# Agilent Technologies U3042AM08

## User's and Service Guide

**Use this manual with the following document:**
**PNA Series Network Analyzer On-line Help System**

**Agilent Technologies**

**Manufacturing Part Number: U3042-90005**

**Printed Date: December 2012**
**Supersede: March 2010**

# Warranty Statement

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# Safety Notes

The following safety notes are used throughout this document. Familiarize yourself with each of these notes and its meaning before performing any of the procedures in this document.

| | |
|---|---|
| **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 instrument. 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 55 °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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# U3042AM08

# Introduction

This document describes how to use and service the U3042AM08 Multiport Test Set with the Agilent 4-Port PNA, PNA-L and PNA-X for a 12-Port network analyzer solution.

**Figure 1**      **4-Port PNA-L with U3042AM08**
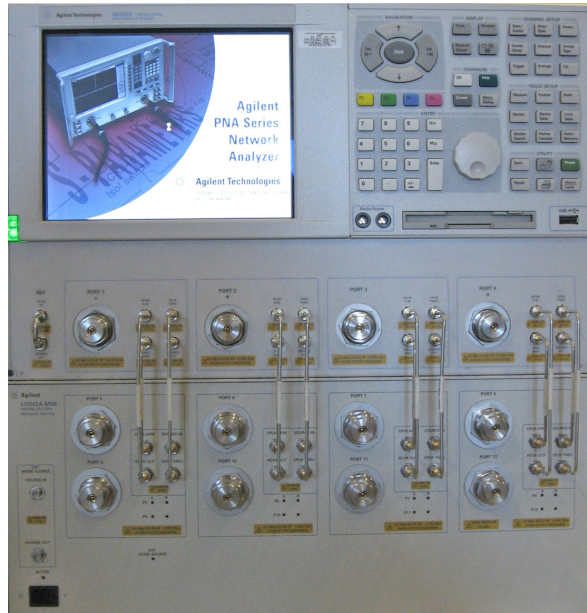


**Figure 2**      **4-Port PNA or PNA-X with U3042AM08**
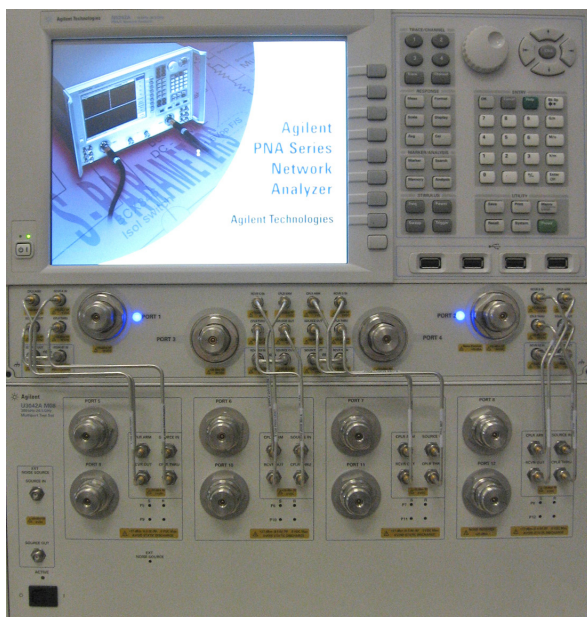
# Description

The Agilent U3042AM08 is a 8-Port mechanical switch extension Test Set with a range of 300 kHz to 26.5 GHz. The 8-Port extension Test Set can be connected to a 4-Port PNA, PNA-L or PNA-X Network Analyzer. This expands the 4-Port network analyzer to a 12 test port analyzer with full cross bar measurement capability. Option 551 in the Network Analyzer provides N port calibration capabilities. Refer to "Network Analyzer Requirements" on page 3.

The Test Set is directly controlled by the network analyzer, no external personal computer or software is required.

The N5222A PNA, N5230A/C and N5232A PNA-L and N5242A PNA-X Network Analyzer's will be referred to as the PNA, PNA-L and PNA-X throughout this document. Analyzer refers to all series of PNA, PNA-L and PNA-X. The U3042AM08 will be referred to as the Test Set.

## Network Analyzer Requirements

- For Multiport Operations the Network Analyzer requires Option 551 (N-Port error correction and measurement capability).

- The N5222A PNA requires Option 401, 417 or 419 (4-Port) with a configurable Test Set option to provide the Test Set interface connections. Install Test Set file u304xam08_pnax_p4.tsx for multiport operation.

- The N5230A/C PNA-L requires Option 245, 145, 246 or 146 (4-Port) with a configurable Test Set option to provide the Test Set interface connections. Install Test Set file u3042am08_p4.tsx for multiport operation.

- The N5232A PNA -L requires Option 416 (4-Port) with a configurable Test Set option to provide the Test Set interface connections. Install Test Set file u3042am08_p4.tsx for multiport operation.

- The N5242A PNA-X requires Option 400 to provide the Test Set interface connections and requires Test Set file u304xam08_pnax_p4.tsx.

More PNA information is available on the following websites:

- Documentation - *http://www.agilent.com/find/pna*

- Network Analyzer Firmware - *http://na.tm.agilent.com/pna/firmware/firmware.htm*

- U3042AM08 Test Set Files - *http://na.tm.agilent.com/multiport*. (see test set files link)

# Available Options

## Test Set Options

The Test Set has two available options:
Refer to "System Block Diagram" beginning on page 67.

- Standard - Mechanical switches for low loss.

- Option 129 - External source path switch ports 1, 5 and 9.

## Accessory Options

Installation instructions are included in the option package.

- U3042A-ICM  - Rackmount Kit (5063-9215)

- U3042A-1CN - Front Handle Kit (5063-9228)

- U3042A-1CP - Rackmount with Front Handle Kit (5063-9222)

## Cable Options

The Test Set has two available cable options:

- U3021PL3 Option 430 provides the interface cable set and hardware to connect the Test Set to the PNA-L. Includes kits U3021-60001 and U3021-60045.

- U3021PL3 Option 442 provides the interface cable set and hardware to connect the Test Set to the PNA-X. Includes kits U3021-60002 and U3021-60047.

# 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 90. Keep the damaged shipping materials (if any) for inspection by the carrier and an Agilent Technologies representative.

# General Specifications

Specifications for the Test Set are characteristic for the system performance of the analyzer and Test Set. Actual performance of the system is based on the customers analyzer that is used with the Test Set. A functional certificate is only offered for the Test Set.

When connected to a analyzer, the Test Set will degrade the performance at the test ports. The internal switch paths reduce test port power to the receivers. This affects the test port power of the analyzer and also reduces dynamic range. The reflection tracking values measured in the "Cal Kit Operational Check" on page 54 can be subtracted from the analyzers dynamic range to determine the approximate performance of the system.

| CAUTION | The life expectancy of the following switches are 5 million cycles. When making measurements using more than one port, single sweeps are recommended to minimize switch cycles. |
|---|---|

- 87104-60001 (switch, x8)
- N1811-60005 (Option 129)

## Power Requirements

Verify that the required ac power is available before installing the Test Set to the analyzer.

- 100/120/220/240 V (50/60 Hz)

- The instruments can operate with mains supply voltage fluctuations up to ± 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 and analyzer.

- U3042AM08 maximum power is 350 W.

| 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 instrument, is likely to make the instrument dangerous. Intentional interruption is prohibited.** |
|---|---|

## Environmental Requirements

Refer to the PNA, PNA-L and PNA-X standard documentation for environmental specifications.

The U3042AM08 complies with all applicable safety and regulatory requirements for the intended location of use.

- Pressure Altitude (Operation)
  3,000 meters (~10,000 feet)

- 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.

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**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.

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### Required Conditions for Accuracy Enhanced Measurement

Accuracy–enhanced (error–corrected) measurements require the ambient temperature of the analyzer 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 analyzer is on a customer provided lab bench, or table top of adequate size and strength. For weight, dimensions and space requirements, refer to the network analyzer documentation that is used to configure the Test Set.

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**CAUTION**      The network analyzer is heavy. It is recommended that two individuals, or a mechanical lift be used to lift or transport the instrument.

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**Table 1      Instrument Dimensions**

| Model | Weight | Height | Width | Depth |
|---|---|---|---|---|
| U3042AM08 | 11.4 kg (25 lb) | 19.1 cm (7.5 in) | 42.5 cm (16.7 in) | 43.2 cm (17 in) |

## Maximum and Recommended Power Levels

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**CAUTION**      It is recommend that you do not operate components near damage levels
(+30 dBm). The power levels must be 3 dB below maximum level to ensure no
damage.

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**Table 2        Recommended Power Levels**

| U3042AM08 Test Port RF Power Levels: | |
|---|---|
| PORT 5-12 | +27 dBm 0 Vdc |
| **U3042AM08 Access Ports:** | |
| SOURCE OUT | +20 dBm 0 Vdc |
| CPLR ARM | +20 dbm 0 Vdc |
| CPLR THRU | +20 dBm 0 Vdc |
| RCVR OUT | +20 dBm 0 Vdc |
| Noise Source IN/OUT | +20 dBm 0 Vdc |

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**NOTE**      Refer to your analyzer's specifications to determine the maximum input
power levels for the analyzer's access and test ports, or to optimize the power
levels in the receivers.

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**NOTE**      Damage and maximum levels are not necessarily the optimum level.

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## Typical Reflection Tracking

Specifications for the Test Set are typical. System performance for the analyzer and Test Set are only characteristic and intended as non warranted information. A functional certificate is provided for the U3042AM08 only

**NOTE**        Typical specifications are based on 1 to 2 units performance. Refer to Table 3 and Table 3.

**Table 3      Typical Reflection Tracking with PNA-L**

| Frequency | Standard 700 |
|---|---|
| 300 kHz to 10 MHz | −0.2 |
| 10 MHz to 4 GHz | −3 |
| 4 GHz to 6 GHz | −4 |
| 6 GHz to 10.5 GHz | −5 |
| 10.5 GHz to 13.5 GHz | −6 |
| 13.5 GHz to 15 GHz | −7 |
| 15 GHz to 20 GHz | −10 |

**Table 4      Typical Reflection Tracking with PNA or PNA-X**

| Frequency | Standard 700 |
|---|---|
| 10 MHz to 50 MHz | −0.5 |
| 50 MHz to 500 MHz | −2 |
| 500 MHz to 3.2 GHz | −3 |
| 3.2 GHz to 10 GHz | −5 |
| 10 GHz to 16 GHz | −7 |
| 16 GHz to 20 GHz | −10 |
| 20 GHz to 24 GHz | −11 |
| 24 GHz to 26.5 GHz | −12 |

# Front and Rear Panel Features

**Figure 3     Standard Front Panel**



5 of 12 Test Ports          Access Ports          CPLR ARM

CPLR THRU

RCVR OUT

Active LED

Standby Switch     Ext Noise Source LED     Port Status LED's (4 sets)

**Figure 4     Option 129 Font Panel**



Opt 129 SOURCE IN

Opt 129 SOURCE OUT

Active LED
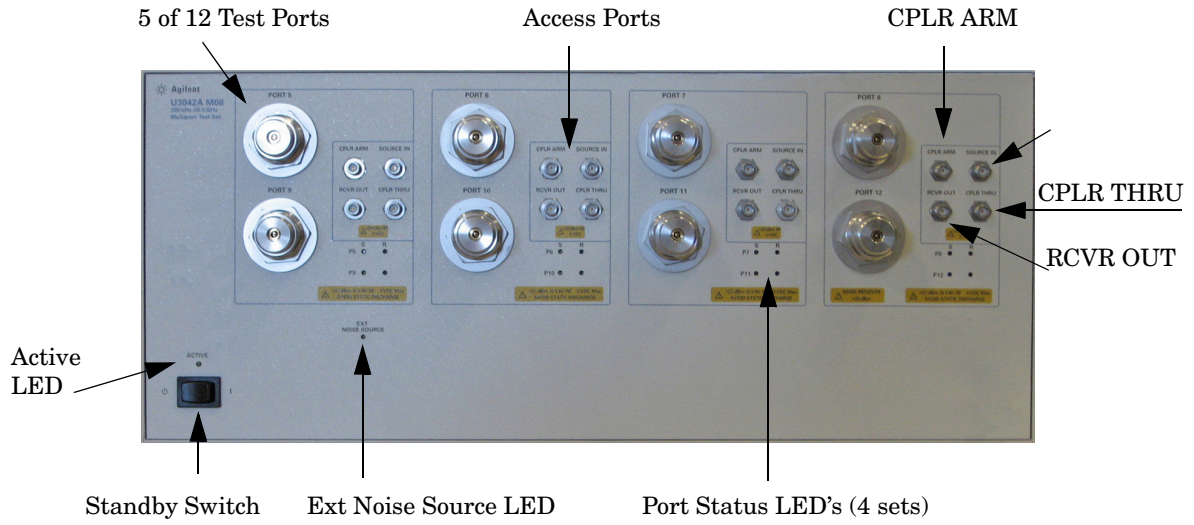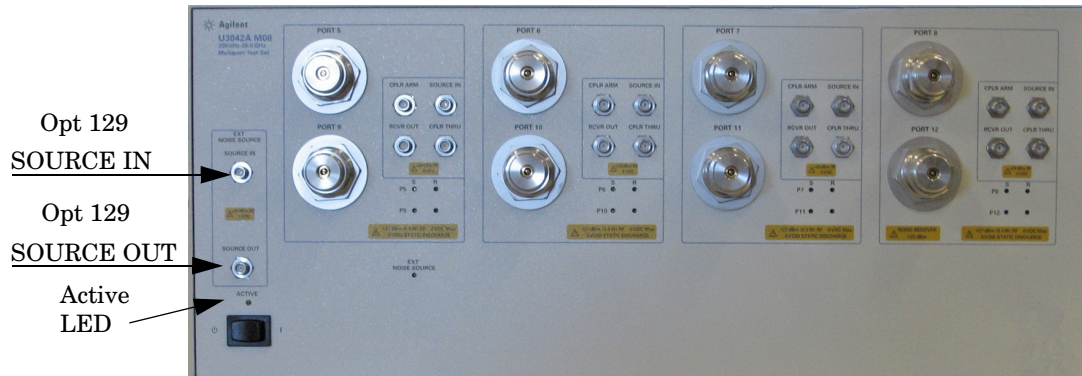
**Test Ports - 3.5 mm Bulkhead (male)**

• Port 5–12

**Access Ports - 3.5 mm (female)**

• CPLR ARM
• SOURCE IN
• CPLR THRU
• RCVR (A-D) OUT
• Noise Source SOURCE IN (Option 129)
• Noise Source SOURCE OUT (Option 129)

**Test Port LEDs**

An illuminated LED indicates an active port in Source or Receiver mode. On the front panel "S" indicates Source test ports and "R" indicates Receiver test ports.

**External Noise Source LED**

An illuminated LED indicates when the External Noise Source path is active.

**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.

**Active LED**

When the Test Set is connected and addressed by a analyzer, the LED is On (illuminated). The LED is Off (not illuminated) when the Test Set is in Standby, or not addressed by the analyzer.

**Figure 5      Rear Panel**

Control Lines  Voltage Adjust



Line Module      Test Set Interface      Pass Through Interface    Ground
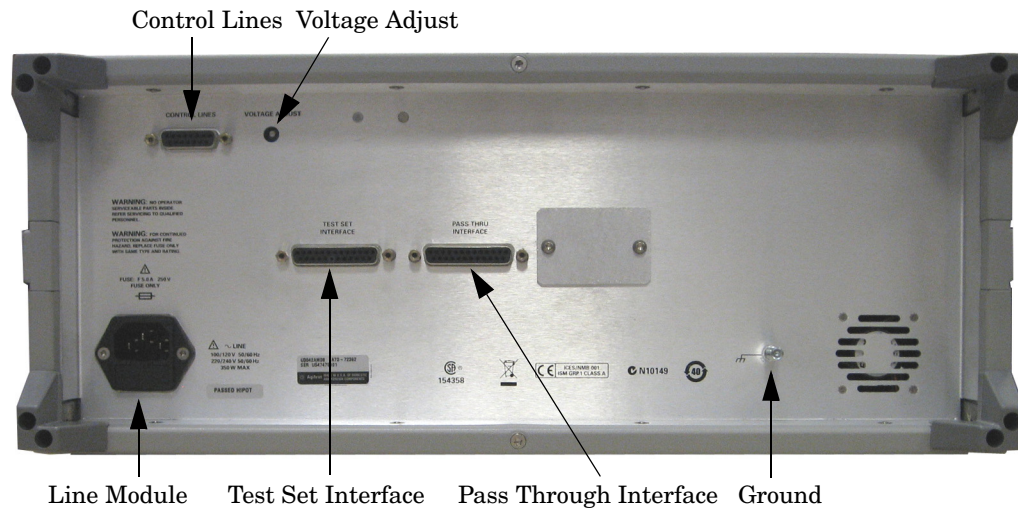
## Control Lines and Voltage Adjust

For further information pertaining to control lines and voltage adjustments see "Control Lines" on page 48.

## Chassis Ground

A threaded terminal post for connecting the Test Set to a conductive object, cabinet or structure to ensure a common potential and reduce leakage current in a system. Requires an English 1/4-20 thread nut (2950-0004) and lock washer (2190-0067).

## Pass Through Interface

The Pass Through Interface is used to connection to another Test Set.

## Test Set Interface

The Test Set Interface connector is used to send address and data to the Test Set from the analyzer.

**Line Module**

The line fuse, as well as a spare, reside within the line module. Figure 6 illustrates where the fuses are located and how to access them.

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.

**Available Fuses**

Fuse (F 5 A/250V, 2110-0709) UL listed and CSA certified.

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**WARNING**    **For continued protection against fire hazard replace line fuse only with same type and rating. The use of other fuses or material is prohibited.**

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**Figure 6    Line Fuse**



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

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# System Setup with N5230C and N5232A

**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 being opened.**

## Locking the Test Set to the PNA-L

1. The kit (U3021-60001) includes items to interface the Test Set to the analyzer.

2. Remove the feet from the bottom of the analyzer.

3. Remove the 2 lower standoffs and screws (0515-1619) from the rear panel on the analyzer.

**Figure 7        Rear Bottom Feet**
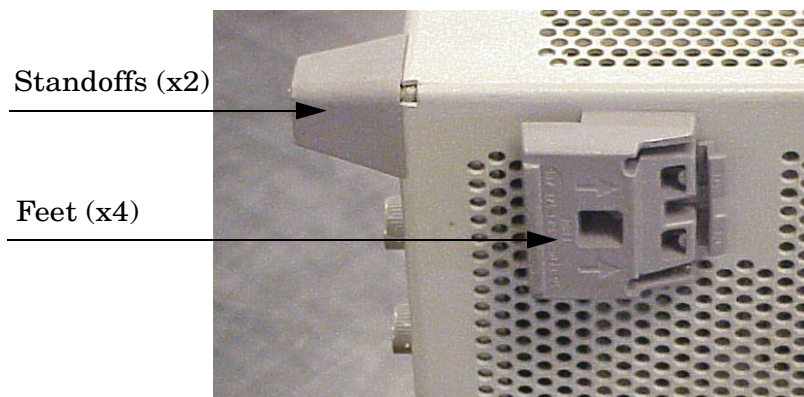
4. Install the two rear locking feet (5023-0132) onto the PNA-L, using the included screws (0515-1619), where the standoffs were removed.

**Figure 8     Install Locking Feet**
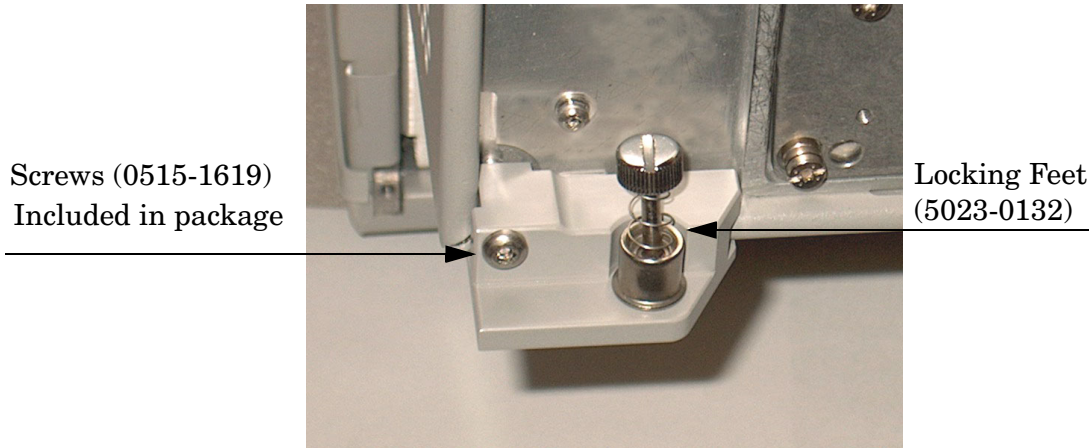


Screws (0515-1619)
Included in package

Locking Feet
(5023-0132)

5. Remove the top two standoffs and screws (0515-1619) from the rear panel on the Test Set.

6. Install the top left and right rear locking feet from the kit (5063-9253) using screws (0515-1244).

**Figure 9     Rear Locking Feet**

7.  Place the analyzer on top of the Test Set and ensure that the front frame of the analyzer is positioned slightly forward of the locks that are attached to the Test Set. Slide the analyzer back so the locks engage the front frame of the analyzer.

8.  Secure the analyzer's lower locking feet to the Test Set's upper locking feet using the spring–loaded screws on the locking feet. If the analyzer's lower locking feet are not aligned with the screw holes in the Test Set's upper locking feet, loosen the screws securing the feet to the instrument slightly to align and tighten.

**Figure 10   Locking the Analyzer's**
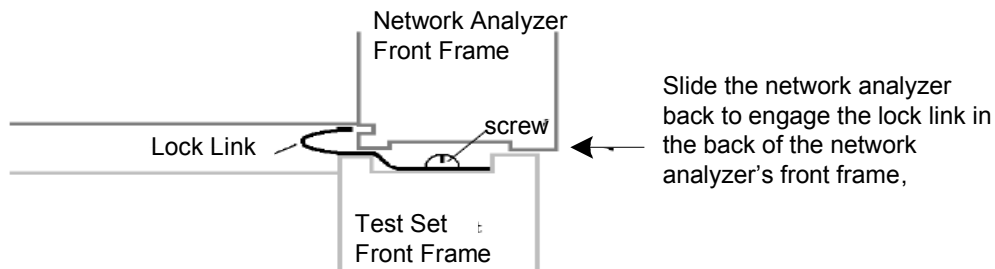
**Figure 11   Locking Feet Screws**

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NOTE          The lock-feet kit (U3021-60001) includes the analyzer and Test Set lock-feet. Refer to "Contacting Agilent" on page 90 for ordering information.

