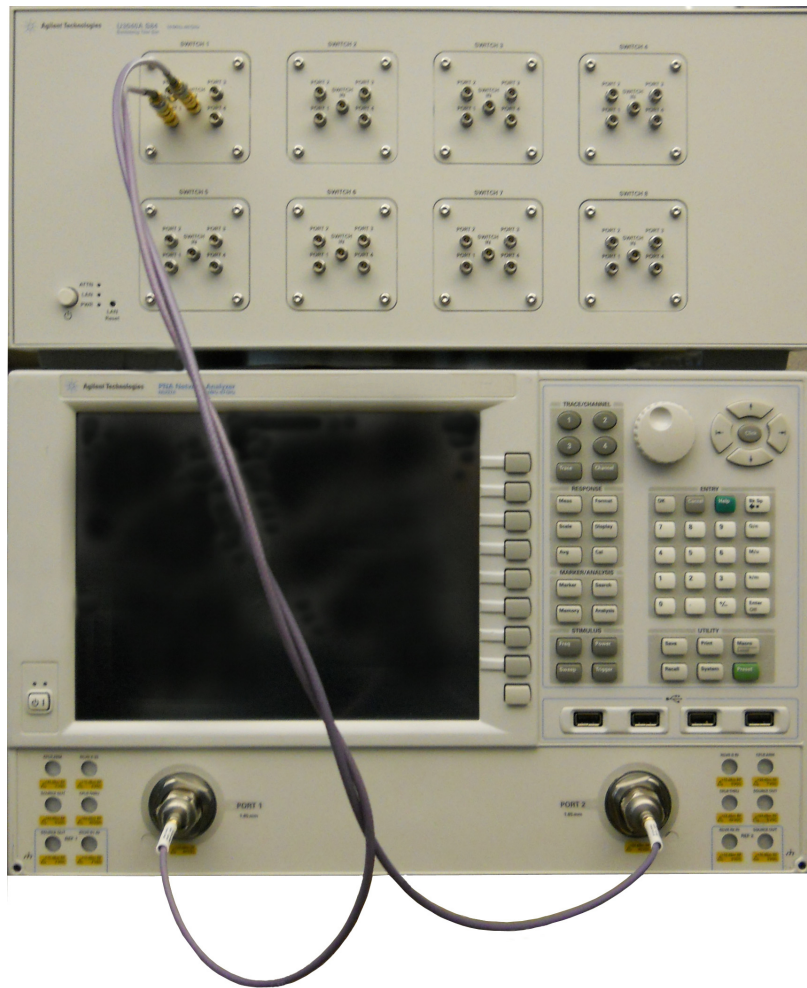
Figure 15 Adapter Removal Cal

Electronic Calibration: Advanced Settings

| | 1st Port | 2nd Port | Thru Cal Method | |
|---------|----------|----------|-----------------|-----------------|
| Thru #1 | 1 | 2 | Adapter Removal | Cal Type/Std... |

Do orientation (auto sensing of port connections)

Figure 16 Connecting the Test Set to the Network Analyzer



Transmission

1. Connect the cable attached to PORT 1 of the network analyzer to Switch number 1 "Switch IN" on the Test Set.
2. Connect the cable from PORT 2 of the network analyzer to Switch number 1 "Port 1" on the Test Set.
3. Set up the Test Set to select Switch number 1 and Port number 1 with the following command over GPIB or LAN:

```
ROUT:SEQ:TRIG Switch1_Port1
```

For complete information on controlling the Test Set, refer to [“Controlling the Test Set” on page 15](#).

4. Set up the network analyzer to measure S21.
5. Verify the performance. Refer to [Table 6 on page 11](#).
6. Save data file as a .CSV for future data performance analysis.