   •  PNA – 5023-0132 (Kit includes locking feet and screws)
   •  Test Set – 5063-9253 (Kit includes lock links, locking feet and screws)

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## PNA-L RF Interface Cable Connections

Figure 12 on page 17 illustrates the cable configuration of the Test Set to the PNA-L, and indicates the final two digits of the part number for each cable. The cables are supplied in the interface cable kit (U3021-60045).

1. Remove the SOURCE OUT to CPLR THRU and RCVR IN to CPLR ARM jumpers (x16) on the PNA. The RCVR R1 to SOURCE OUT reference loop jumper (x1) remain on the front panel.

2. Connect the RF interconnect cables, supplied with this option, from the PNA-L to the Test Set. Torque each cable to 8 in-lb. The Z5623-20418 are the short cables and the Z5623-20419 are the long cables. Refer to Table 5 and Figure 12.

| CAUTION | Each end of the interconnect RF cables have a different length from the bend. When connecting the RF Interconnect cables be sure that the longer end (from the bend) is connected to the PNA-L. |
|---|---|

| CAUTION | Over torque will cause damage to the Test Set and may cause connectors to spin or become loose. |
|---|---|

**Table 5    PNA-L Interface Cable Connection (U3021-60045)**

| RF Cables | From PNA-L | To Test Set |
|---|---|---|
| Z5623-20418 (short) | SOURCE OUT | SOURCE OUT |
| Z5623-20418 (short) | CPLR ARM | CPLR ARM |
| Z5623-20419 (long) | CPLR THRU | CPLR THRU |
| Z5623-20419 (long) | RCVR IN | RCVR OUT |

Figure 12 indicates the final two digits of the part number for each cable, and the quantity required.

**Figure 12    PNA-L RF Interface Connections**
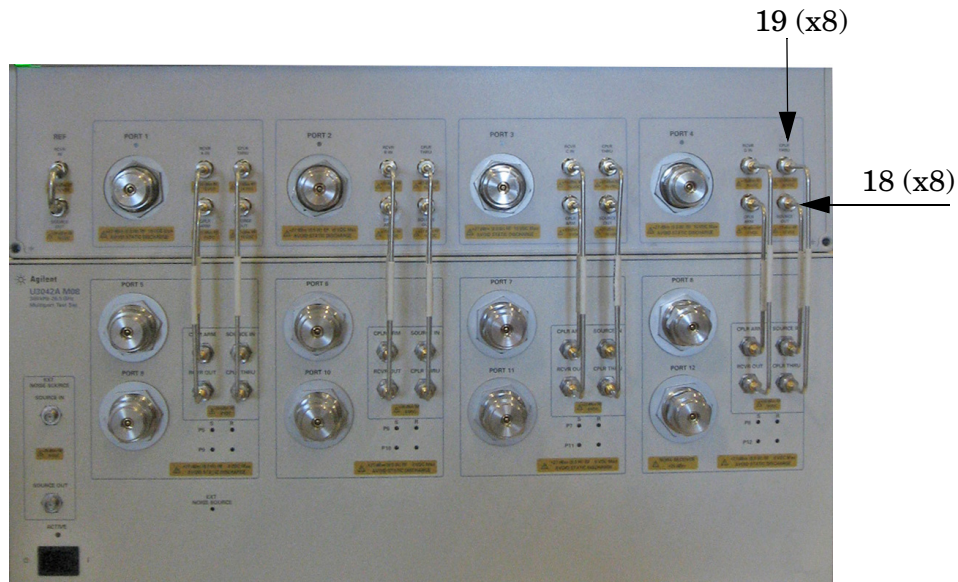


3. Connect the 25 pin D-Sub parallel cable (N4011-21002 or 8121-6818) from the PNA-L Test Set I/O to the Test Set I/O interface connector on the rear panel of the Test Set. Refer to Figure 19 on page 22.

   Refer to "System Operational Checks" on page 42 for turn-on verification of the multiport system.

# System Setup with N5222A or N5242A

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 being opened.**

## Locking the Test Set to the PNA or PNA-X

1. The kit (U3021-60002) includes items to interface the Test Set to the analyzer.

2. Remove the feet from the bottom of the analyzer.

3. Remove the 2 lower standoffs and screws (0515-1619) from the rear panel on the analyzer.

**Figure 13     Rear Bottom Feet**
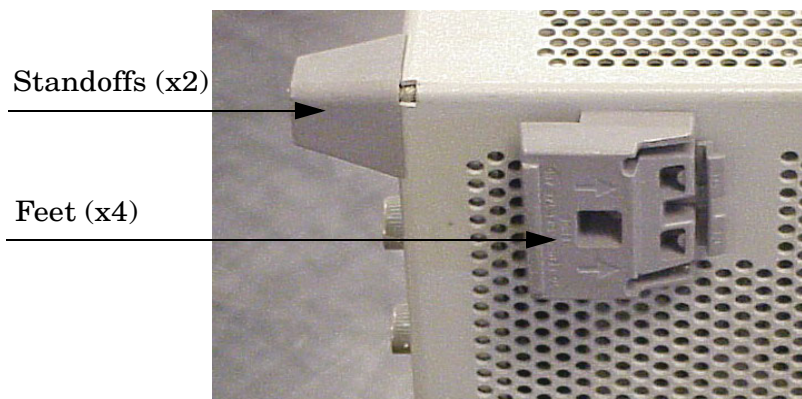
4. Install the two rear locking feet (5023-0132) onto the PNA-X, using the included screws (0515-1619), where the standoffs were removed.

**Figure 14    Install Locking Feet on PNA-X**
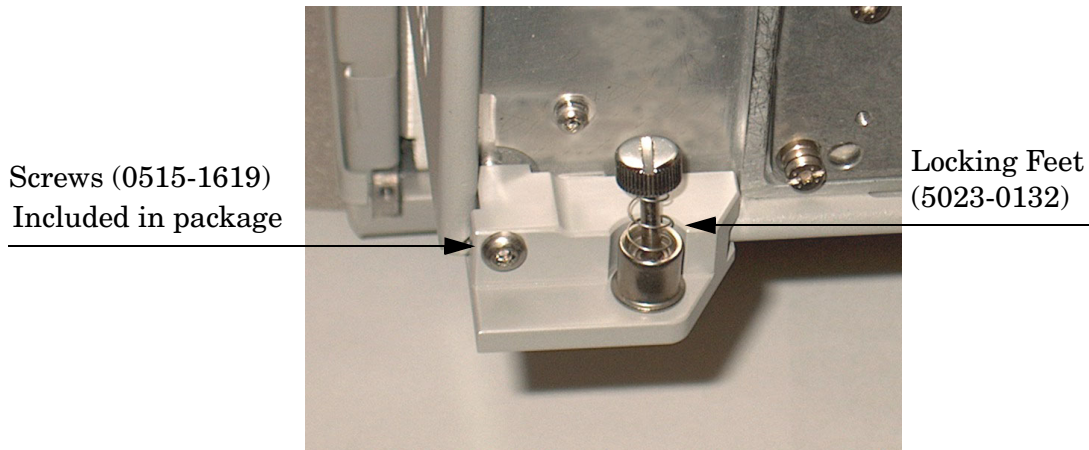


Screws (0515-1619) Included in package

Locking Feet (5023-0132)

5. Remove the top two standoffs and screws (0515-1619) from the rear panel on the Test Set.

6. Install the two rear locking feet onto the Test Set. Looking at the front panel, the N5242-20138 is the right foot and the N5242-20139 is the left foot. Two screws (0515-2317) are included with this option.

**Figure 15     Install Locking Feet on Test Set**



N5242-20139

N5242-20138

7. Place the analyzer on top of the Test Set and ensure that the front frame of the analyzer is positioned slightly forward of the locks that are attached to the Test Set. Slide the analyzer back so the locks engage the front frame of the analyzer.

**Figure 16   Locking the Analyzer's**
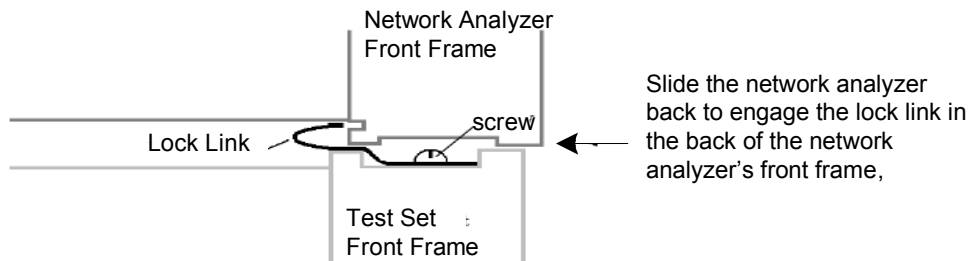


8. Secure the analyzer's lower locking feet to the Test Set's upper locking feet using the spring–loaded screws on the locking feet. If the analyzer's lower locking feet are not aligned with the screw holes in the Test Set's upper locking feet, loosen the screws securing the feet to the instrument slightly to align and tighten.

**Figure 17       Locking Feet Screws**



NOTE          The lock-feet kit (U3021-60002) includes the analyzer and Test Set lock-feet. Refer to "Contacting Agilent" on page 90 for ordering information.

- PNA – 5023-0132 (Kit includes locking feet and screws)
- Test Set – N5242-20138 (right foot) and N5242-20139 (left foot).
- Screw – 0515-2317

## N5222A or N5242A RF Interface Cable Connections

Figure 18 on page 22 illustrates the cable configuration of the Test Set to the analyzer. The cables have been supplied in the interface cable kit (U3021-60047).

1. Remove the SOURCE OUT to CPLR THRU and RCVR IN to CPLR ARM jumpers (x16) on the PNA. The RCVR R1 to SOURCE OUT reference loop jumper (x1) remain on the front panel.

2. Connect the RF interconnect cables from the analyzer to the Test Set in the order listed. As you are connecting each cable, torque to 8 in-lb. The longer, straight end of each cable is connected to the Test Set. Refer to Table 6 and Figure 18 on page 22.

---

**CAUTION**      Over torque will cause damage to the Test Set and may cause connectors to spin or become loose.

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**Table 6**      **PNA or PNA-X RF Interface Cable Connection   (U3021-60047)**

| Numeric Order | RF Cables | From PNA-X | To Test Set |
|:-:|---|---|---|
| 1 | U3042-20031 | Port 1 SOURCE OUT | Port 5 SOURCE IN |
| 2 | U3042-20032 | Port 1 CPLR THRU | Port 5 CPLR THRU |
| 3 | U3042-20029 | Port 1 CPLR ARM | Port 5 CPLR ARM |
| 4 | U3042-20030 | Port 1 RCVR A IN | Port 5 RCVR OUT |
| 5 | U3042-20035 | Port 3 SOURCE OUT | Port 6 SOURCE IN |
| 6 | U3042-20033 | Port 3 CPLR ARM | Port 6 CPLR ARM |
| 7 | U3042-20034 | Port 3 RCVR C IN | Port 6 RCVR OUT |
| 8 | U3042-20036 | Port 3 CPLR THRU | Port 6 CPLR THRU |
| 9 | U3042-20039 | Port 4 SOURCE OUT | Port 7 SOURCE IN |
| 10 | U3042-20037 | Port 4 CPLR ARM | Port 7 CPLR ARM |
| 11 | U3042-20038 | Port 4 RCVR D IN | Port 7 RCVR OUT |
| 12 | U3042-20040 | Port 4 CPLR THRU | Port 7 CPLR THRU |
| 13 | U3042-20041 | Port 2 CPLR ARM | Port 8 CPLR ARM |
| 14 | U3042-20044 | Port 2 CPLR THRU | Port 8 CPLR THRU |
| 15 | U3042-20043 | Port 2 SOURCE OUT | Port 8 SOURCE IN |
| 16 | U3042-20042 | Port 2 RCVR B IN | Port 8 RCVR OUT |

Figure 18 indicates the final two digits of the part number for each cable. The cables must be connected in the numeric order listed in Table 6 on page 21.

**Figure 18    PNA-X RF Interface Cable Connections**
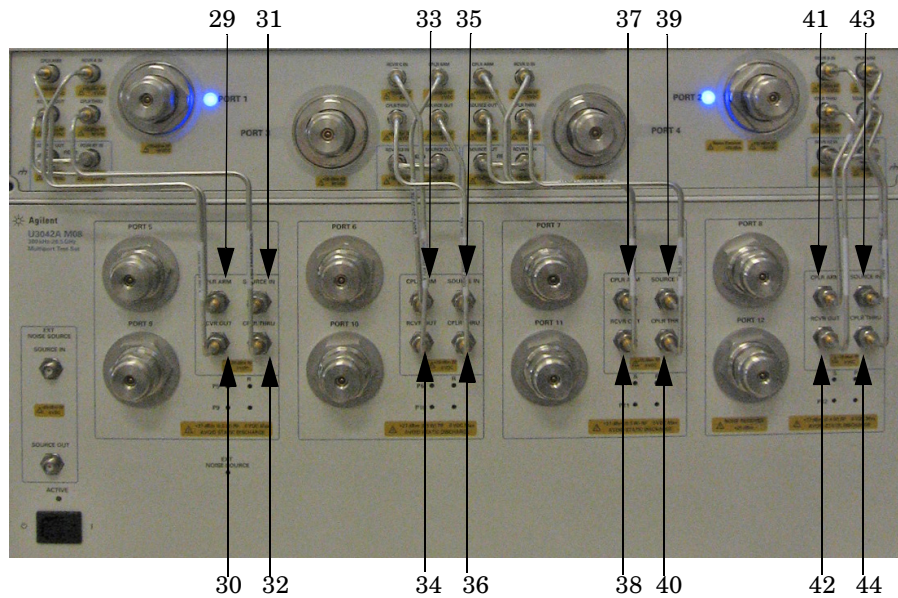


3.  Connect the analyzer Test Set I/O cable to the Test Set Interface on the rear panel.

**Figure 19    Test Set I/O Cable Connection**

# Controlling the Test Set with N5222A, N5230C, N5232A or N5242A

This section will describe how to operate the Test Set with the network analyzer.

**NOTE**        The internal firmware of the analyzer has not been modified for this Test Set option. Power levels may differ from those indicated on the network analyzer when the Test Set is connected.

The Test Set is considered a "slave" instrument. A PNA-X or PNA-L must be used to control the Test Set. There are two methods to control the Test Set. Multiport mode is recommended due to calibration and ease of use.

- "Multiport Mode (Option 551)"
- "Interface Control"
- "GPIB Control"

The U3042AM08 Option 129 (External Source Path Switch) will not operate in multiport mode (Option 551).When changing from multiport mode to standalone mode, send commands 0.0, 16.0, 32.0 and 64.0 to ensure the system is set to a default state.

- Standard - Mechanical switches for low loss. No Option 129 on the serial tag.
- Option 129 - External source path switch ports 1, 5 and 9.

## Multiport Mode (Option 551)

The multiport mode selects the Test Set file that will enable the analyzer to control the Test Set. Multiport mode allows you to complete an N-Port calibration using the Cal Wizard application in the analyzer. Refer to the Help menu for more information.

The U3042A M08 Option 129 (External Source Path Switch) will not operate in multiport mode (Option 551).

### How to Access Multiport Mode

1. The Option 551 must be installed for Multiport capability. To access the multiport9 application select **Utility** > **System** > **Configure** > **Multiport Capability**.

**Figure 20　Selecting Multiport Mode**
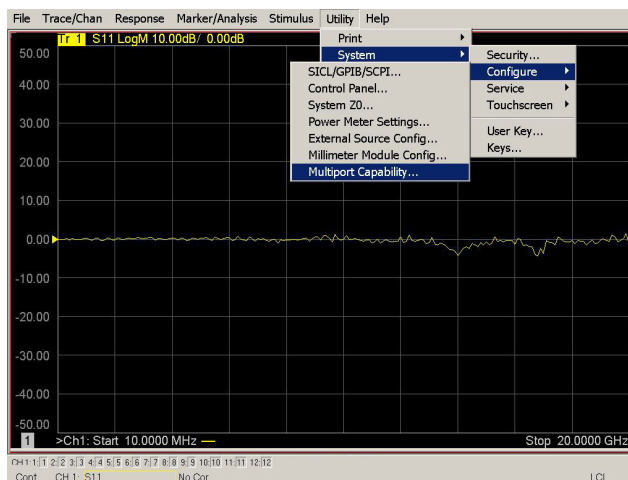


2. Select **U3042AM08** (12-Port System) from the Test Set drop-down menu and select **Restart as a Multiport PNA with this test set** > **OK**. The analyzer will restart the network application with the Test Set interface features.

If the U3042M08 is not available in the drop-down list, it will be necessary for you to copy the required Test Set file to the analyzer's hard drive. The current version of the Test Set files are available on the web at *http://na.tm.agilent.com/multiport*. Copy the appropriate file to c:\program files\Agilent\Network Analyzer\testsets directory.

**Figure 21　Test Set Selection**

**External Test Set Control Feature**

To verify that the network application has the Test Set interface features, select
**Trace/Chan** > **Channel** > **Hardware Setup** > **External Test Set** > **Other**. The Test Set will be
displayed as **External Test Set Control-U3042AM08**. See Figure 22, Figure 23 and Figure
24.

**Figure 22    External Test Set Control**
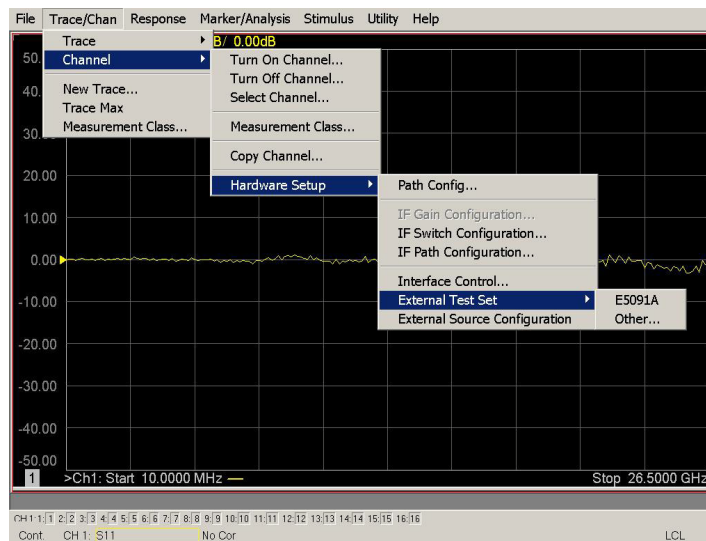
This menu will allow the physical Ports 1 thru 12 to be identified as any port for your convenience. For example; Port 5 can be named Port 2.

The **External Test Set Control-U3042AM08** also allows control of the DUT control lines, refer to "Control Lines" on page 48. To change the state from LOW to HIGH, select the graphical user interface (GUI) for the specific control (LINE 1 thru 8) > **OK**. Each line can be controlled separately.

**Figure 23    External Test Set U3042AM08 (Port 1 - 8)**
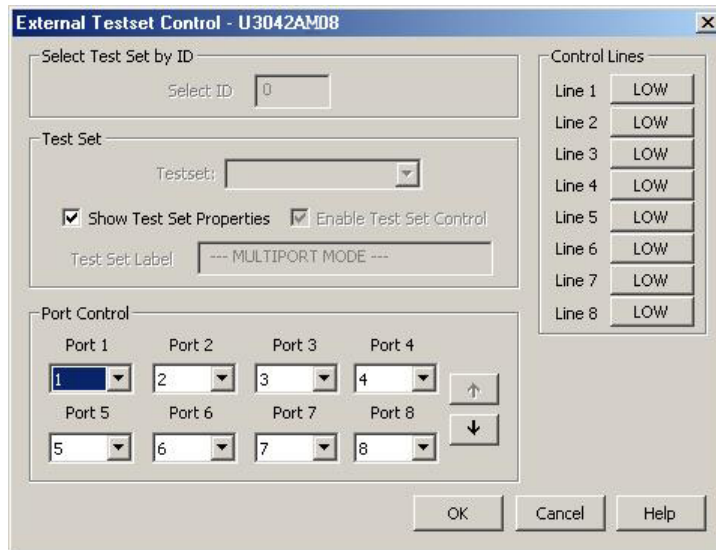


Select the **Port Control** down arrow for Ports 9 thru 12.

**Figure 24    External Test Set U3042AM08 (Port 9 - 12)**
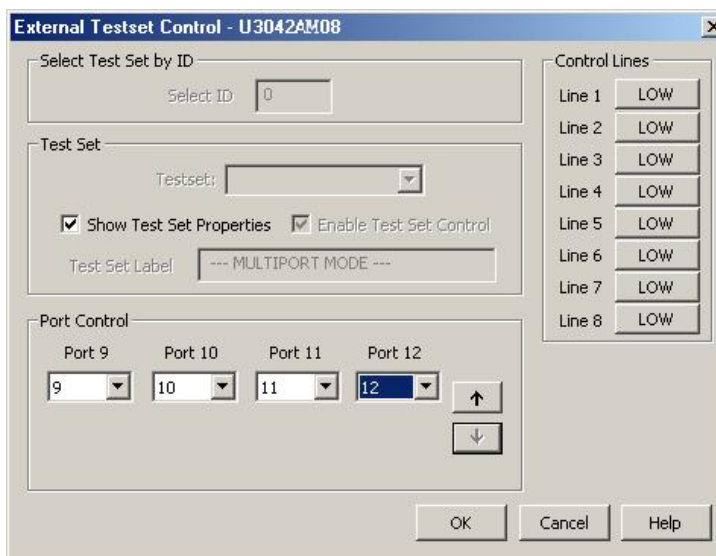
**Trace Measure S-Parameter**

S-Parameter selection can be accomplished using **Response** > **Measure**. Use the drop-down menus to select 1 of 144 S-Parameters for the 12-Port system, see Figure 25. The first number in the Sxx selection is the Receiver Port and the second number will be the Source Port. Any port can be selected to be the Receiver, Source or both, as in S11. The front panel R LED indicates the port is the Receiver and the S LED indicates the port is the Source.