Figure 17 Saving Data

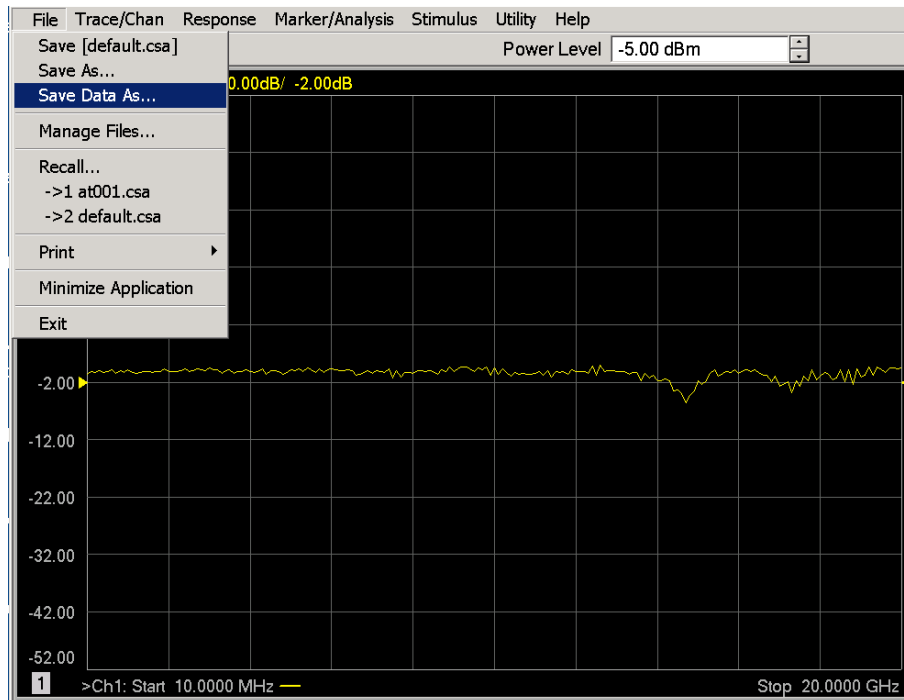
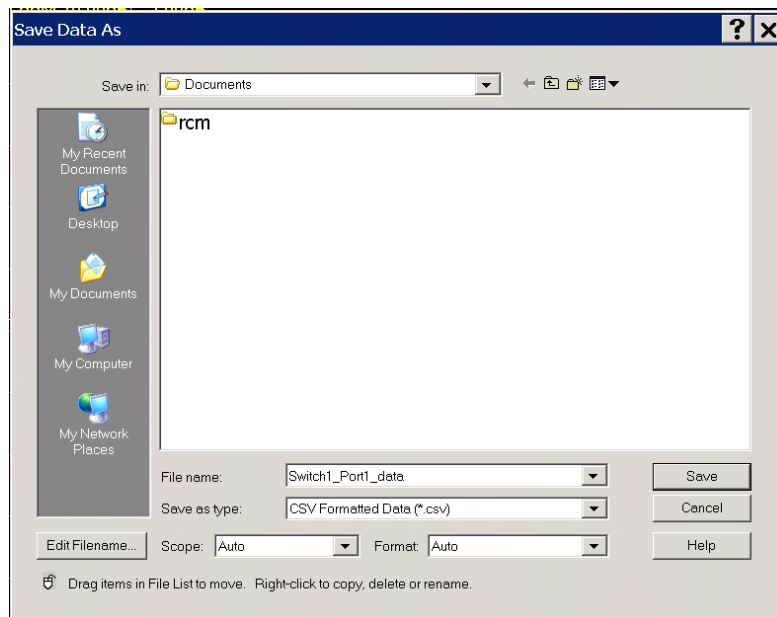


Figure 18 Selecting CSV File

7. Set up the Test Set to select different switches and ports. [Table 4 on page 20](#). Execute the following command over the GPIB:
`ROUT:SEQ:TRIG Switch x _Port y (X = 1/2/3/4/5/6/7/8, Y = 1/2/3/4)`
8. Repeat [step 1](#) through [step 7](#) for all switches.
9. Verify the isolation, match, etcetera for all the switches and ports, using the .CSV files.

Service Information

There are many other repair and calibration options available from the Agilent Technologies support organization. The options cover a range of service agreements with varying response times. Contact Agilent for additional information on available service agreements for this product.

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.**

Troubleshooting

This section contains information for troubleshooting the Test Set to the assembly level only. By following these procedures, you may determine if the power supply, front panel, or main switch board needs replacing. Refer to [Figure 12, “Block Diagram for the U3040AS84 Test Set,”](#) as an aid in troubleshooting.

NOTE Refer to the L4491A Service manual for lower level component replacement.

NOTE If you need to disassemble the instrument, be sure to work at an antistatic workstation and use a grounded wrist strap to prevent damage from electrostatic discharge (ESD). See [Figure 21 on page 38](#).

Troubleshooting the Power Supply

Turn the instrument on. Verify the condition of the LED on the front panel:

1. Check the cable and connections between the main board and front panel board.
2. If the cable and connections are working and the LED is still off, there is still a possibility that the power supply is not supplying the necessary +24 V, +12 V, and +5 V to the main board.

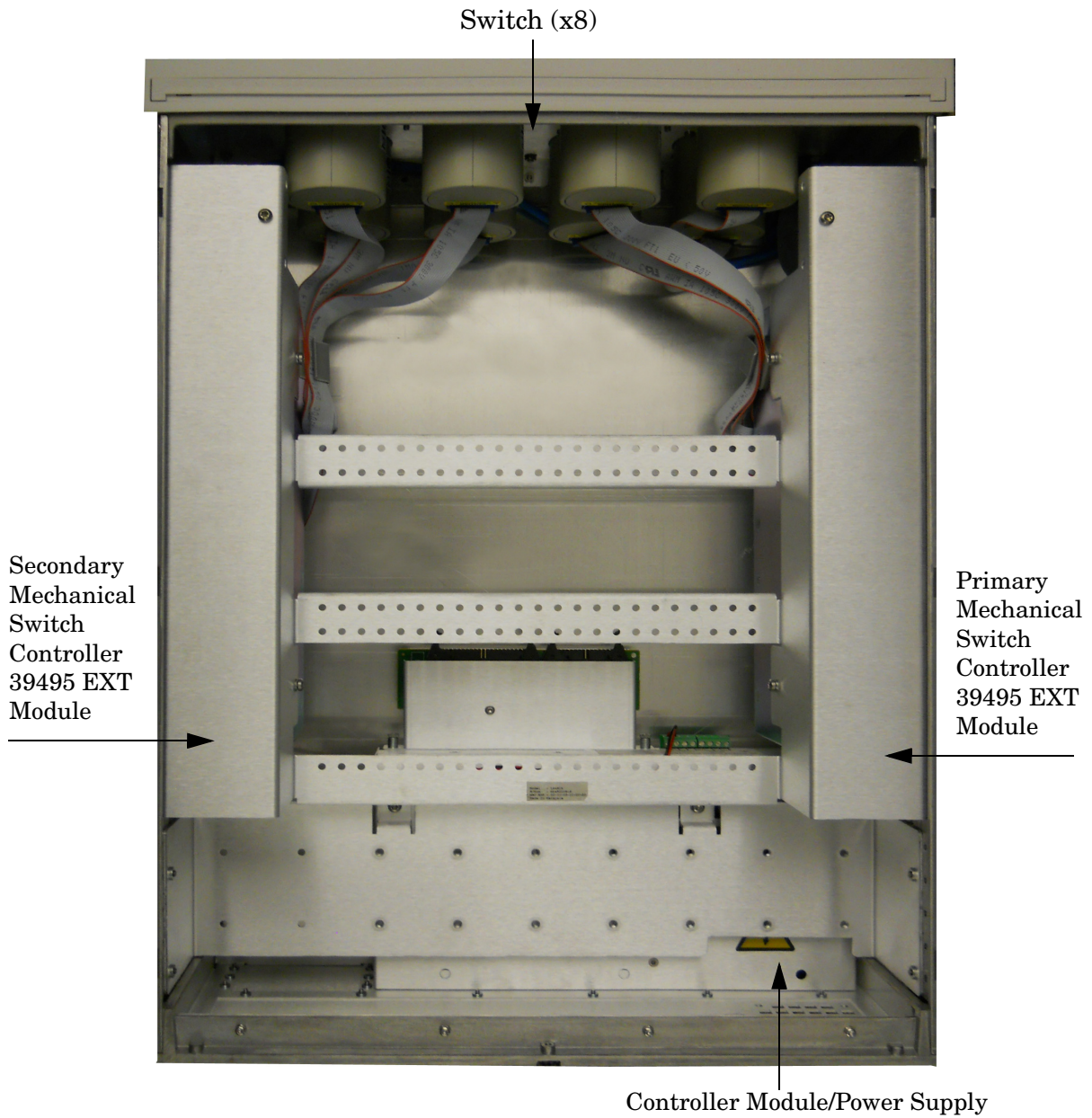
Disconnect the dc power cable from the power supply to the main switch board and measure the voltages. They should be +24 V, +12 V, and +5 V. If not, replace the power supply.