**Figure 25      Trace Measure**
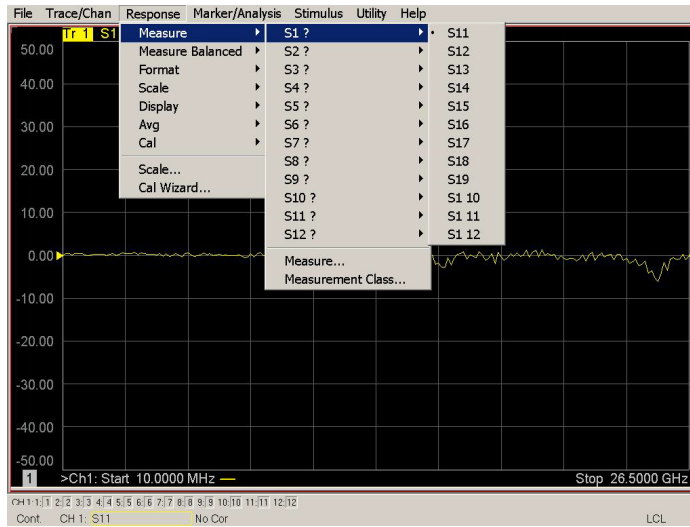


**New Trace Measure S-Parameter**

Multiple S-Parameters can be made by selecting **Trace/Chan** > **Trace** > **New Trace**. Use the drop-down menu and select any of the 144 S-Parameter's.

**Figure 26      New Trace Measure**
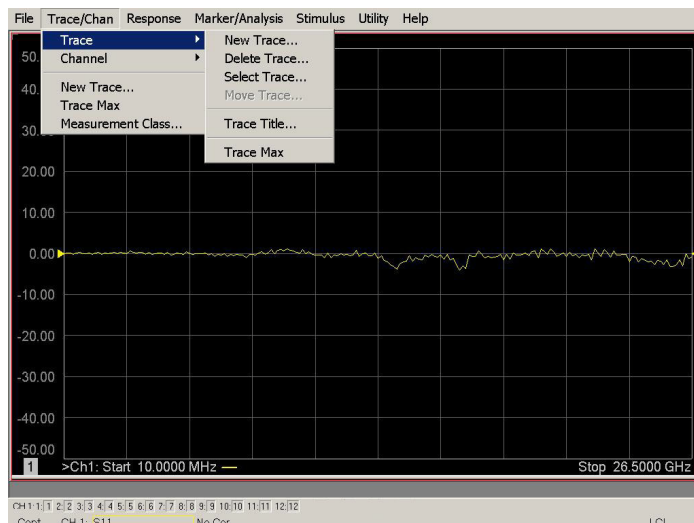
**Figure 27    12-Port New Trace Measure (S11 - S55)**



Use the scroll bar
to select other
s-parameter
measurements
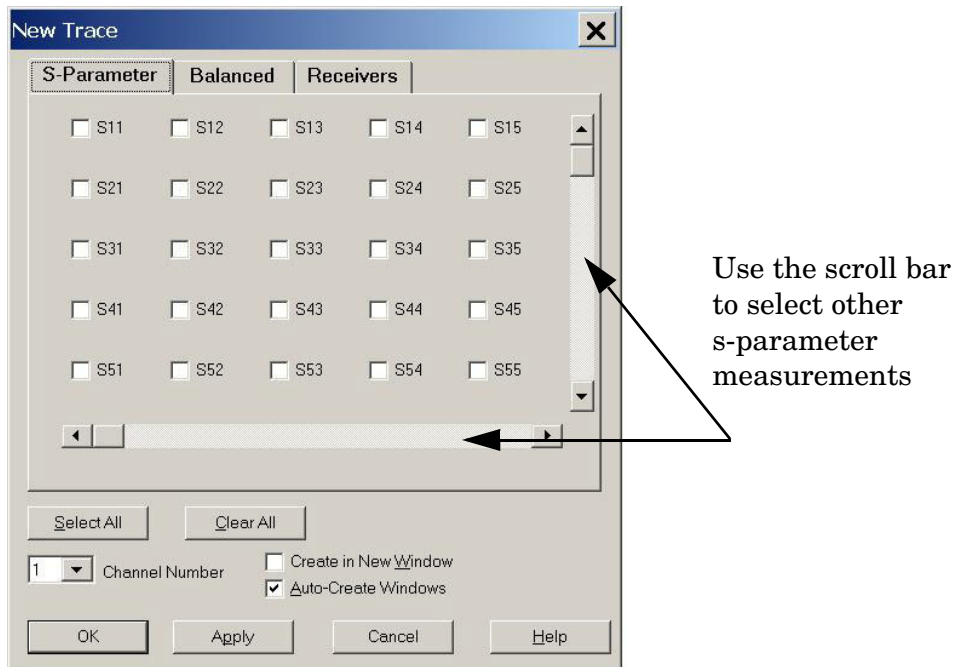
**Figure 28    12-Port New Trace Measure (S88 - S1212)**
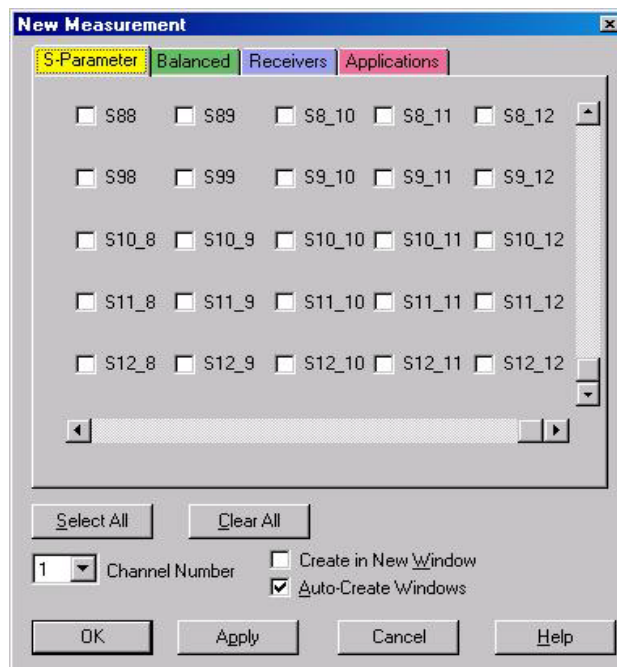
**Balanced Tab:** Balanced Measurements can be configured by selecting the Balance tab in the New Trace menu.

For more information on balanced (differential) component measurement, refer to the Application Note 1373-1 and 1373-2 (5988-5634EN and 5988-5635EN) at *http://www.home.agilent.com*. In the search menu type "Multiport and Balanced."

**Figure 29      Selecting Balanced Measurements**
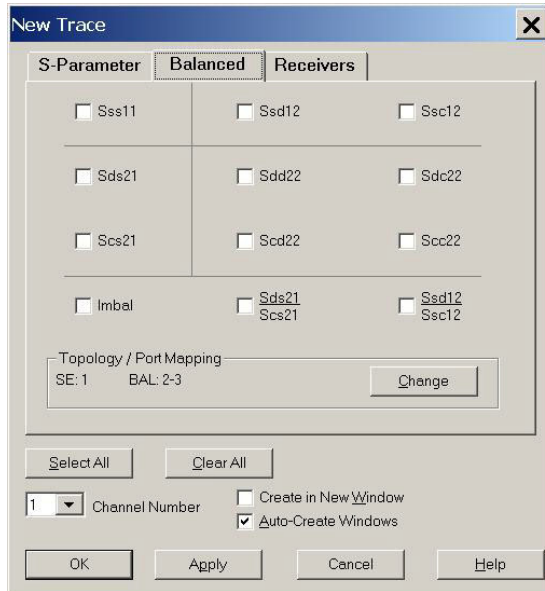


**Receivers Tab:** The S-Parameter measurements can be ratioed with selectable Denominators for each port and receiver. Refer to the standard documentation for more information.

**Figure 30      Receiver Measurements**
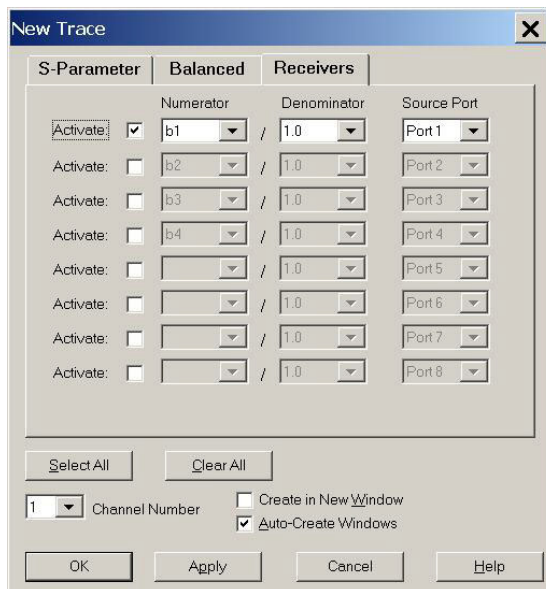
## Sweep Setup for Multiport and Standalone PNA Modes

When the Test Set is connected to the PNA, it is recommended that the analyzer's Sweep Setup be configured to Stepped Sweep before calibrating. This is slower than the Analog Sweep, but is more accurate due to the extra electrical length of the Test Set and test port cables. Stepped Sweep is available on all models.

1. On the PNA select **STIMULAS** > **Sweep** > **Sweep Setup**.

2. Select the **Stepped Sweep-sweep moves in discrete steps** check box.

3. Set the **Dwell Time** to **5 μs** > **OK**.

## RF Path Configuration with Option 029

**NOTE**        If the PNA-X has Option 029 (noise figure capability) verify that the path configuration is set to default. If the PNA-X is not in Default configuration, ports 5 and 9 will not operate correctly. Select **Trace/Chan > Hardware Setup > Path Cong**... and in the drop-down menu select **Default** > **OK**.
Save this configuration as a User Preset by selecting **Save** > **User Preset** > **Save current state as User Preset**. Do not use the factory Preset (User Preset Off), the PNA-X will return to Option 029 path configuration.

**Figure 31    RF Path Configuration**
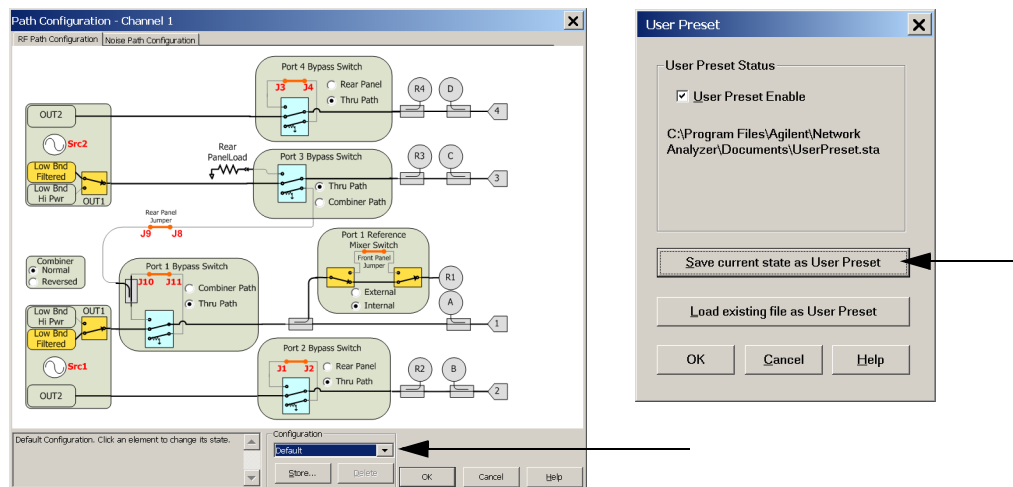
## N-Port Calibration

It is recommended that you perform an ECal characterization to minimize the connections required for multiple port calibration. The N4691B Option M0F is recommended with cable (85131F) if you are calibrating at the analyzer and Test Set ports.

Characterize the ECal module with adapters that will not be used in the measurement of the DUT. To characterize the ECal module select **Response** > **Cal** > **More** > **ECal > Characterize ECal Module**.

Calibrate at the end of the test port RF cables and any adapters that are used to connect the DUT. This removes the effect on the measurement of the DUT. Failure to do this will create ripple and other measurement errors. Refer to the Help menu, Ecal > user-characterization.

---

**NOTE**        If measurement errors occur, ensure the newest version of firmware is installed on the analyzer. Measurement errors can be a result of firmware algorithms. Consult with Agilent Service or firmware web page for the latest PNA, PNA-L or PNA-X Option 551 firmware revisions and history. *http:\\na.tm.agilent.compna\firmware\firmware.htm*.

---

1. To perform an ECal characterization select **Response** > **Cal Wizard > Characterize ECal Module** to perform ECal characterization and follow the prompts and save the ECal characterization file. Refer to the Help menu for characterizing information.

**Figure 32    ECal Characterization and Calibration Wizard**
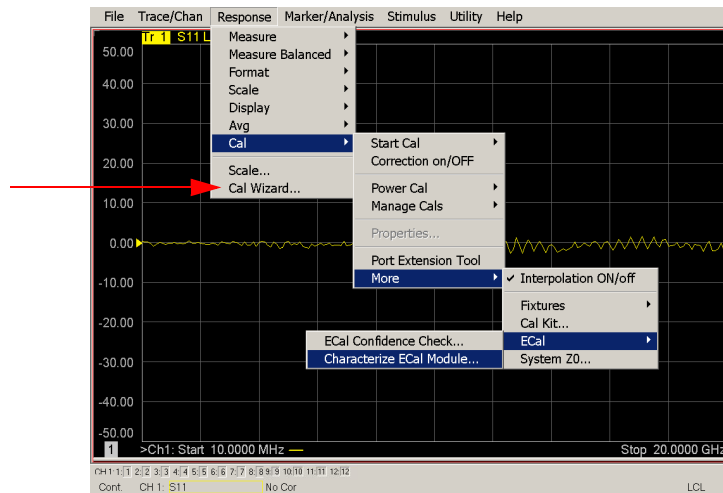
2. On the network analyzer select **Response > Cal Wizard**.

   a. If using a mechanical cal kit, select **SmartCal (Guided Calibration)** > **Next**.

   b. If using an ECal module, connect the ECal to an available USB port and select **Use Electronic Calibration (ECal)** > **Next**.

3. On the "Select Calibration Ports and ECal Module" dialog box, press **Select All** or select the ports you are calibrating and press **Next**. If an ECal characterization has been done, select **View/Select ECal Module** and select the previously saved user file from step 1.

**Figure 33    12-Port Calibration**
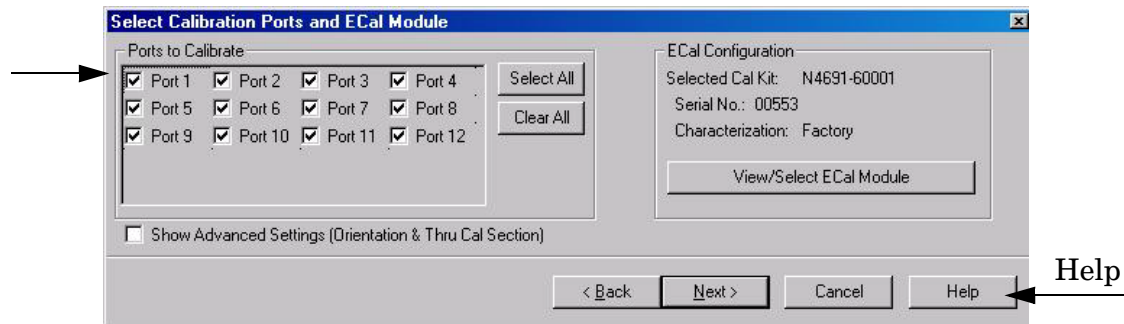


4. Connect the ECal or the mechanical cal kit to the ports you are calibrating following the Cal Wizard prompts and press **Measure** after each connection.

5. At the Calibration Completed prompt, select **Save As User Calset** and enter the name desired and **Save**.

6. After calibrating Test Set ports, use a quality load and short to verify the calibration on each port or end of the test cable. Measure reflection and confirm the return loss is as expected. If the result is not as expected, repeat the calibration without the Test Set and ensure that the analyzer is in standard (non-multiport) mode.

# Interface Control

| | |
|---|---|
| **NOTE** | The interface control will not function properly when using the multiport mode. The multiport mode will reset the switch path commands of the interface control. It is recommended that the analyzer be restarted in stand-alone mode if the interface control is being used. |

This section includes only the features required in the Interface Control for the Test Set. Applications and feature information can be found in the Help menu, "Interface Control."

- Overview
- How to Access Interface Control Settings
- Interface Control Dialog Box

Other connectivity topics can be found in the Help menu.

**Overview of the Interface Control**

The Interface Control feature allows you to send data and remote commands to control external equipment using the GPIB, Material Handler I/O, Test Set I/O, and Auxiliary I/O without needing to create a remote program. Refer to Help menu, "Rear Panel Tour."

- A unique set of control data can be sent for each channel. In addition, a unique set of control data can be sent before the channel sweep starts and after the sweep ends.

- Interface Control settings can be saved and recalled from the Interface Control Dialog Box or with Instrument State Save and Recall.

- Interface Control settings can be copied to other channels using Copy Channels.

- Control data can only be WRITTEN to the interfaces, NOT READ from the interfaces.

- Control data is sent in the following order and this order cannot be changed:

    1. GPIB Interface

    2. Material Handler Interface

    3. Test Set Interface

    4. Dwell Time

## How to Access Interface Control Settings

This section will describe how to setup and operate the Test Set with the analyzer. To access the **Interface Control** application select **Trace/Chan** > **Channel** > **Hardware Setup** > **Interface Control** in the drop-down menu, and select **Enable Interface Control**.

---

NOTE          The network analyzer comes with the Interface Control application. Please review this application before connecting the Test Set to the analyzer. Information regarding this application can be found in the analyzer's Help menu, InterfaceControl. The application is shown below.

---
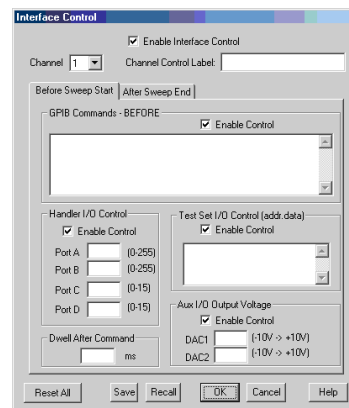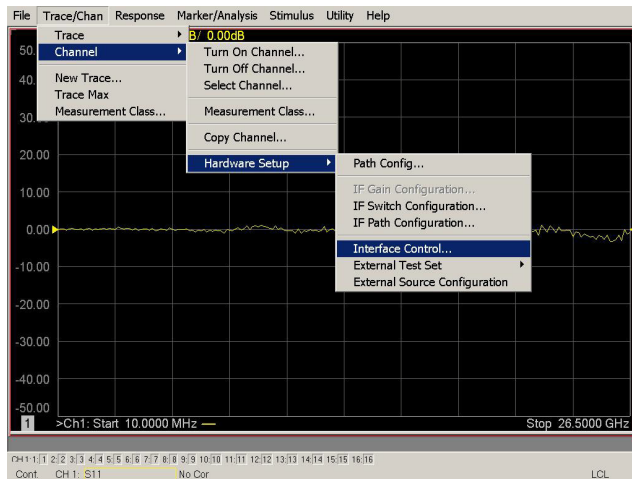
## Using Interface Control Mode

An Instrument Preset will reset all of the fields to their default settings.

---

**NOTE**      If an error is encountered when sending Interface Control data, an error
             message is displayed on the display and the Channel Trigger State is set to
             Hold. You must fix the condition that caused the error, then change the
             Channel Trigger State to its original setting.

---

**Figure 34    Interface Control**
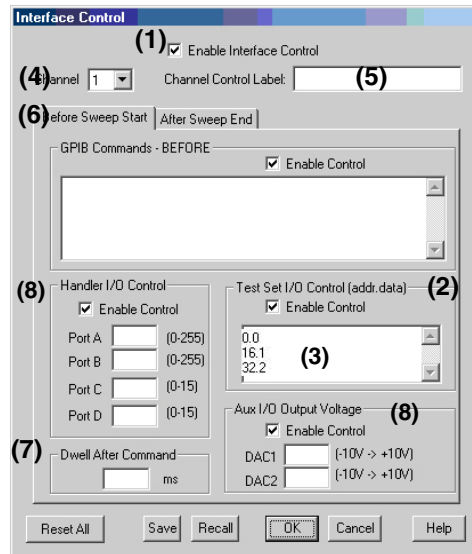


## Enable Interface Control: (1)

Enables and disables ALL Interface Control communication. When cleared (default
setting) Interface Control is disabled and NO data is sent. To send data, the individual
interfaces must also be enabled.

## Test Set I/O Control (addr.data): (2)

Provides control of the Test Set I/O Interface on the rear panel of the analyzer. Used to
control your Test Set.

Only positive integers are allowed to select switch positions or states of DUT control
interface lines. Refer to "Address and Data Values" on page 46.

Address and data integers must be separated by a period. Each set of entries should be
separated by a new line, or carriage return. The front panel Enter key can be used to insert
a new line into the field. The quantity of Test Set I/O entries that can be entered is limited
by the available memory of the analyzer.

Address and Data example: **addr.data (3)**

**0.0**
**16.1**
**32.2**

**Channel: (4)**

Specifies the channel number for dialog settings. Each channel is configured individually. The drop-down list illustrates the channels that currently have measurements. There must be at least one displayed trace for the Test Set I/O Interface to function.

**Channel Control Label: (5)**

Specifies the label to be displayed on the analyzer's screen during the channel sweep.

**Before Sweep Start – After Sweep End Tabs: (6)**

Commands (GPIB, I/O's and Dwell) can be sent Before Sweep Start and After Sweep End. However, they are configured and enabled separately on the Interface Control dialog box. For example; to send a command before and after a analyzer sweep, the Enable Interface Control check box must be selected and commands entered in both the Before Sweep Start and After Sweep End tabs. The **Before Sweep Start** data is sent before the first trace on the channel begins sweeping. The **After Sweep Start** data is sent after the last trace on the channel sweep is completed.