Troubleshooting the Controller Board

Turn the instrument power on and verify the following:

1. Check the LED display for the model/option and revision information; if there is no backlite or horizontal/vertical lines are missing, verify that the power supply is working properly, if so replace the LED display.
2. If there is no information or the information is scrambled, replace the controller board.
3. Verify the switching paths by issuing commands to switch each of the paths. Ensure that the LED indicates the appropriate path.

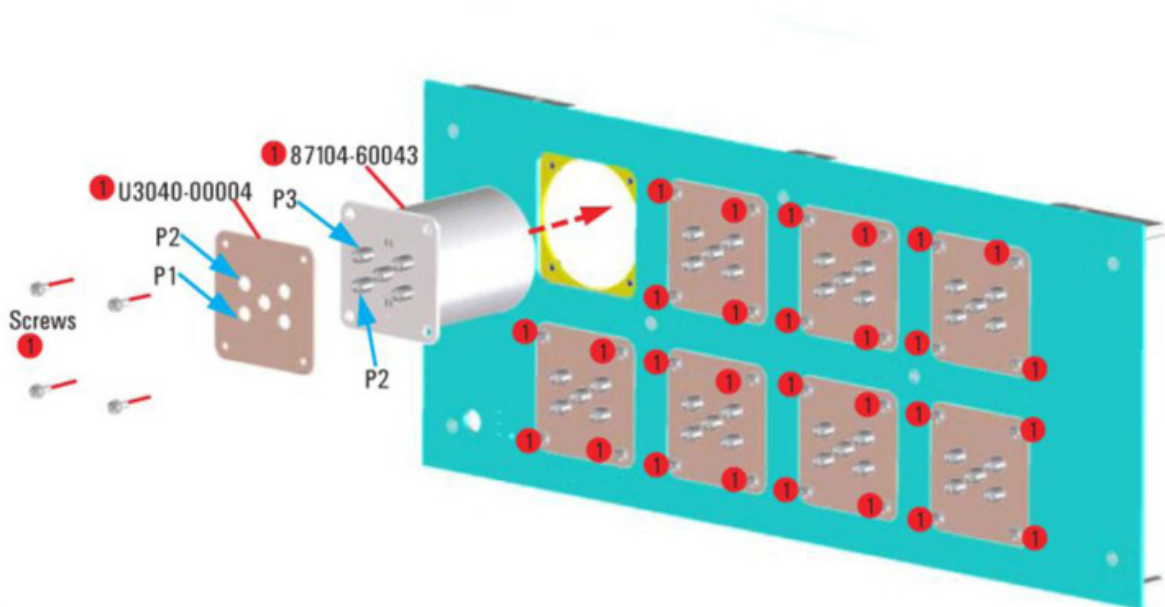
Figure 19 U3040AS84



Removing the Coaxial Switch

1. Remove the four screws (0515-0772) from the front panel.
2. Remove the dress panel (U3040-00004).
3. Remove the old coaxial switch (87104-60043) and disconnect the ribbon cable (87050-6055).
4. Re-connect the ribbon cable and install the new coaxial switch (87104-60043).
Note: Port 1 of the dress panel aligns with Port 2 of the coaxial switch.
5. Re-install the dress panel and the four screws (Torque to 9 in-lb).

Figure 20 Replacing the Coaxial Switch



Replaceable Parts

The following table contains the list of replaceable parts for the U3040AS84. If any of these parts or assemblies are replaced, you must run all performance tests to verify conformance to specifications.

NOTE Special options are built to order, long lead times may be encountered when ordering replacement parts.

Table 5 Replaceable Parts

| Replacement Part | Part Number | Qty |
|---------------------------------------------------------------------------------------------------------------------|-----------------|-----|
| Cable assembly multi bias connect | 87050-6055 | 8 |
| Replacement for 40 GHz SP4T, terminated, Option 161-024 | 87104-60043 | 8 |
| 4U RF Switch platform with integrated switch driver, includes 64 switch drive lines with Options STD, 005, 002, 004 | L4491A-CFG004 | 1 |
| Extender Driver for 34945A, 1 required for each 64 coils with standard option. | 34945EXT-CFG001 | 1 |
| PCA, front panel | 34989-66502 | 1 |
| Assembly, controller box for L4490A and L4491A | L4490-60001 | 1 |
| 1 x 4 Switch dress panel | U3040-20004 | 8 |
| PCA, UW Distribution card | Y1153-66501 | 4 |

NOTE Before replacing an assembly or board, inspect the assembly for obvious, easily repaired defects such as bent pins on ICs or cold solder joints.

Safety and Regulatory Information

Introduction

Review this product and related documentation to familiarize yourself with safety markings and instructions before you operate the instrument. The documentation contains information and warnings that must be followed by the user to ensure safe operation and to maintain the product in a safe condition.

Safety Earth Ground

WARNING **This is a Safety Class I product (provided with a protective earthing ground incorporated in the power cord). The mains plug shall be inserted only into a socket outlet provided with a protective earth contact. Any interruption of the protective conductor, inside or outside the product is likely to make the product dangerous. Intentional interruption is prohibited.**

CAUTION Always use the three prong AC power cord supplied with this product. Failure to ensure adequate earth grounding by not using this cord may cause product damage and the risk of electrical shock.

Declaration of Conformity

A copy of the Declaration of Conformity is available upon request, or a copy is available on the Agilent Technologies web site at
<http://regulations.corporate.agilent.com/DoC/search.htm>

Statement of Compliance

This instrument has been designed and tested in accordance with CAN/CSA 22.2 No. 61010-1-04, UL Std. 61010-1 (2nd Edition), and IEC 61010-1 (Second Edition).

Before Applying Power

Verify that the premises electrical supply is within the range of the instrument. The instrument has an autoranging power supply.

WARNING If this product is not used as specified, the protection provided by the equipment could be impaired. This product must be used in a normal condition (in which all means for protection are intact) only.

CAUTION The Mains wiring and connectors shall be compatible with the connector used in the premise electrical system. Failure, to ensure adequate earth grounding by not using the correct components may cause product damage, and serious injury.

CAUTION This product is designed for use in Installation Category II and Pollution Degree 2.

CAUTION Verify that the premise electrical voltage supply is within the range specified on the instrument.

CAUTION **Ventilation Requirements:** When installing the instrument in a cabinet, the convection into and out of the instrument must not be restricted. The ambient temperature (outside the cabinet) must be less than the maximum operating temperature of the instrument by 4 °C for every 100 watts dissipated in the cabinet. If the total power dissipated in the cabinet is greater than 800 watts, forced convection must be used.