**Dwell After Command: (7)**

Specifies a wait time, in milliseconds, after all commands to all interfaces are sent. Any positive integer is allowed. This is used to allow all external devices to settle before beginning a measurement. An erratic trace could indicate that more settling time is necessary.

**Handler I/O Control and Aux I/O Output Voltage: (8)**

Provides I/O interface control through the rear panel of the analyzer. Refer to the Help menu for further information.

**Reset All:**

Sets all fields on all channels to their default values.

**Save and Recall:**

Saves and recalls the contents of the dialog box. If the Interface Control dialog box is populated with settings during an Instrument State Save, the settings are automatically recalled with the instrument state settings. Interface control uses an *.xml file type. An example file is stored on the analyzer's hard drive. You can recall it into the dialog, or you can open and edit it with a word processor, such as Word Pad.

**OK:**

Applies the settings and closes the dialog box.

**Cancel:**

Does not apply changes that were made and closes the dialog box.

**Help:**

Provides additional information for using the interface control application.

## GPIB Control

The GPIB Command Processor feature allows you to send remote commands and data to the PNA rear-panel GPIB connector and Test Set I/O connector. More information regarding the GPIB Command Processor can be found in the PNA Help menu.

- Overview
- How to Access GPIB Command Processor
- GPIB Command Processor Console

### Overview of the GPIB Control

The GPIB Command Processor allows you to send address and data to control an external Test Set, without needing to create a remote program. The user is required to manually input address and data using the GPIB Command Processor Console in the PNA Help menu.

- GPIB Command Processor settings can not be saved or recalled.
- Address and data can be *written* from the GPIB Command Processor.

**How to Access GPIB Command Processor**

1. To access the GPIB Command Processor select: **Utility > System > Configure > SICL/GPIB/SCPI**.

**Figure 35    Utility Configure**
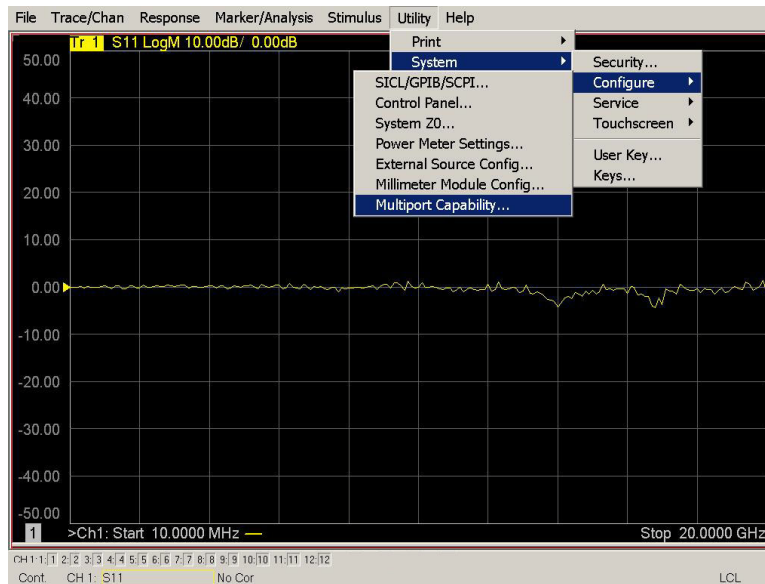


2. Select **GPIB Command Processor Console** > **OK**.

**Figure 36    GPIB Command Processor**
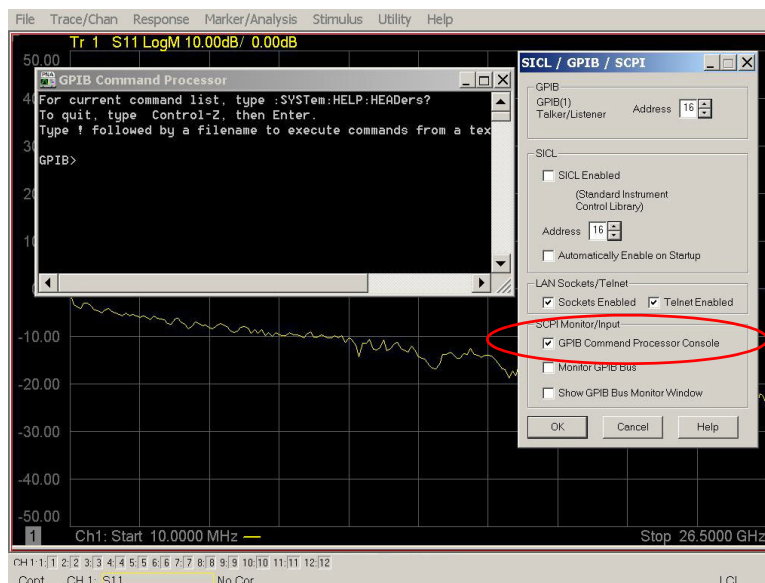
**GPIB Command Processor Console**

**Write Commands**  Once the GPIB Command Processor Console is open, commands can remotely control the external Test Set I/O connector by sending the following:

> **address:** a integer number

> **data:** a integer number

Address and data are separated by a comma. Commands should be separated by a new line, or carriage return.

For example:

CONT:EXT:TEST:DATA <address>,<data>
CONT:EXT:TEST:DATA 0,0

Example: CONT:EXT:TEST:DATA 0,0
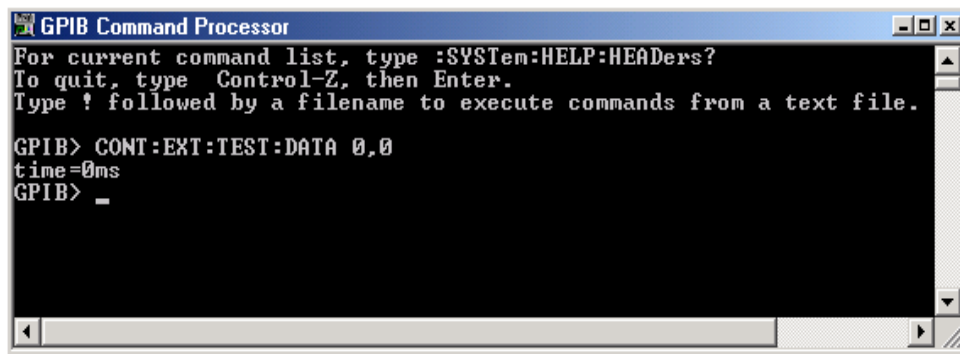


Refer to "Address and Data Values" on page 46.

# Option 129 External Noise Source

The U3042AM08 with Option 129 allows an external ECal module, or noise source to be switched into the Source path of Ports 1, 5 or 9. Only one port can be the source at a time.

## System Configuration

The cable (U3042-20076) provided with Option 129 is intended to be used with the N46xx series ECal modules. The ECal module with Option M0F is recommended.

1. Connect the ECal module to the NOISE SOURCE IN on the Test Set.

2. Connected the cable (U3042-20076) from the NOISE SOURCE OUT on the Test Set to the ECal module.

3. Connect the ECal modules USB cable to one of the PNA-X USB ports.

**Figure 37    N5242A System with ECal Module**
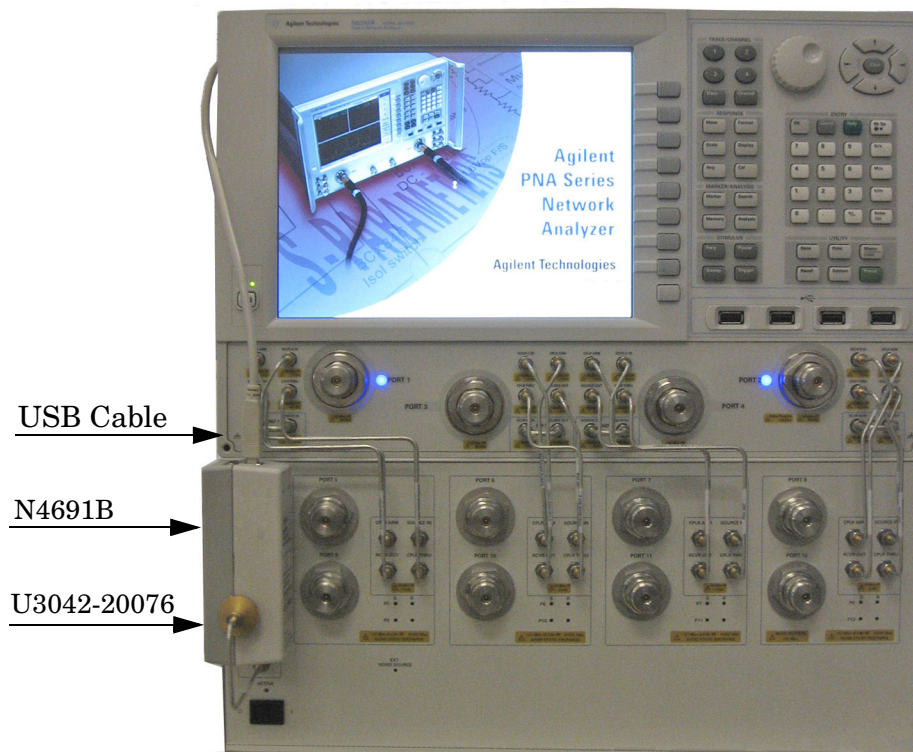
## Setting Option 129 Source Path

1. Restart the PNA to Standalone Mode, if it is in Multiport Mode. Refer to Figure 21 on page 24.

2. Refer to "Interface Control" on page 33, use the values listed in Table 7 to set Port 1, 5 or 9 as the noise source path.

---

**NOTE**          The Test Set will not operate in multiport mode. Interface or GPIB control is required to set the Noise Source Path.

---

**Table 7  Option 129 Source Path Test Set I/O Commands**

| Address Data | Source Path |
|:---:|:---|
| 0.0 | Standard Port 1 |
| 0.8 | Noise Source Port 1 |
| 0.25 | Noise Source Port 5 |
| 0.42 | Noise Source Port 9 |

---

**NOTE**          The Noise Source path is active when the front panel LED is On.

---

# System Operational Checks

The following procedure will confirm that the RF interface cables between the Test Set and analyzer are installed and the system is working correctly. Ensure that your analyzer is calibrated by measuring the short on each port before connecting the Test Set.

Before beginning this procedure complete the following steps:

- Stack the analyzer on top of the Test Set.

- Install the Test Set I/O cable on the rear panel.

- Install all of the RF interface cables on the front panel.

- Install the included female 3.5 mm short (85052-60007) to Port 1 on the analyzer.

## Equipment Setup

- Turn *on* the Test Set and analyzer.

- Preset the analyzer and make the following settings:

    — Set to Multi-Port Mode

    — Set the analyzer to measure S11

    — Ensure the RF path of the analyzer is in Default mode, refer to "RF Path Configuration with Option 029" on page 30.

## Verify Results

The 3.5 mm short will be relocated to each Test Port and an uncorrected reflection response trace should be displayed that resembles the following plots indicated in the table below. If you suspect an RF signal path problem, refer to the RF cable diagram and check the interface cables associated with this signal path for proper installation.

**Table 8      Reflection Response Results**

| Reflection Port | Response Trace | Cable Path Diagram |
|---|---|---|
| Port 1 to 4 | Figure 38 on page 43 | Figure 39 on page 43 |
| Ports 5 to 8 | Figure 40 on page 44 | Figure 41 on page 44 |
| Ports 9 to 12 | Figure 40 on page 44 | Figure 42 on page 45 |

**NOTE**      The trace ripple (peak-peak variation) will be higher than when using an ECal Module due to variation in your Short's performance. If response is in question perform "Cal Kit Operational Check" on page 54.

**Figure 38    Typical Reflection Response Ports 1 to 4**
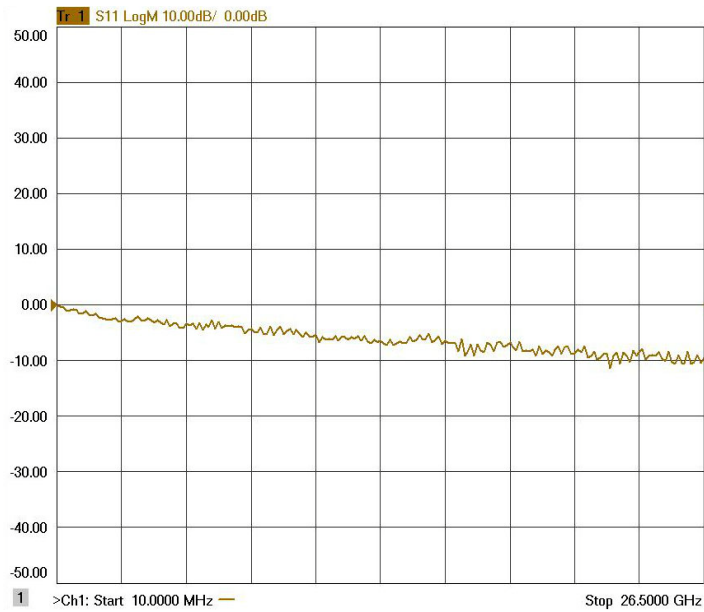


**Figure 39    Reflection Response Signal Path Diagram Ports 1 to 4**
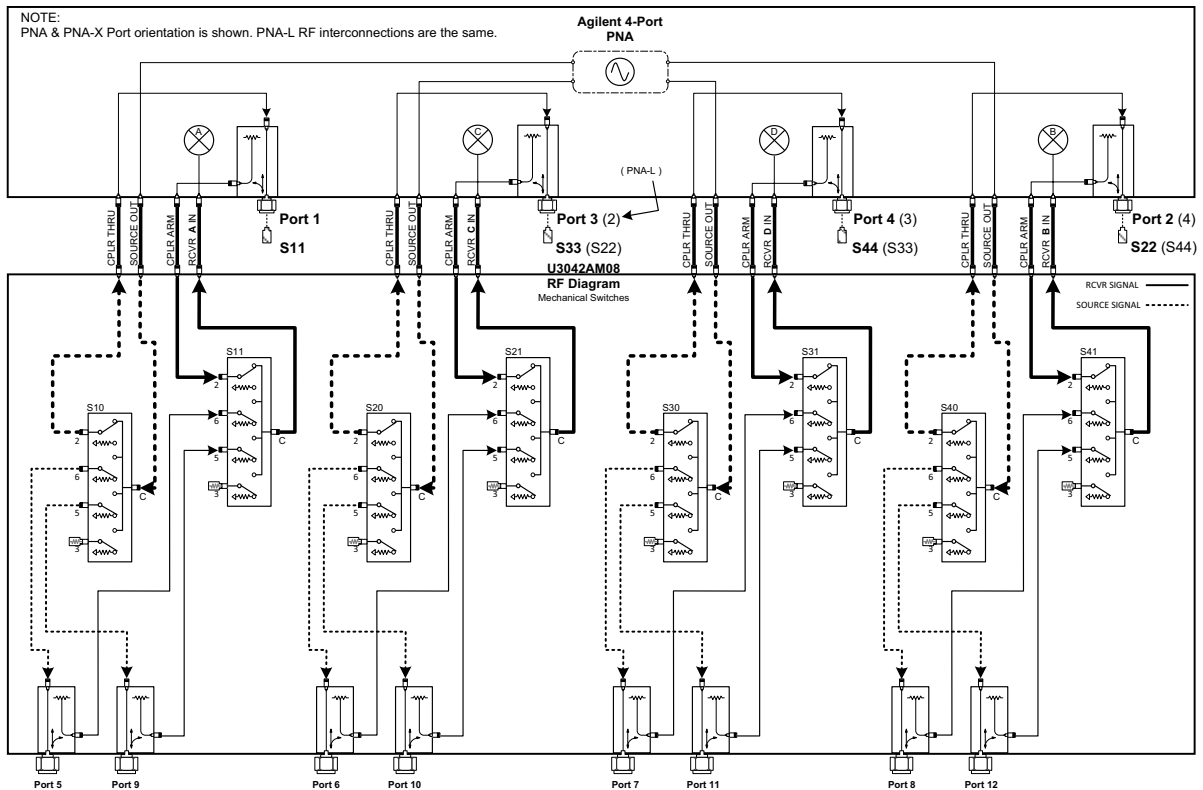
**Figure 40     Typical Reflection Response Ports 5 to 8**
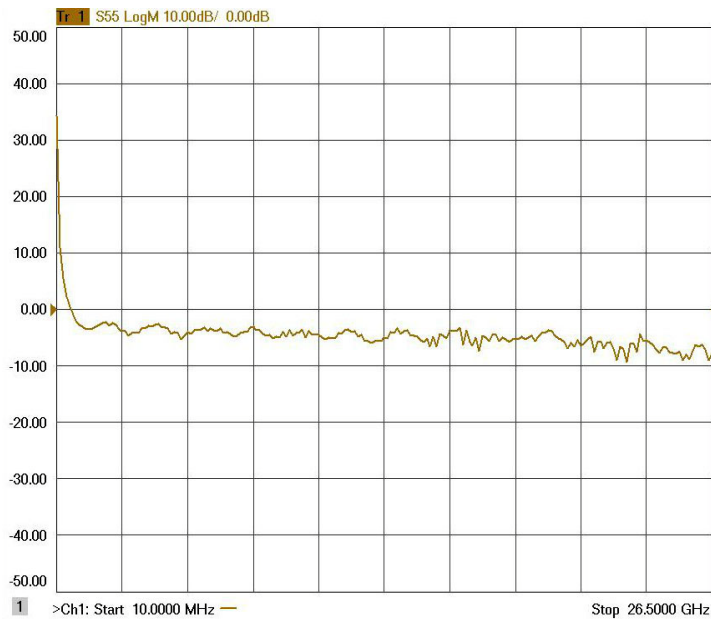


**Figure 41     Reflection Response Signal Path Diagram Ports 5 to 8**
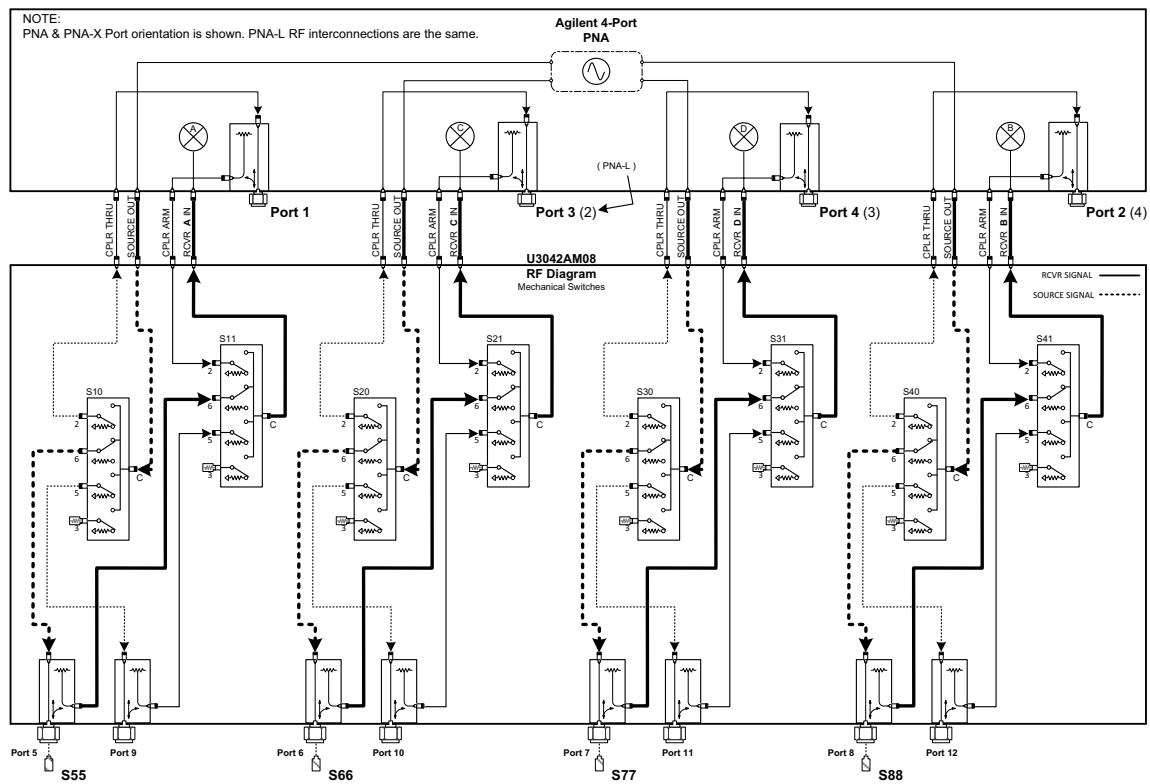
## Figure 42    Reflection Response Signal Path Diagram Ports 9 to 12
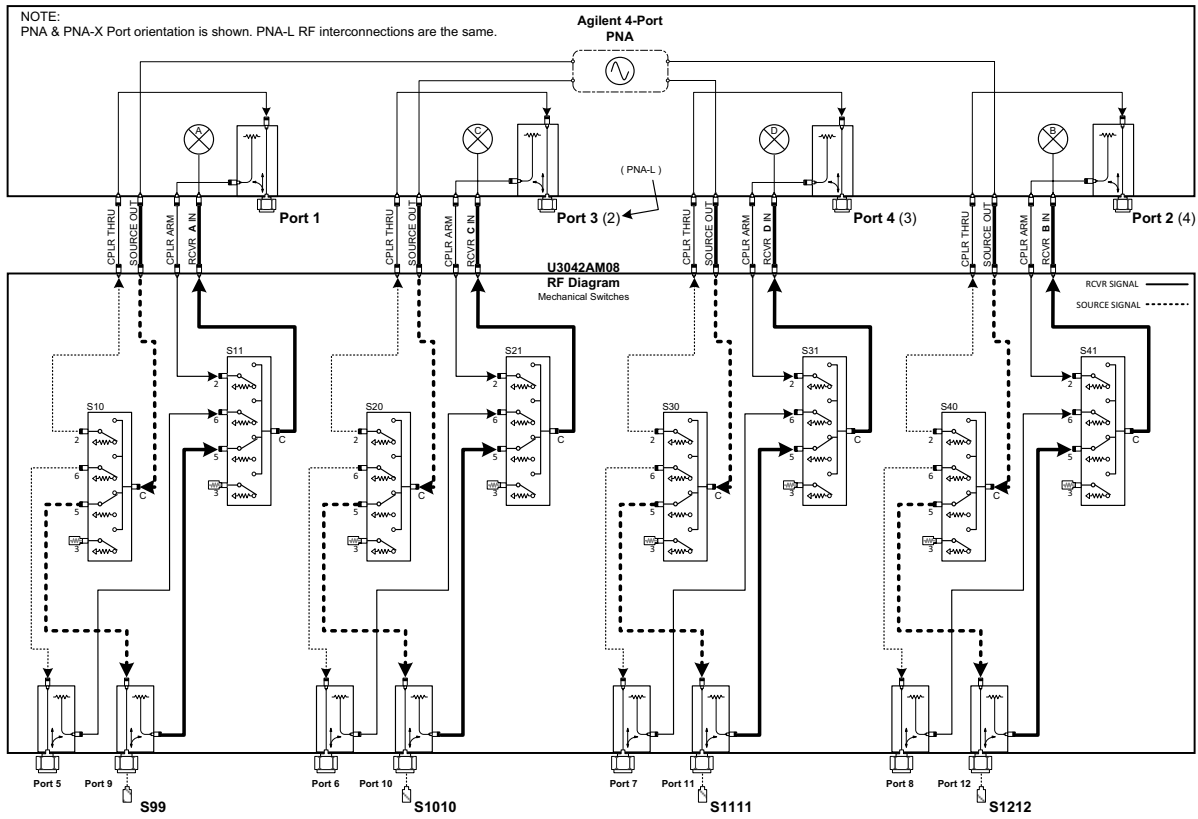
# Address and Data Values

## Setting the Test Port Paths with Address and Data

Refer to Table 9 and Table 10 and Figure 43 on page 47 to set the internal switch paths of the Test Set.