Servicing

-
- WARNING** **Danger of explosion if battery is incorrectly replaced. Replace only with the same or equivalent type recommended. Discard used batteries according to manufacturer's instructions.**
-
- WARNING** **Always turn the instrument power off before removing or installing an assembly.**
-
- 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 the user to dangerous voltages. Disconnect the instrument from all voltage sources before opening.**
-
- WARNING** **No operator serviceable parts inside. Refer servicing to qualified personnel. To prevent electrical shock, do not remove covers.**
-
- WARNING** **The detachable power cord is the instrument disconnecting device. It disconnects the mains circuits from the mains supply before other parts of the instrument. The front panel switch is only a standby switch and is not a LINE switch (disconnecting device).**
-

Connector Care and Cleaning Precautions

Remove the power cord to the instrument. To clean the connectors use alcohol in a well ventilated area. Allow all residual alcohol moisture to evaporate, and fumes to dissipate prior to energizing the instrument.

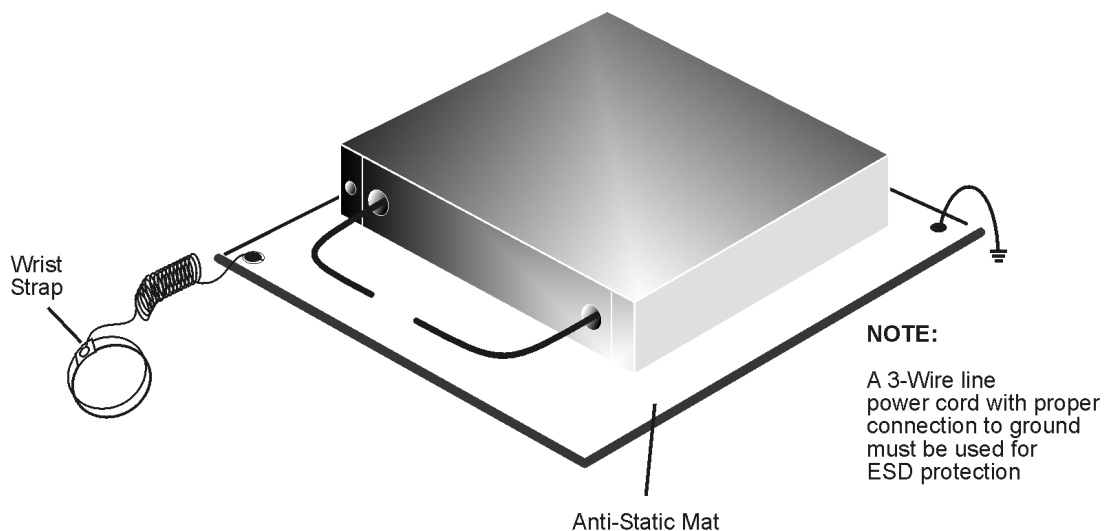
-
- WARNING** **To prevent electrical shock, disconnect the [Agilent Technologies U3040A Option S84](#) from mains electrical supply before cleaning. Use a dry cloth or one slightly dampened with water to clean the external case parts. Do not attempt to clean internally.**
-
- WARNING** **If flammable cleaning materials are used, the material shall not be stored, or left open in the area of the equipment. Adequate ventilation shall be assured to prevent the combustion of fumes, or vapors.**
-

Electrostatic Discharge Protection

Protection against electrostatic discharge (ESD) is essential while removing assemblies from or connecting cables to the instrument. Static electricity can build up on your body and can easily damage sensitive internal circuit elements when discharged. Static discharges too small to be felt can cause permanent damage. To prevent damage to the instrument:

- *always* have a grounded, conductive table mat in front of your test equipment.
- *always* wear a grounded wrist strap with grounding cord, connected to a grounded conductive table mat, having a 1 M Ω resistor in series with it, when handling components and assemblies or when making connections.
- *always* wear a heel strap (9300-1126) when working in an area with a conductive floor. If you are uncertain about the conductivity of your floor, wear a heel strap.
- *always* ground yourself before you clean, inspect, or make a connection to a static-sensitive device or test port. You can, for example, grasp the grounded outer shell of the test port or cable connector briefly.
- *always* ground the center conductor of a test cable before making a connection to the analyzer test port or other static-sensitive device. This can be done as follows:
 1. Connect a short to one end of the cable to short the center conductor to the outer conductor.
 2. While wearing a grounded wrist strap, grasp the outer shell of the cable connector.
 3. Connect the other end of the cable to the test port and remove the short from the cable.