The address is the first value in the Test Set I/O control or GPIB data command. The second value controls the source and receiver paths of the ports. To select a Test Set port configuration both switches must be set to complete the source and receiver paths. To do this you must add the data values together to determine the data command value for each port, which is the second number in the Test Set I/O or GPIB command.

*Example 1*: Refer to Figure 43.

If the ports have different addresses, two separate address data commands must be used.

Port 5 is the Source and Port 8 is the Receiver.

Source Port 5 = address 0, data 1 and Receiver Port 8 = address 16, data 16.
Two separate commands must to be sent, you may use the same dialog box. Send address 0 and data 1 in one command line, and address 16 and data 16 in the second line. Refer to "Interface Control" on page 33 and in "GPIB Control" on page 37.

For further information refer to "How to Access Interface Control Settings" on page 34 and "How to Access GPIB Command Processor" on page 38.

*Example 2*:

If the ports have the same address, only one command is needed.

Port 5 is the Source and Ports 9 is the Receiver.

Source Port 5 = address 0, data 1 and Receiver Port 9 = address 0, data 32. The data values are added together, the entry will be 0.33.

Refer to Figure 57, "U3042AM08 RF Block Diagram," for in-depth RF path information.

**Table 9      PNA-L Port Value Select**

| Address | | Source Path | | | Receiver Path | | |
|---|---|---|---|---|---|---|---|
| | Data | 0 | 1 | 2 | 0 | 16 | 32 |
| 0 | Ports | 1 | 5 | 9 | 1 | 5 | 9 |
| 16 | Ports | 2 | 6 | 10 | 2 | 6 | 10 |
| 32 | Ports | 3 | 7 | 11 | 3 | 7 | 11 |
| 64 | Ports | 4 | 8 | 12 | 4 | 8 | 12 |

**Table 10      PNA or PNA-X Port Value Select**

| Address | | Source Path | | | Receiver Path | | |
|---|---|---|---|---|---|---|---|
| | Data | 0 | 1 | 2 | 0 | 16 | 32 |
| 0 | Ports | 1 | 5 | 9 | 1 | 5 | 9 |
| 16 | Ports | 3 | 6 | 10 | 3 | 6 | 10 |
| 32 | Ports | 4 | 7 | 11 | 4 | 7 | 11 |
| 64 | Ports | 2 | 8 | 12 | 2 | 8 | 12 |

**Figure 43    Address and Data Example 1 (Port 7 to 12)**
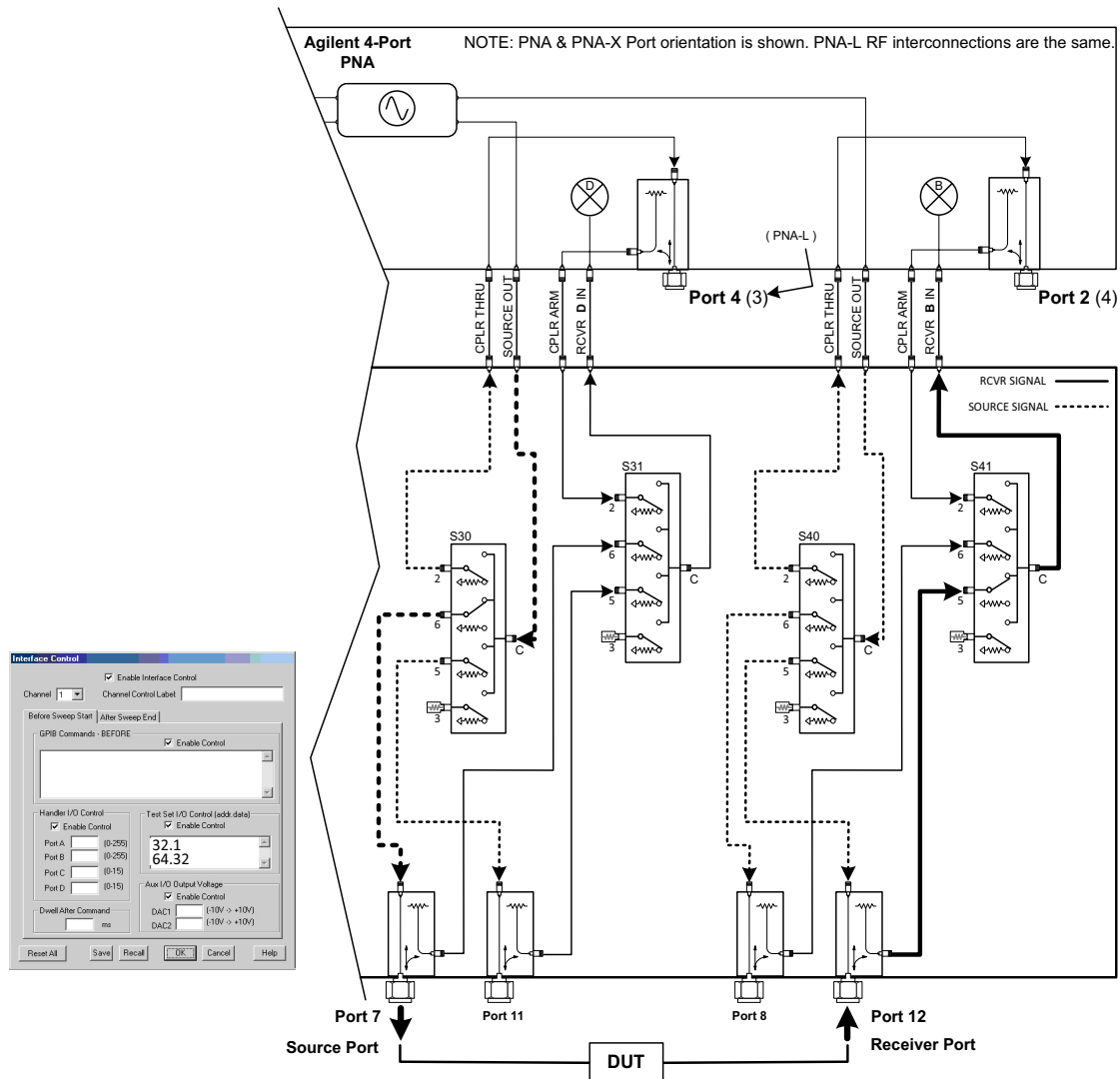
# Control Lines

The 15 pin female D-Sub connector on the rear panel provides 8 latched data lines that can be used to control your device under test (DUT). The lines can be controlled with the multiport external Test Set control, or Test Set I/O commands. Refer to "External Voltage Supply Configuration" on page 51 and "Setting the Control Lines with Address and Data Values" on page 52. See Table 11 for DUT control line specification.

The output voltage of the lines can be from the internal adjustable voltage source (+2 to +5 Vdc), or an external dc power supply depending on how the connection to the control line is configured. When using an external power supply a positive or negative voltage can be used. Refer to Figure 44 and Table 12 on page 49 for control line pin location and description. Refer to "Internal Voltage Supply Configuration" on page 50 and "External Voltage Supply Configuration" on page 51 for configurations.

**Table 11      DUT Control Specifications**

| Item | Specifications |
|---|---|
| Connector Type | D–Sub, 15–pin female |
| Max Output Line Current | 100 mA (each line) |
| Control Line DC resistance | < 10 Ω (each line) |
| Voltage Range: | |
|    Positive Input | 0 to +5 V |
|    Negative Input | –5 to 0 V |
| Internal Variable Voltage | +2 to +5 V |

**Figure 44    DUT Control Line Pin Assignment**
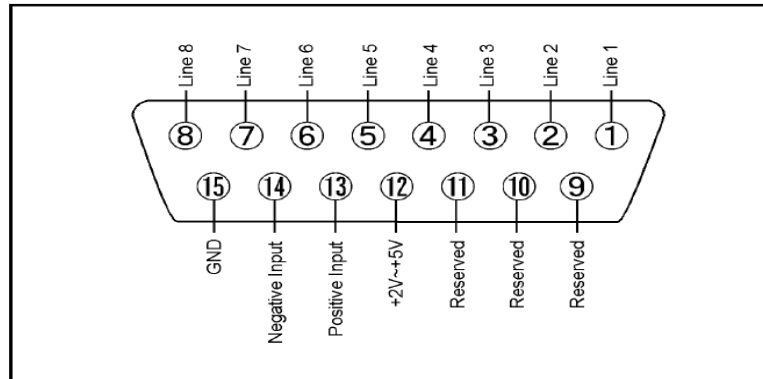


**Table 12    DUT Control Line Interface Connector Pin Assignment**

| Pin | Signal Name | Description |
|---|---|---|
| 1 | Line 1 | Control Line Output of the voltage from pin 13 or pin 14. |
| 2 | Line 2 | Control Line Output of the voltage from pin 13 or pin 14. |
| 3 | Line 3 | Control Line Output of the voltage from pin 13 or pin 14. |
| 4 | Line 4 | Control Line Output of the voltage from pin 13 or pin 14. |
| 5 | Line 5 | Control Line Output of the voltage from pin 13 or pin 14. |
| 6 | Line 6 | Control Line Output of the voltage from pin 13 or pin 14. |
| 7 | Line 7 | Control Line Output of the voltage from pin 13 or pin 14. |
| 8 | Line 8 | Control Line Output of the voltage from pin 13 or pin 14. |
| 9, 10 & 11 | | Not used |
| 12 | +2 V to +5 V | Internal voltage output, adjusted with the trimmer on the rear panel. |
| 13 | Positive Input | Connection for internal (pin 12) or external positive voltage supply. |
| 14 | Negative Input | Connection for ground (pin 15) or external negative voltage supply. |
| 15 | Gnd | ground terminal |

## Internal Voltage Supply Configuration

The output voltage of pin 12 can be varied from +2 to +5 V. Perform the following procedure to set the voltage:

1. Turn *on* Test Set.

2. Measure the voltage between pin 12 and 15 using a multimeter.

3. Rotate the voltage adjustment trimmer on the front panel until the multimeter indicates the appropriate voltage.

Figure 45 illustrates an example of the connection between the DUT and the Test Set *without* an external dc power supply. Connect pin 12 to pin 13 for +5 V, and pin 14 to pin 15 to provide the ground path. Connect each DUT control line to the external device under test.

---

**CAUTION**      You may only connect pin 12–13, and pin 14–15. Damage may result if any other path is short–circuited.

---

**Figure 45    Internal DC Power Configuration (rear panel view)**
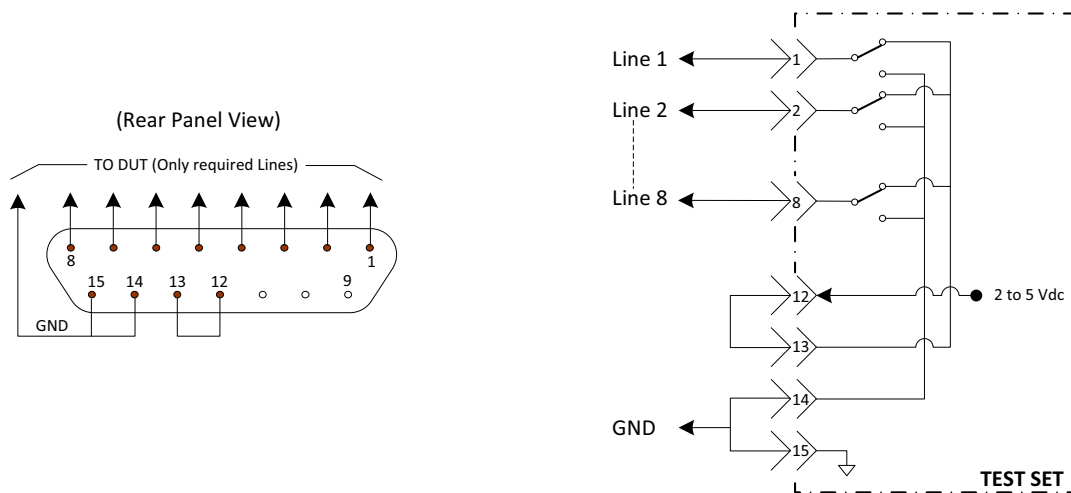
## External Voltage Supply Configuration

Figure 46 illustrates an example of the connection between the DUT and the Test Set *with* an external dc power supply. Input the High and Low signals from the external power supply to the Positive Input and Negative Input respectively, and connect each line to the control terminal of the DUT.

### Turning *On* the Test Set using an External Power Supply

1.  Turn *on* the Test Set.

2.  Connect the DUT.

3.  Turn *on* the external power supply.

### Turning *Off* the Test Set using an External Power Supply

1.  Turn *off* the Power Supply.

2.  Turn *off* the Test Set.

3.  Disconnect the DUT.

**Figure 46    Test Set to the DUT and External DC Power Supply**
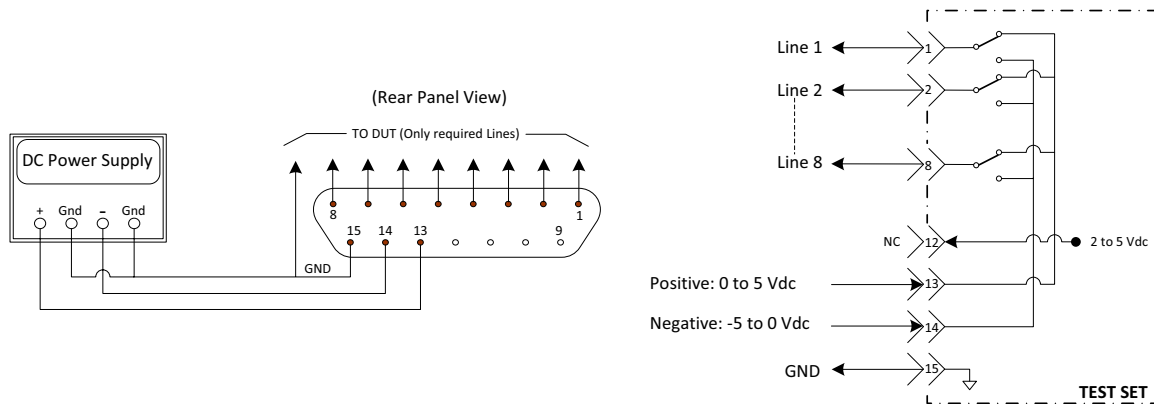
## Setting the Control Lines with Address and Data Values

This section describes how to control the rear panel DUT control lines.

---

**NOTE**         The following control feature will function only while the analyzer is in its
                 Standalone mode.

---

**Setting the Analyzer to Standalone Mode**

1. Select **Utility** > **System** > **Configure** > **Multiport Capability**. In the dialog box select
   **Restart as a standalone PNA** > **OK**.

As described in "Address and Data Values" on page 46, the <address>.<data> values are
determined in a similar manor, with the following exceptions:

- Table 13 will be used.
- The <address> value is always = 112

**Table 13       Test Set DUT Control Address and Data Logic Table**

| <Address> | <Data> | Description | Line/Pin |
|:---:|:---:|---|:---:|
| 112 | 0 | ALL DUT Control Lines set to logic high or connected to Pin 13 | 1-8 |
| 112 | 255 | ALL DUT Control Lines set to logic low or connected to Pin 14 | 1-8 |
| 112 | 1 | DUT Control Line 1 set to logic low or connected to Pin 14 | 1 |
| 112 | 2 | DUT Control Line 2 set to logic low or connected to Pin 14 | 2 |
| 112 | 4 | DUT Control Line 3 set to logic low or connected to Pin 14 | 3 |
| 112 | 8 | DUT Control Line 4 set to logic low or connected to Pin 14 | 4 |
| 112 | 16 | DUT Control Line 5 set to logic low or connected to Pin 14 | 5 |
| 112 | 32 | DUT Control Line 6 set to logic low or connected to Pin 14 | 6 |
| 112 | 64 | DUT Control Line 7 set to logic low or connected to Pin 14 | 7 |
| 112 | 128 | DUT Control Line 8 set to logic low or connected to Pin 14 | 8 |

After a power reset all DUT control lines are initially configured to a logic high state or connected to Pin 13, refer to . To reset all control lines to logic high, without having to reset the power switch on the Test Set, make the following PNA entry:

Front panel PNA Interface Control Mode line entry = 112.0 > OK.

Always determine which control lines you want set to a logic zero, the other remaining lines will automatically be set to a logic high. Note the <data> value of these lines and calculate the SUM of their <data> values.

Listed are two examples to illustrate this concept. Refer to Figure 28, shown with all lines = logic high.

*Example 1*: To change lines 1 & 8 to equal logic Low, all others logic high.

1. Line 1 (<address> = 112 and <data> = 1)

2. Line 8 (<address> = 112 and <data> = 128)

3. The SUM of the <data> values = 129

4. Front panel PNA Interface Control Mode line entry = 112.129 > OK.

*Example 2*: From Example 1 to only change Lines 2 & 3 to equal logic low, all others logic high.

1. Line 2 (<address> = 112 and <data> = 2)

2. Line 3 (<address> = 112 and <data> = 4)

3. The SUM of the <data> values = 6

4. Front panel PNA Interface Control Mode line entry = 112.6 > OK.

---

**NOTE**         Since all control lines have the same <address>, only one "<address>.<data>" command line is needed to control all 8 lines.

---

# Cal Kit Operational Check

This section provides operational check to confirm the Test Set and analyzer operational performance. The operation verification limits provided ensure that your Test Set and analyzer are operating properly.

## Equipment Required

The Test Set requires that the user be familiar with the equipment and components listed in Table 14.

This section provides an equipment list and setup of the analyzer and Test Set.

**Table 14       Equipment List**

| Description | Qty |
|---|---|
| N4691A 3.5 mm ECal Module 10 MHz - 26.5 GHz (Option 00F or M0F) *or* N4691B 3.5 mm ECal Module 300 kHz - 26.5 GHz (Option 00F or M0F) *or* Mechanical cal kit 85052B or 85052D | 1 |
| N5230C 4-Port Network Analyzer (Option 245 and 551) *or* N5222A, N5232A or N5242A Option 400 and 551 | 1 |
| Set of interconnect cables (PNA and Test Set), see "PNA-L RF Interface Cable Connections" on page 16 or "N5222A or N5242A RF Interface Cable Connections" on page 21. | 1 |

## Verification Limits

Specifications for the Test Set are typical. System performance for the analyzer and Test Set are only characteristic and intended as non-warranted information. Only a functional certificate is provided for the U3042AM08.

It is recommended that you return your instrument to Agilent Technologies for servicing or repair if the Test Set and analyzer performance exceed the operational verification limits.

**NOTE**      Typical specifications are based on 1 to 2 units performance. Refer to Table 15 and Table 16 on page 55.

**Table 15      Reflection Tracking with PNA-L[1]**

| Frequency | Port 1-12 |
|---|---|
| 10 MHz to 4 GHz | −5 dB |
| 4 GHz to 6 GHz | −6 dB |
| 6 GHz to 10 GHz | −8 dB |
| 10 GHz to 15 GHz | −12 dB |
| 15 GHz to 20 GHz | −14 dB |

1. Reflection Tracking takes into account Source Loss, Receiver Loss, Margin, and PNA-L Mixer Cal.

**Table 16      Reflection Tracking with PNA or PNA-X[1]**

| Frequency | Port 1-12 |
|---|---|
| 10 MHz to 4 GHz | −5 dB |
| 4 GHz to 6 GHz | −6 dB |
| 6 GHz to 10 GHz | −8 dB |
| 10 GHz to 15 GHz | −12 dB |
| 15 GHz to 20 GHz | −14 dB |
| 20 GHz to 26.5 GHz | −15 dB |

1. Reflection Tracking takes into account Source Loss, Receiver Loss, Margin, and PNA or PNA-X Mixer Cal.

**NOTE**      If you suspect that your 12-Port configuration is not operating properly, ensure that all front RF jumper interconnect cables are correctly attached.

**Table 17      Option 129 Noise SOURCE OUT to CPLR THRU**

| Frequency | Loss |
|-----------|------|
| 10 MHz to 4 GHz | −1 dB |
| 4 GHz to 6 GHz | −1.5 dB |
| 6 GHz to 10 GHz | −2 dB |
| 10 GHz to 15 GHz | −3 dB |
| 15 GHz to 20 GHz | −4 dB |
| 20 GHz to 26.5 GHz | −5 dB |

**Table 18      Option 129 Noise SOURCE IN to Port 1, 5 or 9**

| Frequency | Port |
|-----------|------|
| 10 MHz to 4 GHz | −4 dB |
| 4 GHz to 6 GHz | −5 dB |
| 6 GHz to 10 GHz | −6 dB |
| 10 GHz to 15 GHz | −7 dB |
| 15 GHz to 20 GHz | −8 dB |
| 20 GHz to 26.5 GHz | −10 dB |

## Cal Kit Operational Check Procedure

The sequence of this procedure is very important and must be followed or the performance accuracy and results may vary from the reference plots provided. Ensure that the Test Set is not connected to the PNA if you are performing a PNA Operator's Check. The PNA will indicate false failures if the Test Set is connected.

### Preparing the Network Analyzer

1. Configure the Test Set to the analyzer using the interconnect cables as shown in "System Setup with N5230C and N5232A" on page 13 or "System Setup with N5222A or N5242A" on page 18.

2. Turn *on* the Test Set.

3. Select **Response** > **Cal** > **Manage Cals** > **Cal Set**. Delete or Rename any Cal Sets titled "999.1" thru "999.12" (12-Port), although it is unlikely that you will find Cal Sets with these names.

4. Verify that the network analyzer is in Multiport mode. See the bottom of the measurement window.

   a.  If only four S-Parameters are listed, select **Utility** > **System** > **Configure** > **Multiport Capability**. Select **Restart as multiport PNA with this testset** and select **U3042AM08** (12-Port) from the drop-down menu > **OK**. Refer to Figure 21 on page 24.

5. Press **Preset.**

6. Verify that the **[Start Frequency]** is set to **[300 kHz or 10 MHz]**.

7. Set **[Stop Frequency]** to **[20 GHz or 26.5 GHz]**.

8. Select **[Power]** > **Power Level** and enter **[0 dBm]**.

9. Select **Response** > **Avg > IF Bandwidth** > **100 Hz** > **OK**.

10. Select **Stimulus** > **Sweep** > **Number of Points** > **401**.

11. Connect the ECal module to an available PNA USB port on the front or rear panel. This procedure assumes you are using a ECal. If you are not, see "1-Port Calibration and Verification Procedure" on page 58, step 2.

12. Allow the ECal module, Test Set and analyzer to warm up for a minimum of 30 minutes.

**1-Port Calibration and Verification Procedure**

1. Connect the ECal or the mechanical cal kit to Port 1 or the port you are testing. Torque to 8 in-lb. For further information refer to the Help menu.

2. Perform a 1-Port Calibration on Port 1. On the analyzer select **Response** > **CAL** > **Start Cal** > **Calibration Wizard**.

   a. If using a mechanical cal kit, select **SmartCal (Guided Calibration)** > **Next**.

   b. If using an ECal module, connect the ECal to a PNA USB port. Select **Use ElectronicCalibration (ECal)** > **Next**.

3. Continue following the Cal Wizard prompts. In the Select Calibration Ports and ECal Module dialog box click **Clear All**, then select **Port 1** > **Next** > **Measure**.

4. Ensure the Cal Kit you are using is indicated on the right side of the window.

**Figure 47    1-Port Calibration**
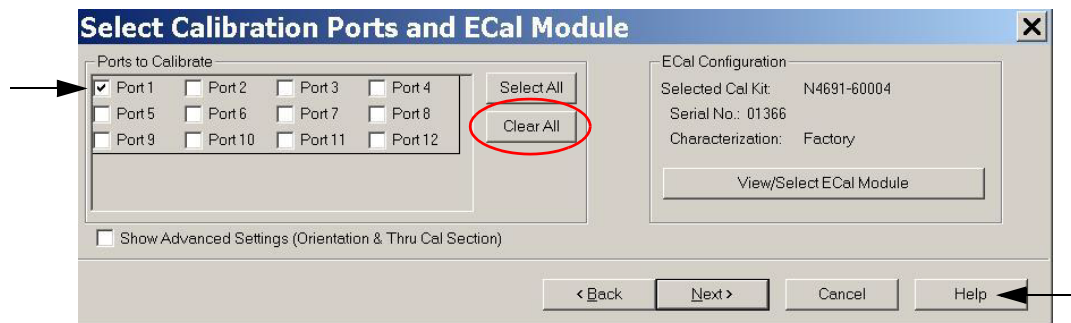


5. Continue to follow the prompts until the "Calibration Completed" dialog box appears.

6. At the Calibration Completed prompt, select **Save As User Calset**, type the name **999.1**. Overwrite the Calset if it already exists and **Save**.

---

**NOTE**        If you do not have a key board, select **Save As User Calset** > **Edit Name** and save as **999.x**. X is the port number you are calibrating. Use the numeric keypad on the analyzer front panel to enter "999.1."

---

**Figure 48    Calibration Complete**
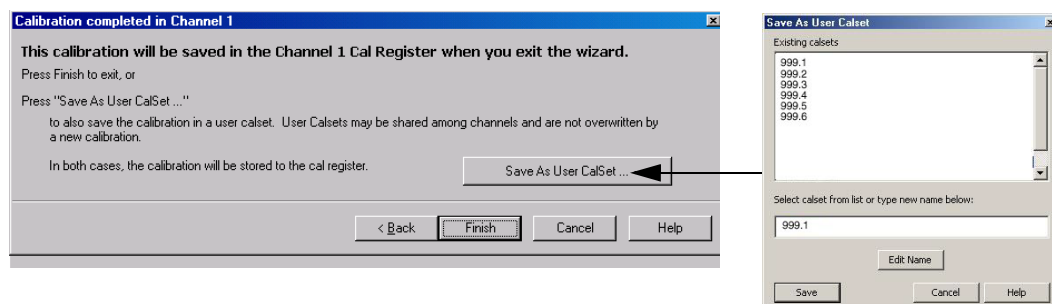
7.  Repeat step 1 thru step 5 (1-Port Calibration Procedure) for Ports 2 thru 12. When finished, there should be twelve Cal Sets saved with the titles "999.1" thru "999.12" (12-Port).

    If you are using an ECal module you can verify the individual port calibration by selecting **Response** > **CAL** > **More** > **ECAL** > **ECAL Confidence Check**. Select Change Measurement and select the test port S-Parameter > **Apply** > **OK** > **Read Module Data**. For further information refer to the Help menu.

8.  Select **Trace/Chan** > **Trace** > **Delete Trace**. There should be no traces on the screen.

9.  To launch the Cal Set Viewer toolbar. Select **Response** > **CAL** > **Manage CALS** > **CAL Set Viewer**.

**Figure 49      Calibration, Cal Set Viewer**
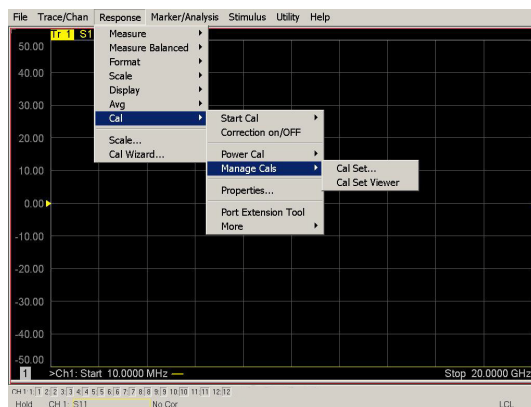


10. From the Cal Sets drop-down menu, select **999.1** and select **Enable**. Select the **Reflection Tracking(x,x)**, where x,x is the port being tested. Ensure that the **Enable** and **Error Terms** check boxes are selected.

11. Compare the Reflection Tracking (1,1) trace to the appropriate limits in Table 16 on page 55. This can be done using Limit Lines (press **Marker/Analysis** > **Analysis** > **Limit Test**). The trace should be above the limit. PASS will be displayed on the screen if the limit lines are used.

12. Repeat step 10 and step 11 for Cal Sets "999.1" thru "999.12" (12-Port).

**Figure 50      Setting the Test Limits**

13.
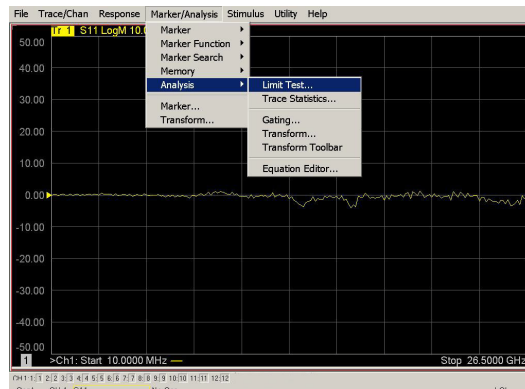
**Figure 51      Reflection Tracking PNA or PNA-X (Port 1-4) & PNA-L (Port 1-12)**
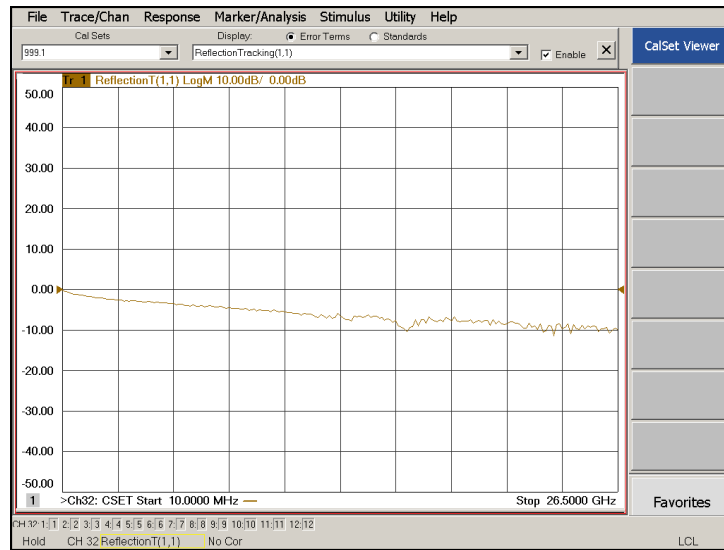


**Figure 52      Reflection Tracking (Port 5-12) with PNA or PNA-X**
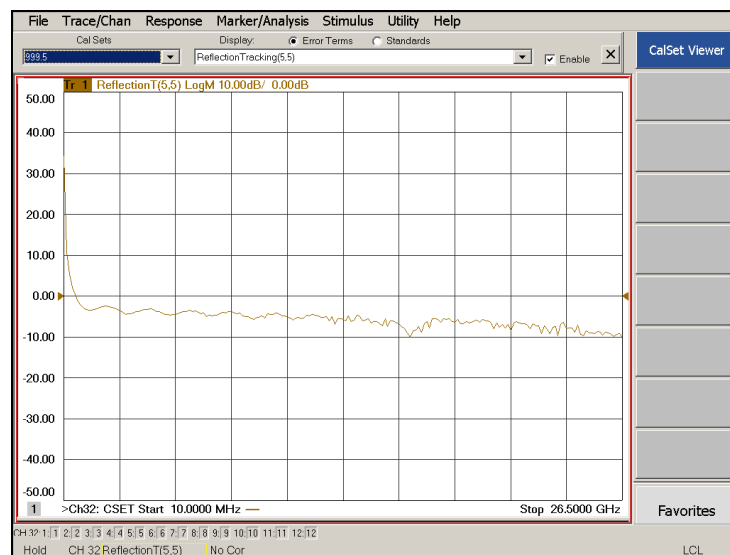


**NOTE**          Response from 10 MHz to 500 MHz is normal due to the PNA or PNA-X Couplers in comparison to the Test Set bridges. The bridges have more gain in the coupled RF path.

## Option 129 Operational Check

This test will verify the RF paths of Option 129 in standard mode. This measures the insertion loss of the Noise Source In to Port 1, 5 or 9 and the Noise Source Out to the CPLR THRU.

### Noise Source In Test

1. Set the PNA to Standalone Mode.

2. Connect the interface cables, as shown in Figure 12 on page 17 or Figure 18 on page 22.

3. Connect two RF test cables to the PNA Ports 3 and 4. Connect the two cables together using an adapter.

4. Perform a response calibration to normalize and remove the loss created the test cables.

5. Move the adapter to Port 1.

6. Connect the cable from Port 3 to Noise Source In.

7. Connect the cable from Port 4 to the adapter on Port 1.

8. Send the Test Set I/O command 0.8. Verify that the Ext Noise Source front panel LED is On.

9. Set trace S34 and verify that the trace is approximately –3 to –7 dB.

10. Repeat for Port 5 (Test Set I/O command 0.25).

11. Repeat for Port 9 (Test Set I/O command 0.42).

**Figure 53    Noise Source In Trace**
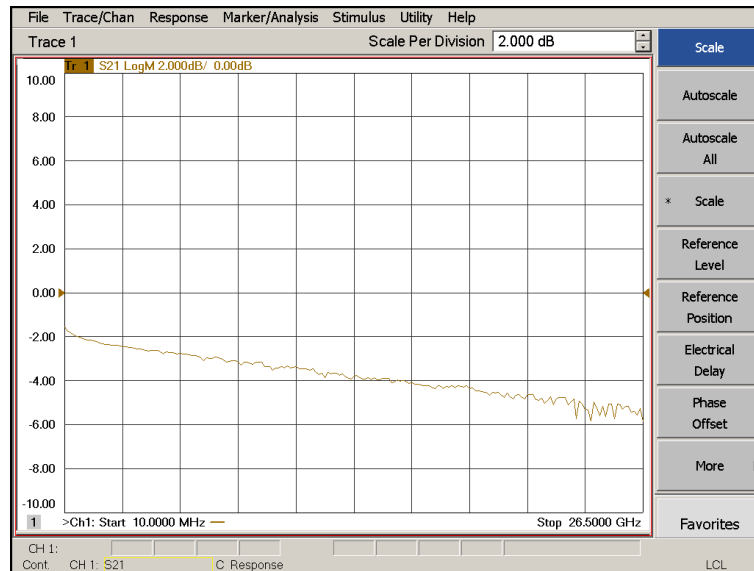
**Noise Source Out Test**

1. Set the PNA to Standalone Mode.

2. Remove the jumper from Port 1 CPLR THRU to Test Set CPLR THRU. Figure 12 on page 17 or Figure 18 on page 22.

3. Connect two RF test cables to the PNA Ports 3 and 4. Connect the two cables together using an adapter.

4. Perform a response calibration to normalize and remove the loss created the test cables.

5. Remove the adapter.

6. Connect the cable from Port 3 to Noise Source Out.

7. Connect the cable from Port 4 to the CPLR THRU on the Test Set.

8. Send the Test Set I/O command 0.8. Verify that the Ext Noise Source front panel LED is On.

9. Set trace S34 and verify that the trace is approximately –0 to –3 dB.

**Figure 54    Noise Source Out Trace**
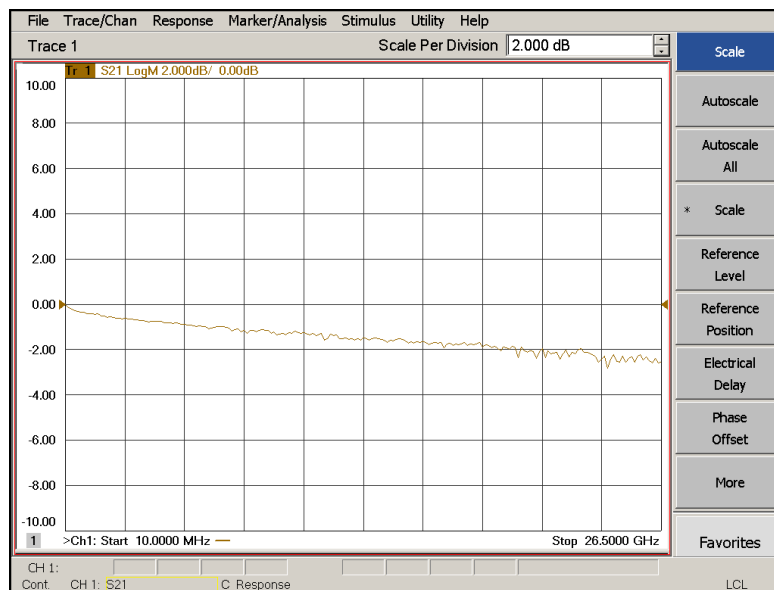
## Verifying Cal Kit Operational Check Failure

If your test results fail the Cal Kit Operational Check limits, see Table 3 and Figure 4 on page 9. Verify the following verify following:

1. Ensure that the Test Set is turned on and connected properly to the analyzer.

2. Check all appropriate analyzer and Test Set connectors for damage, cleanliness, and proper torque.

3. Repeat the relevant 1-Port calibrations using another ECal or mechanical standard.

4. Verify that the analyzer is operating properly and meeting its published specifications. If the analyzer is connected to the Test Set it will fail the Operational Check. Refer to "Network Analyzer Requirements" on page 3.

### ECal Confidence Check

The following ECal Confidence Check is a method to check the accuracy of a 1-Port calibration performed with mechanical standards or an ECal module. In order to perform this check, the test port of the ECal module must connect directly to the test port being verified (without adapters).

1. Perform a 1-Port calibration on the Test Set port being tested.

2. Connect the ECal Module to the port being tested. Terminate any remaining ports on the ECal Module.

3. Select the Cal Set to be tested. Select **[CAL]** > **Cal Set** > **Cal_File** > **Apply Cal** > **Close**. If the Choose Stimulus Settings prompt appears, select **Change the active channel's stimulus..** > **OK** > **Close**.

4. Select **[Response]** > **Cal > More** > **ECal** > **ECal Confidence Check**.

**Figure 55**     **ECal Confidence Check**
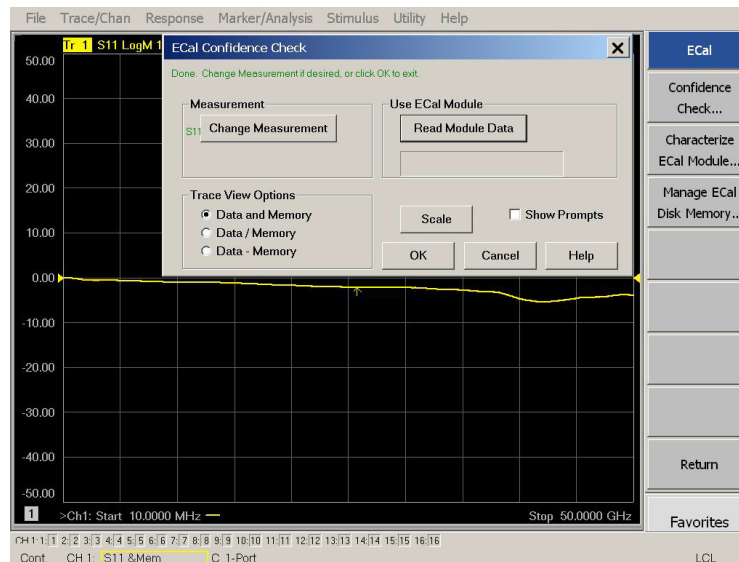
5.  ECal Confidence Check dialog box: Click **Change Measurement** and select the test port S-parameter > **Apply** > **OK**. Click **Read Module Data**.

6.  Select ECal Module dialog box: Select the ECal Module you are using, and select the **ECal Module Memory and Factor ID** > **OK**.

**Figure 56    ECal Confidence Check Trace**
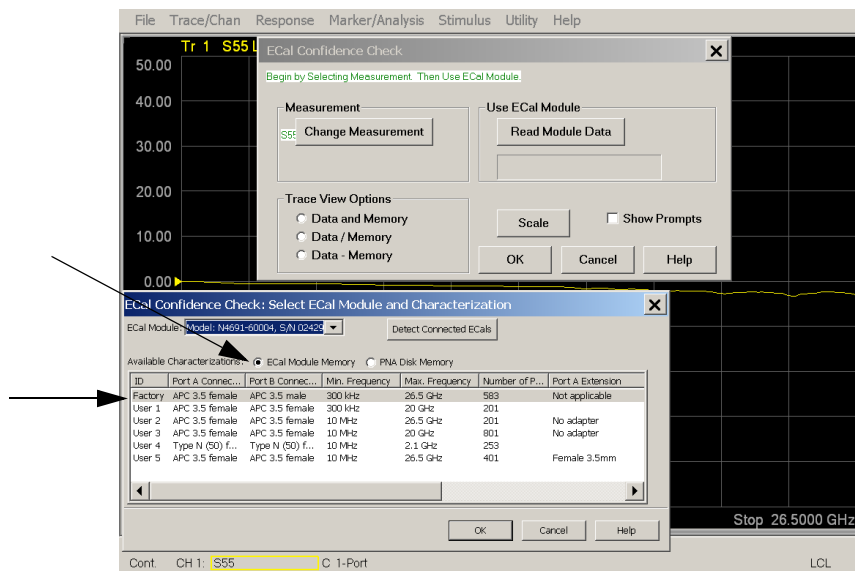


**Interconnect Cable Verification**

1.  Perform the "System Operational Checks" on page 42.

2.  If the problem still exists, perform the "RF Switching Failures" on page 76.

3.  If a power hole or other failure still exists, refer to "Contacting Agilent" on page 90.

# Service Information

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.

| **WARNING** | **No operator serviceable parts inside. Refer servicing to qualified personnel. To prevent electrical shock do not remove covers.** |

| **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.** |

## Replaceable Parts

The following replaceable parts are available from Agilent Technologies "Find-A-Part" system on the web at *www.parts.agilent.com*.

**Table 19      Available Replacement Parts (SPO)**

| Description | Agilent Part Number |
|---|---|
| 4-Port Terminated Latching Coax Switch with Opt 124, 026, 201, 302 and 403 | N1811-60005 |
| Switch, Multiport, SP4T, DC-26.5 GHz | 87104-60001 |
| Fuse (5 A 250 V non-time delay Socket | 2110-0709 |
| Fuse (8 A 250 V non-time delay 0.0146 Ohm | 2110-0342 |
| PWR Supply (AC/DC SWG 650W 9- Output | 0950-4729 |
| Couplers, Bridge | 5087-7716 |
| Analyzer's Locking Feet | 5023-0132 |
| PNA-L Test Set Locking Feet | 5063-9253 |
| Test Set I/O Cable | N4011-21002 *or* 8120-6818 |
| Fan (rear panel) | 87050-60027 |
| DUT Control Board | E5091-66503 |
| RF Cable, Semi-rigid | Z5623-20418 |
| RF Cable, Semi-rigid | Z5623-20419 |

The following replaceable parts may be ordered by sending an e-mail request to ctd-soco_support@agilent.com. Be sure to include Test Set model, options and serial number. Some parts may have long lead times.