Figure 21 ESD Protection Setup



ku310b

Regulatory Information

This section contains information that is required by various government regulatory agencies.

Instrument Markings



The instruction documentation symbol. The product is marked with this symbol when it is necessary for the user to refer to the instructions in the documentation.



This symbol indicates separate collection for electrical and electronic equipment, mandated under EU law as of August 13, 2005. All electric and electronic equipment are required to be separated from normal waste for disposal (Reference WEEE Directive, 2002/96/EC).



This symbol indicates that the power line switch is in the STANDBY position.



This symbol is used to identify a terminal which is internally connected to the product frame or chassis.



The CE mark is a registered trademark of the European Community. (If accompanied by a year, it is when the design was proven.)



The CSA mark is a registered trademark of the CSA International. This instrument complies with Canada: CSA 22.2 No. 61010-1-04.

ISM1-A

This is a symbol of an Industrial Scientific and Medical Group 1 Class A product (CISPR 11, Clause 54)

ICES/NMB-001

This is a marking to indicate product compliance with the Canadian Interference-Causing Equipment Standard (ICES-001).

IP 2 0

The instrument has been designed to meet the requirements of IP 2 0 for ingress and operational environment.



This is a required mark signifying compliance with an EMC requirement. The C-Tick mark is a registered trademark of the Australian Spectrum Management Agency.



China RoHS regulations include requirements related to packaging, and require compliance to China standard GB18455-2001.



This symbol indicates compliance with the China RoHS regulations for paper/fiberboard packaging.

Battery Collection

Do not throw batteries away but collect as small chemical waste, or in accordance with your country's requirements. You may return the battery to Agilent Technologies for disposal. Refer to [“Contacting Agilent” on page 41](#) for assistance.

Compliance with German Noise Requirements

This is to declare that this instrument is in conformance with the German Regulation on Noise Declaration for Machines (Laermangabe nach der Maschinenlaermverordnung-3. GSGV Deutschland).

| Acoustic Noise Emission/Geraeuschemission | |
|-------------------------------------------|----------------------|
| LpA<70 dB | Lpa<70 dB |
| Operator Position | am Arbeitsplatz |
| Normal Operation | normaler Betrieb |
| per ISO 7779 | nach DIN 45635 t. 19 |

EMC Information

Complies with European EMC Directive 2004/108/EC

- IEC/EN 61326-1
- CISPR Pub 11 Group 1, class A
- AS/NZS CISPR 11
- This ISM device complies with Canadian ICES-001.
Cet appareil ISM est conforme a la norme NMB du Canada.

Agilent Support, Services, and Assistance

Service and Support Options

The standard product warranty is a *one-year return to Agilent Technologies* service warranty.

NOTE There are many other repair and calibration options available from the Agilent Technologies support organization. These options cover a range of service agreements with varying response times. Contact Agilent for additional information on available service agreements for this product.

Contacting Agilent

Assistance with test and measurements needs and information or finding a local Agilent office are available on the Web at:

<http://www.agilent.com/find/assist>

If you do not have access to the Internet, contact your field engineer.

NOTE In any correspondence or telephone conversation, refer to the Agilent product by its model number and full serial number. With this information, the Agilent representative can determine the warranty status of your unit.

Shipping Your Product to Agilent for Service or Repair

IMPORTANT Agilent Technologies reserves the right to reformat or replace the internal hard disk drive in your analyzer as part of its repair. This will erase all user information stored on the hard disk. It is imperative, therefore, that you make a backup copy of your critical test data located on the analyzer's hard disk before shipping it to Agilent for repair.

If you wish to send your instrument to Agilent Technologies for service or repair:

- Include a complete description of the service requested or of the failure and a description of any failed test and any error message.
- Remove and retain the front handles and all rack mount hardware. The analyzer should be sent to Agilent in the same configuration as it was originally shipped.
- Ship the analyzer using the original or comparable antistatic packaging materials.
- Contact Agilent for instructions on where to ship your analyzer.