**Table 20       Replaceable Parts (M08)**

| Description | Agilent Part Number |
|---|---|
| Port 1 SOURCE OUT | U3042-20031 |
| Port 1 CPLR THRU | U3042-20032 |
| Port 1 CPLR ARM | U3042-20029 |
| Port 1 RCVR A IN | U3042-20030 |
| Port 3 SOURCE OUT | U3042-20035 |
| Port 3 CPLR ARM | U3042-20033 |
| Port 3 RCVR C IN | U3042-20034 |
| Port 3 CPLR THRU | U3042-20036 |
| Port 4 CPLR ARM | U3042-20037 |
| Port 4 RCVR D IN | U3042-20038 |
| Port 4 SOURCE OUT | U3042-20039 |
| Port 4 CPLR THRU | U3042-20040 |
| Port 2 CPLR ARM | U3042-20041 |
| Port 2 SOURCE OUT | U3042-20043 |
| Port 2 RCVR B IN | U3042-20042 |
| Port 2 CPLR THRU | U3042-20044 |
| SW Interface Board, programmed | U3025-60062 |
| User's Guide (Option M08) | U3042-90005 |
| Dress Nut (coupler/bridge) | N5230-20081 |
| PNA-X Test Set Rear Lock Feet (right) | N5242-20138 |
| PNA-X Test Set Rear Lock Feet (left) | N5242-20139 |
| 10 LED Board | N5261-60005 |
| Test Set Control Board (programmed) | N5261-60006 |

# System Block Diagram

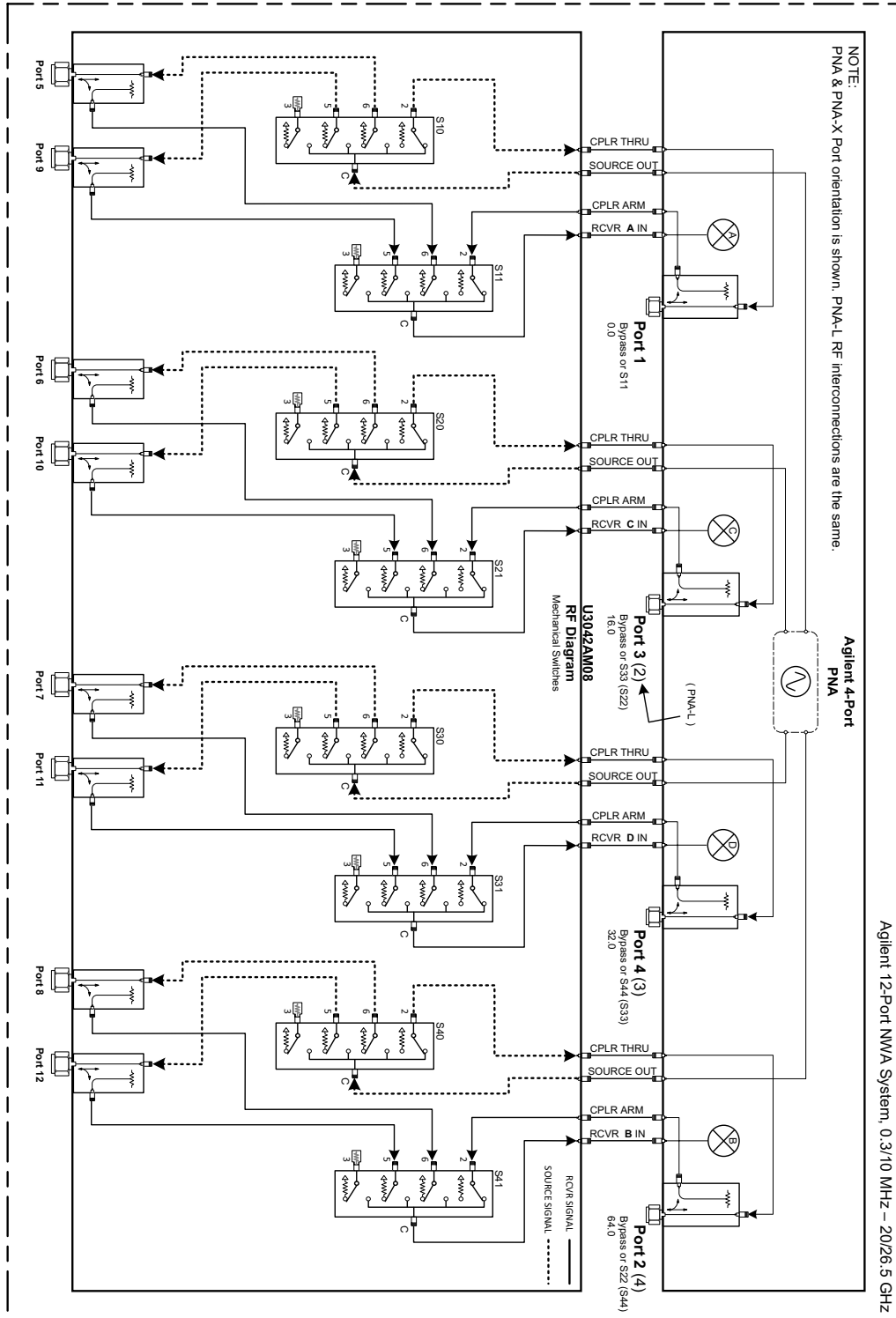**Figure 57    U3042AM08 RF Block Diagram**

**Figure 58    U3042AM08 Option 129 Configuration**
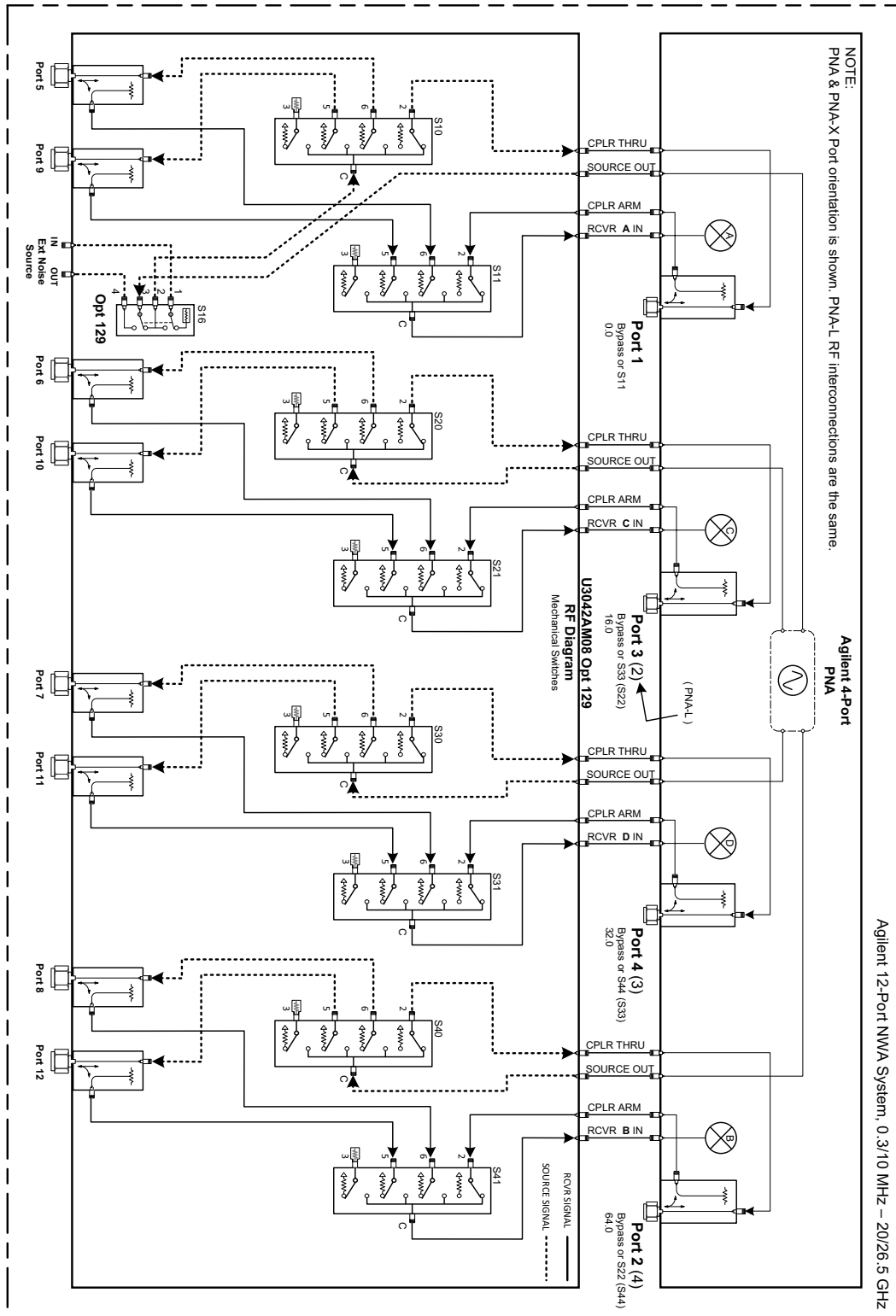
**Figure 59    Electrical Block Diagram**
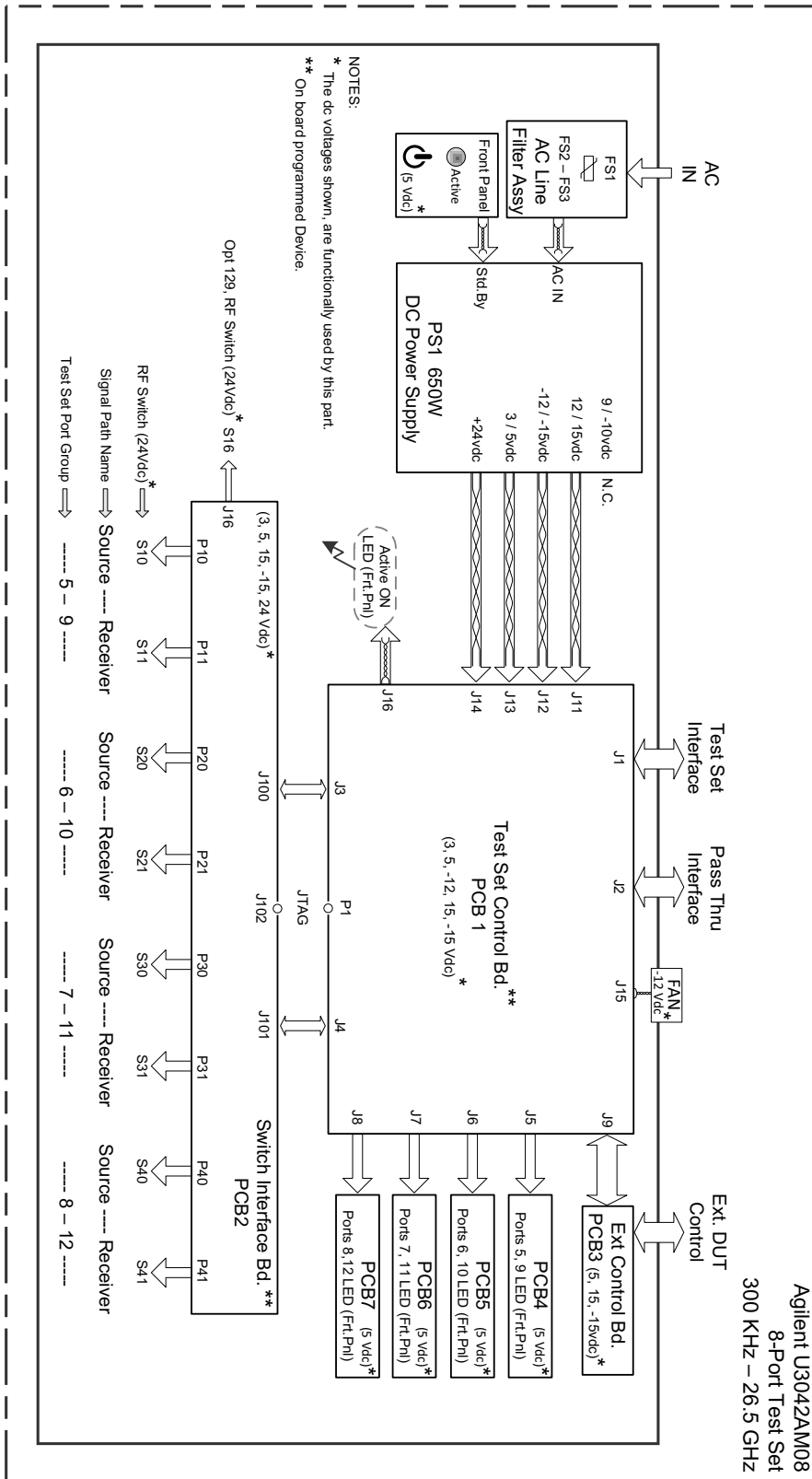
## Theory of Operation

The following is a description of the operation of the Test Set. Reference the Test Set block diagrams shown in Figure 57 on page 67. This section assumes the user has a general understanding of couplers, switches, and network analyzers.

The Test Set adds 12 test ports to a 4-Port network analyzer. The internal RF switches direct the source and receiver signals of the analyzer to the selected measurement test port.

The switches and couplers are arranged in four groups to control the source and receiver paths of the analyzer port to the couplers in the column under the analyzer port.

### Test Set Control Board

The Test Set Control Board (N5261-60006) is a surface mount, printed circuit assembly (PCA). It provides a connection to the power supply, and the analyzer's Test Set I/O for control of the RF switch paths (through the Switch Interface board (U3025-60062). The front panel "Active" and port LEDs are on only when the analyzer has addressed the Test Set. The rear panel fan is on when the controller board supplies are operational.

### Switch Interface Board

The Switch Interface board (U3025-60062) is installed on top of the Test Set Controller Board and provides connections to the RF switches. This board regulates the DC voltage supply (24 volts), and routes logic signals to the switches through harness cables connected to plugs J10-11, J20-21, J30-31 and J40-41. J16 is also connected if your unit has Option 129.

### Front Panel LED Boards

Four LED board assemblies (N5261-60005) are mounted to the front panel. The LED's indicate the Source Path (amber/yellow color), or Receiver Path (green colored) shown as "S" and "R" on the front panel. The LED board assemblies are connected to the Test Set controller board by ribbon cables to J5, J6, J7 and J8.

### DUT Control Board

The DUT Control board (E5091-66503) provides eight control lines for controlling an external device. The DUT Control Board installed on the rear panel and is connected to the Test Set Control board through a ribbon cable to J9.

### Power Supply

The switching power supply (0950-4729) coverts the AC line voltages to DC. This is an automatic line voltage selecting power supply. The DC supplies are connected to the Test Set control board through four wire harness to J11, J12, J13 and J14. The 9/10 Vdc section of the power supply is not used in this instrument. The AC line voltage (100 to 240 V @ 50/60 Hz) is provided from the line module on the rear panel.

**RF Coupler/Bridges**

The Test Set uses 8 couplers (5087-7716) on the front panel for RF Test Ports 5-12. The couplers provide the signal separation of the source and receiver paths. The Test Set ports can receive from or stimulate a signal to the DUT.

The RF Test Port connectors are male 3.5 mm. The coupling factor is approximately –16 dB for the Coupled Arm (–22 dB and Max –12 dB at 26.5 GHz). The insertion loss through the CPLR THRU path is typically < 4 dB at 26.5 GHz.

**RF Switch Components**

The Test Set uses 8 SP4T mechanical, DC to 26.5 GHz, switches (87104-60001). The switches select the RF paths from the analyzer's source and receiver through interconnect cables to the Test Set. Option 129 installed a Transfer Switch (N1811-60005) in the Source Out path for ports 1, 5, and 9.

**Source and Receiver Switch Paths**

**S10 - Source to Ports (1, 5 and 9)**  Switch 10 provides control of the PNA Source path to Port 1, 5 and 9. In the state shown in the block diagram, switch 10 routes the RF Source to Port 1 and the Test Set Source paths to ports 5 and 9 are terminated.

**S20 - Source to Ports (2 or 3, 6 and 10)**  Switch 20 provides control of the PNA Source path to PNA-L Port 2 or PNA-X Port 3 and the Test Set Ports 6 and 10. In the state shown in the block diagram, switch 20 routes the RF Source back to the PNA Port and unused Test Set ports (6 and 10) are terminated.

**S30 - Source to Ports (3 or 4, 7 and 11)**  Switch 30 provides control of the PNA Source path to PNA-L Port 3 or PNA-X Port 4 and Test Set Ports 7 and 11. In the state shown in the block diagram, switch 30 routes the RF Source back to the PNA Port and unused Test Set ports (7 and 11) are terminated.

**S40 - Source to Ports (2 or 4, 8 and 12**  Switch 40 provides control of the PNA Source path to PNA-L Port 4 or PNA-X Port 2 and the Test Set Ports 8 and 12. In the state shown in the block diagram, switch 40 routes the RF Source back to the PNA Port and unused Test Set ports (8 and 12) are terminated.

**S11 - Receiver to Ports (1, 5 and 9)**  Switch 11 provides control of the Receiver path to Port 1, 5 and 9. In the state shown in the block diagram, switch 11 routes the Coupler Arm from the PNA Port 1 to the A Receiver and all unused Test Set Ports (5 and 9) Coupler Arm paths are terminated.

**S21 - Receiver to Ports (2 or 3, 6 and 10)**  Switch 21 provides control of the Receiver path to PNA-L Port 2 or PNA-X Port 3 and Test Set Ports 6 and 10. In the state shown in the block diagram, switch 21 routes the Coupler Arm from the PNA Port 2 to the A Receiver and all unused Test Set ports (2, 6 and 10) Coupler Arm paths are terminated.

**S31 - Receiver to Ports (3 or 4, 7 and 11)**  Switch 31 provides control of the Receiver path to PNA-L Port 3 or PNA-X Port 4 and Test Set Ports 7 and 11. In the state shown in the block diagram, switch 31 routes the Coupler Arm from the PNA Port 3 to the A Receiver and all unused Test Set ports (3, 7 and 11) Coupler Arm paths are terminated.

**S41 - Receiver to Ports (2 or 4, to 8 and 12)** Switch 41 provides control of the Receiver path to PNA-L Port 4 or PNA-X Port 2 and Test Set Ports 8 and 12. In the state shown in the block diagram, switch 41 routes the Coupler Arm from the PNA Port 4 to the B Receiver and all unused Test Set ports (2, 8 and 12) Coupler Arm paths are terminated.

**Test Set Control Board** The Test Set Control Board (N5261-60006) is a surface mount, printed circuit assembly (PCA). It provides a connection to the power supply, and the PNA Test Set I/O for control of the RF switch paths (through the Switch Interface board (U3025-60062). The front panel "Active" and port LEDs are on only when the PNA has addressed the U3042AM08 Test Set. The rear panel fan is on when the controller board supplies are operational.

## Troubleshooting the Test Set

If the Test Set is not operating properly, use the following procedures to isolate and repair the type of failure encountered. It is recommended that a qualified service technician perform the following procedures.

Refer to the Agilent PNA Series: Service & Support Home Page at: *http://na.tm.agilent.com/pna* for further information.

To request service, please contact your local service center. In the US, call 800-829-4444. For a listing of service centers worldwide, please visit us at www.agilent.com/find/service.

| | |
|---|---|
| WARNING | **No operator serviceable parts inside. Refer servicing to qualified personnel. To prevent electrical shock do not remove covers.** |

### Non-RF Failures

Typical malfunctions may be the rear panel fan, DUT control lines or front panel indicator lights.

1. Verify that the front panel Power Switch is operational.

    a. The rear panel fan and front panel Active LED should operate when the Standby Switch is in the On position.

2. AC line voltage checks (remove AC power from the instrument).

    a. Ensure the proper AC line voltage is present at the instrument line cord.

    b. Remove the AC power cord from the instrument. Confirm the instrument AC line module fuse is operational. See Figure 6 on page 12.

    c. Internal AC line fuses - Remove the bottom cover of the instrument. Near the rear panel are two fuse holders, remove the fuses and verify that they are operational. Refer to Figure 66 on page 83.

| | |
|---|---|
| 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 being opened.** |

3. Internal DC Power - During this check you will apply AC power to the instrument with the top cover removed. Connect the AC power cord to the Test Set.

    a. Set the front panel switch to the Standby position. The fans and indicator lights should be Off.

    b. Set the standby switch to the On position. The rear panel and internal power supply fans should be operational. The Active LED will be On when Test Set is connected to an active the analyzer and is addressed by the analyzer.

    c. Verify that the DC LEDs indicators are On.
    Note: The LEDs only indicate the presence of a DC voltage, not the DC voltage level. Use the indicated wire locations for voltage measurements, TP1 is your common. Refer to Figure 60 on page 74.

d. If there is no DC power, suspect the power supply module. The actual power supply terminal connection should also be confirmed with a DVM by removing the bottom cover and using the power supply label to identify the terminal voltage values.

e. If all of the DC Input LEDs are On and the fan is not working, replace fan.

f. Using a DVM confirm that the RF Switch power regulator output (> 21 Vdc) is present on the Switch Driver board, at the side of the SMT Cap (C90) as shown in Figure 60.

**NOTE**        The +9 and −10 Vdc indicators are not used in this instrument (Off is normal).

**Figure 60    DC Power Status LEDs**
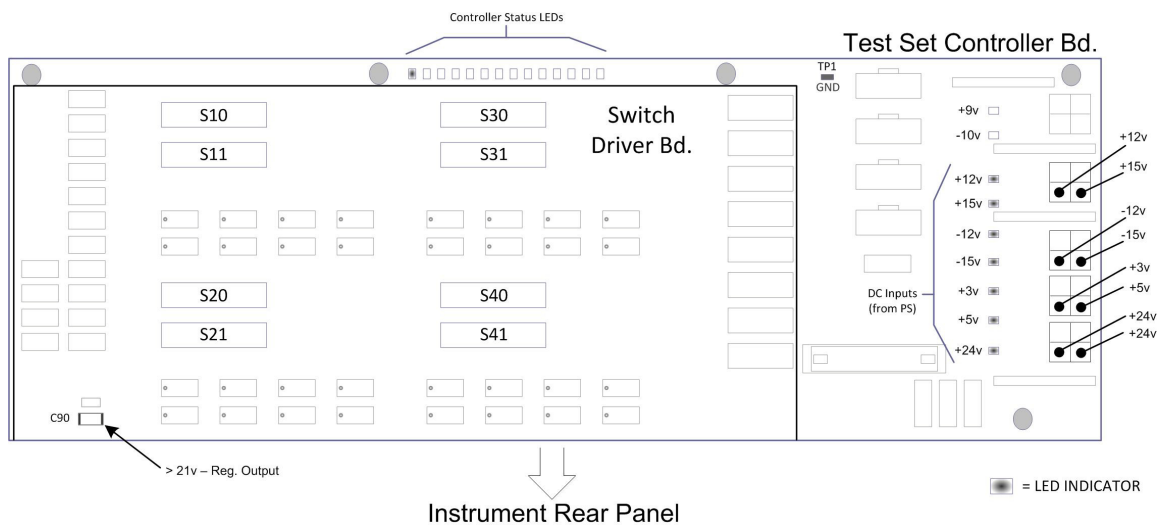


4. Front panel R and S indicator LED check.

a. If the indicators are not operating, continue to "RF Switching Failures" step 1 and step 2.

5. Control Lines are not working.

   a. Verify that the control voltage pin connections to the DUT control lines are connected properly. Refer to "Control Lines" on page 48.

   b. Verify that the rear panel DC voltage control adjustment can be set to 5 Vdc. Refer to Figure 5 on page 11.

   c. Remove the instrument top cover. Using a DVM, verify that the three DC voltage inputs are present on the DUT control board (E5091-66503). Refer to Figure 61.

   d. If the DC voltages are normal, then replace the DUT control board. If the voltages are not present, check the ribbon cable and its connections at both ends. Suspect the Test Set Control board as the possible problem.

**Figure 61    DUT Control Board DC Voltage Locations**



E5091-66503
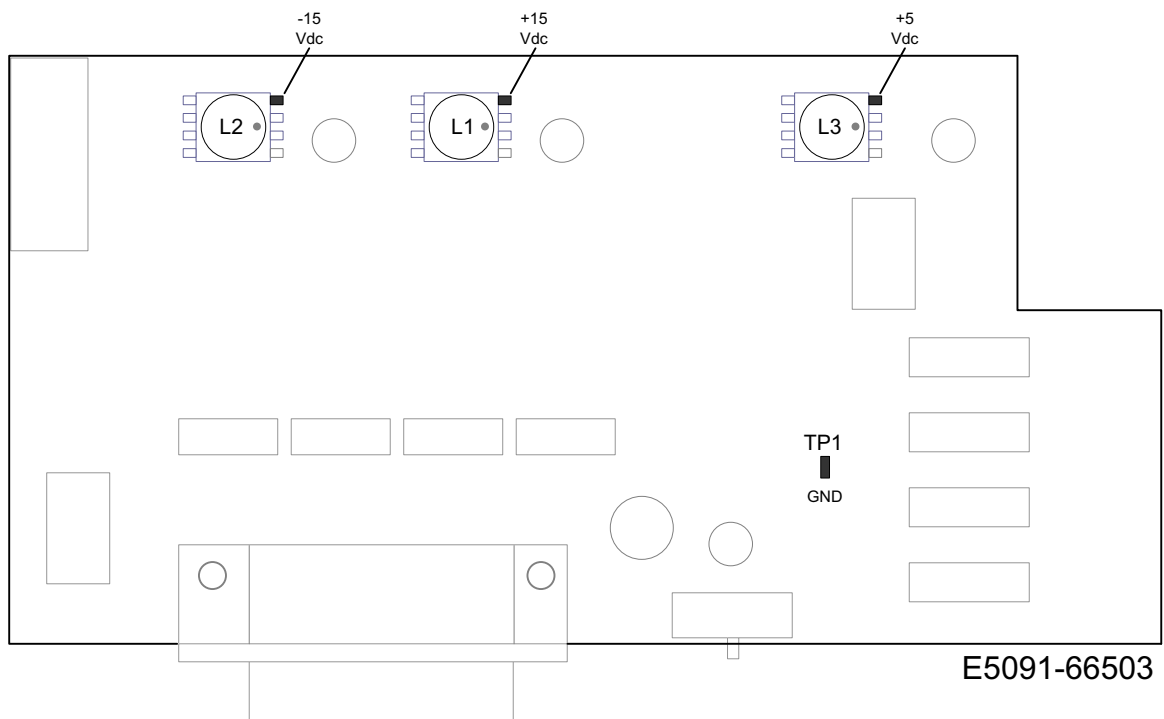
**RF Switching Failures**

Typical failures may be the loss of RF switch control or a non RF failure as outlined in the prior section. The internal RF switches used in this instrument are controlled by the +21 Vdc from the Switch Driver board.

1. Confirm that the analyzer and Test Set are properly connected using the Test Set I/O cable (N4011-21002). See Figure 19 on page 22.

2. Using Multiport Mode (Option 551), verify that the analyzer's firmware is correct, and that the Test Set file is loaded into the analyzer. Refer to "Network Analyzer Requirements" on page 3.

3. Using the I/O command values, confirm that the correct address and data values are used. Refer to "Address and Data Values" on page 46.

4. Follow the "Non-RF Failures" on page 73 procedure (if not already done so).

5. Front Panel R and S indicator LED Check.

   a. Confirm that the Test Set Controller Board Status LED's are On. Refer to Figure 60 on page 74. If the LED's are Off remove the Switch Driver board, if the LED's are remain Off replace the Controller board.

   b. If the Status LED's are On and the front panel Active LED is On, suspect the front panel LED board or the ribbon cable (replace as needed).

**Test Set and RF Switching Path**

If you suspect an RF signal path problem with the Test Set and have verified that the problem in not the front panel RF interface cables, the following procedure will check all of the RF signal paths through the Test Set. Path checks 1 thru 4 are from the front panel Test Port to the analyzer source and receiver interconnect ports. Path checks 5 and 6 are Test Set bypass signal paths for of analyzer Ports 1 to 4.

- Install the Test Set interface cable from the analyzer to the Test Set's rear panel.

- Remove the front panel RF interface cables and reinstall the analyzer's front panel jumper cables.

**Equipment Required**

- N52xxA Network Analyzer for 10 MHz to 26.5 GHz

- Two 26.5 GHz, 3.5 mm RF Flex Cables

- Three 3.5 mm Adapters (female to female)

- Test Set Interface Cable

**Equipment Setup**

1. Turn *on* the Test Set and the analyzer.

2. **Preset** the analyzer and set it to **Standalone Mode**. Select **Utility** > **System** > **Configure** > **Multiport Capability**. In the dialog box select **Restart as a standalone PNA** > **OK**.

3. Confirm the frequency range is set to 10 MHz to 26.5 GHz.

4. Connect the RF flexible cables to Ports 1 and 2 on the analyzer. Connect the cables together using a 3.5 mm adapter.

5. Configure the analyzer to measure S21 and normalize the response trace.

6. Set the analyzer to **Interface Control Mode**: Select **Channel > Hardware Setup > More > Interface Control…** and click **Enable Interface Control box**.

---

**NOTE**         The <addrs>.<data> entries noted in the following Test Instructions table will be used to configure the RF switches for this testing. After making your entry select <OK> to execute the command, to return back for further entries, select Interface Control on the display.

---

**Cable Connections**

The RF flex cables will be connect to the designated Test Set front panel ports and an uncorrected response trace should resemble the figures indicated in Table 21.

**Table 21      RF Signal Path Insertion Loss (S21)**

| RF Path Description | Signal | Insertion Loss (typical) |
|---|---|---|
| Source IN to Ports 5-12 | Source | Figure 62 on page 79 |
| RCVR OUT to Ports 5-12 | Receiver | Figure 63 on page 79 |
| Source IN to CPLR THRU | Source | Figure 64 on page 79 |
| RCVR OUT to CPLR ARM | Receiver | Figure 64 on page 79 |

**Source Signal Path Insertion Loss Test**

Connect the RF Flex cables to the Test Port and Source IN port indicated in Table 22, the expected results should be similar to Figure 62 on page 79.

**Table 22      Source Signal Path Test Instructions**

| Path # | RF Path Description | Control Mode <Address>.<Data> | Path Components |
|---|---|---|---|
| 1 | Source IN to Port 5[1] | 0.1 | P5 CPLR, S10 |
| 2 | Source IN to Ports9 | 0.2 | P9 CPLR, S10 |
| 3 | Source IN to Port 6 | 16.1 | P6 CPLR, S20 |
| 4 | Source IN to Port10 | 16.2 | P10 CPLR, S20 |
| 5 | Source IN to Port 7 | 32.1 | P7 CPLR, S301 |
| 6 | Source IN to Port 11 | 32.2 | P11 CPLR, S30 |
| 7 | Source IN to Port 8 | 64.1 | P8 CPLR, S40 |
| 8 | Source IN to Port 12 | 64.2 | P12 CPLR, S40 |

1. Use the Source IN port associated with this group of test ports.

**Figure 62    Source IN to Ports 5-12 Path Response**
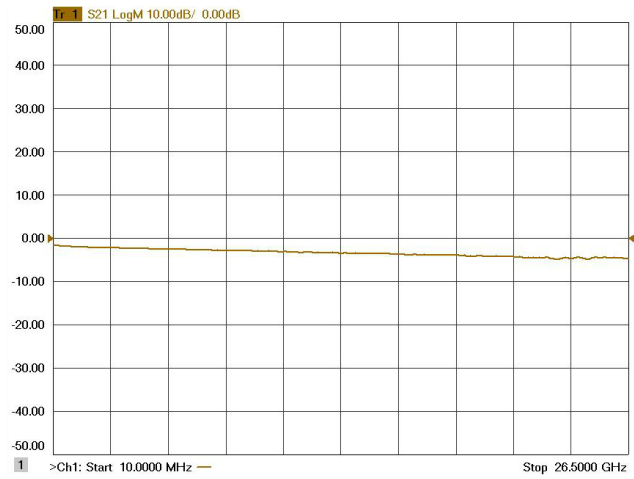


**Figure 63    RCVR OUT to Ports 5-12 Path Response**
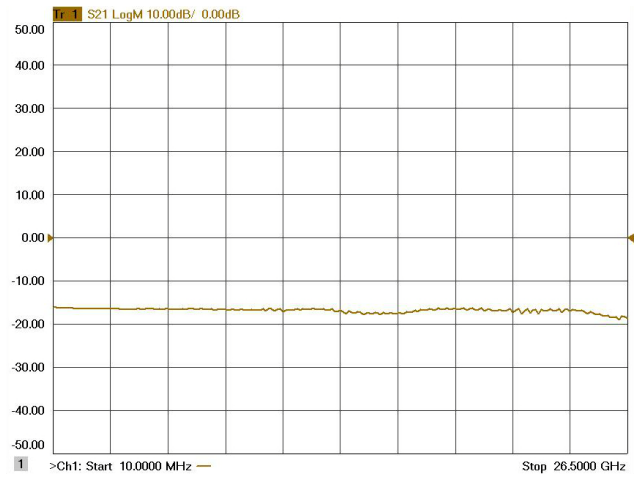


**Figure 64    Source & Receiver Bypass Signal Path Response**
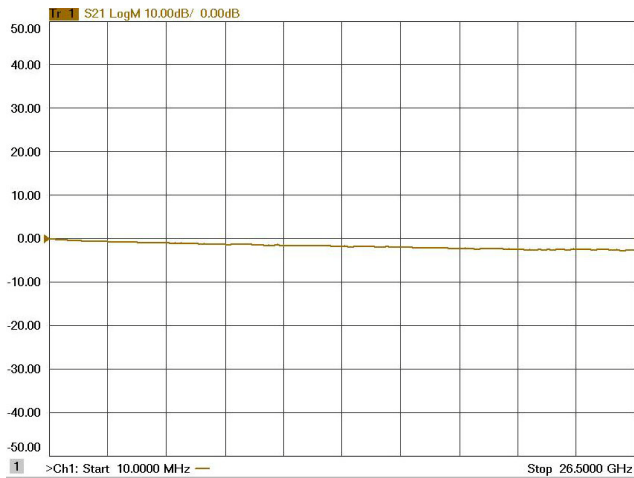
Connect the RF Flex cables to the Test Port and RCVR OUT port indicated in Table 23. The expected results should be similar to Figure 63 on page 79.

**Table 23      Receiver Signal Path Test Instructions**

| Path # | RF Path Description | Control Mode <Address>.<Data> | Path Components |
|--------|---------------------|-------------------------------|-----------------|
| 1 | RCVR OUT to Ports 5[1] | 0.16 | P5 CPLR, S11 |
| 2 | RCVR OUT to Ports 9 | 0.32 | P9 CPLR, S11 |
| 3 | RCVR OUT to Ports 6 | 16.16 | P6 CPLR, S21 |
| 4 | RCVR OUT to Ports 10 | 16.32 | P10 CPLR, S21 |
| 5 | RCVR OUT to Ports 7 | 32.16 | P7 CPLR, S31 |
| 6 | RCVR OUT to Ports 11 | 32.32 | P11 CPLR, S41 |
| 7 | RCVR OUT to Ports 8 | 64.16 | P8 CPLR, S41 |
| 8 | RCVR OUT to Ports 12 | 64.32 | P12 CPLR, S41 |

1. Use the RCVR OUT port associated with this group of test ports.

Connect the RF Flex cables to the Source IN and CPLR THRU port indicated in Table 24, the expected results should be similar to Figure 64 on page 79.

**Table 24    Source Bypass Signal Path Test Instructions**

| Path # | Test Port Group | RF Path Description | Control Mode <Address>.<Data> | Path Components |
|--------|-----------------|--------------------|-------------------------------|-----------------|
| 1 | Port 5 and 9 | Source IN to CPLR THRU | 0.0 | S10 |
| 2 | Port 6 and 10 | Source IN to CPLR THRU | 16.0 | S20 |
| 3 | Port 7 and 11 | Source IN to CPLR THRU | 32.0 | S30 |
| 4 | Port 8 and 12 | Source IN to CPLR THRU | 64.0 | S40 |

Connect the RF Flex cables to the Source IN and CPLR ARM port indicated in Table 25, the expected results should be similar to Figure 64 on page 79.

**Table 25    Receiver Bypass Signal Path Test Instructions**

| Path # | Test Port Group | RF Path Description | Control Mode <Address>.<Data> | Path Components |
|--------|-----------------|--------------------|-------------------------------|-----------------|
| 1 | Port 5 and 9 | RCVR OUT to CPLR ARM | 0.0 | S11 |
| 2 | Port 6 and 10 | RCVR OUT to CPLR ARM | 16.0 | S21 |
| 3 | Port 7 and 11 | RCVR OUT to CPLR ARM | 32.0 | S31 |
| 4 | Port 8 and 12 | RCVR OUT to CPLR ARM | 64.0 | S41 |

### RF Performance Fails

If the U3042AM08 operates correctly, but RF performance fails the Signal Path test. Refer to the "U3042AM08 RF Block Diagram" on page 67 to determine the components that will need to be inspected further. The following procedures can be used to isolate the failed component. Suspect the internal coax switches, RF cables, or coupler.

---

**NOTE**          The RF performance of the U3042AM08 depends on the performance of the analyzer. Ensure the analyzer is meeting specification before continuing.

---

1. Verify that the Test Set and analyzer SOURCE, RCVR, CPLR THRU, and CPLR ARM connectors are clean and that the center pins are not damaged.

2. Verify the interface and internal RF cables are cleaned and not damaged. "Verifying Cal Kit Operational Check Failure" on page 63.

# Troubleshooting Diagrams and Tables

**Table 26      Controller Board Connections**

| Controller Board Connection | Connection |
|---|---|
| **LED Ribbon Cables From the LED Board** | |
| J5 | Ports 5 and 9 |
| J6 | Ports 6 and 10 |
| J7 | Ports 7 and 11 |
| J8 | Ports 8 and 12 |
| **Wire harness Active LED** | |
| P1 | Active LED |
| **DUT Control Ribbon Cable** | |
| J9 | DUT Controller Board |
| **Power Supply Wire Harness** | |
| J11- 14 | Power Supply |

**Table 27      Switch Interface Board**

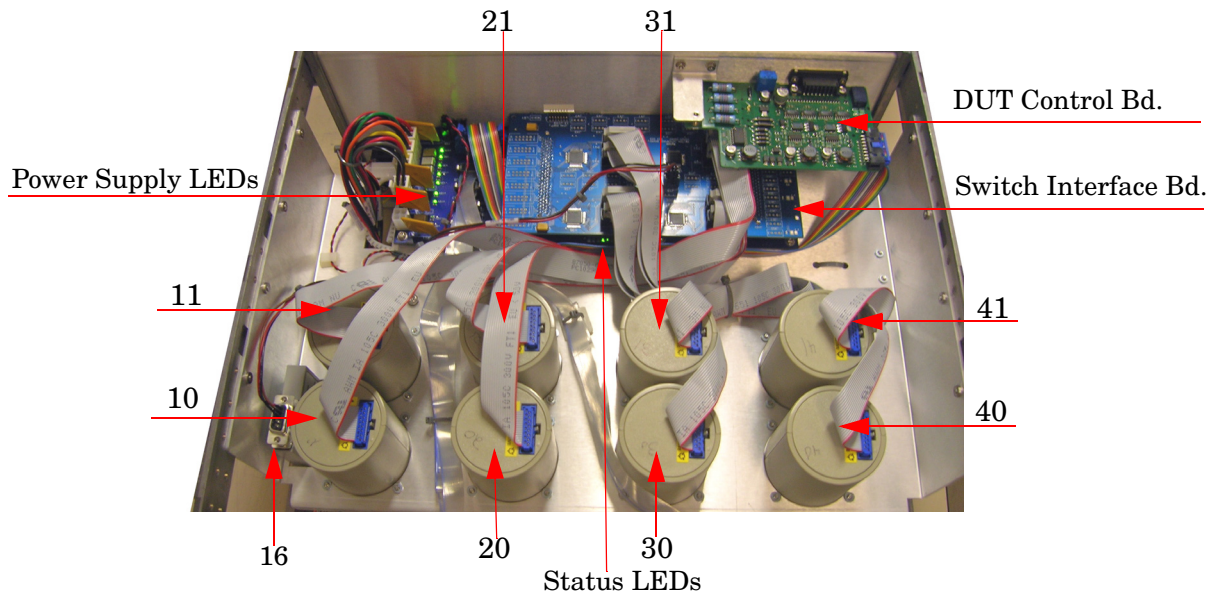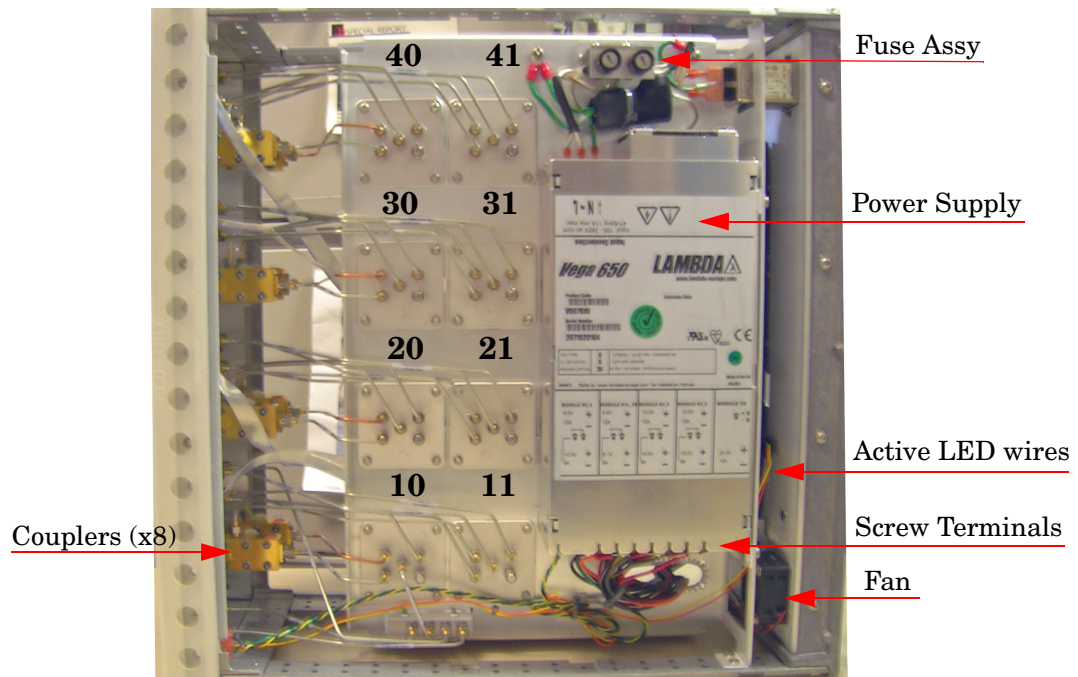| Switch Interface Board | Connection |
|---|---|
| **Switch Interface Board Connection** | |
| P10 | Ports 5 and 9 (Source) |
| P11 | Ports 5 and 9 (Receiver) |
| P20 | Ports 6 and 10 (Source) |
| P21 | Ports 6 and 10 (Receiver) |
| P30 | Ports 7 and 11 (Source) |
| P31 | Ports 7 and 11 (Receiver) |
| P40 | Ports 8 and 12 (Source) |
| P41 | Ports 8 and 12 (Receiver) |

**Figure 65    Top View**



**Figure 66    Bottom View**

# 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.

## Before Applying Power

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

---

**WARNING**      **To prevent electrical shock, disconnect the Agilent Technologies U3042AM08 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.**

---

## Connector Care and Cleaning

If alcohol is used to clean the connectors, the power cord to the instrument must be removed. All cleaning should take place in a well ventilated area. Allow adequate time for the fumes to disperse and moist alcohol to evaporate prior to energizing the instrument.

---

**WARNING**      **Keep isopropyl alcohol away from heat, sparks, and flame. Store in a tightly closed container. It is extremely flammable. In case of fire, use alcohol foam, dry chemical, or carbon dioxide; water may be ineffective.**

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## 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 No. 61010-1 (Second Edition), and IEC 61010-1 (Second Edition).

## General Safety Considerations

### Cautions

Cautions applicable to this instrument.

| | |
|---|---|
| **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** | 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. |

| | |
|---|---|
| **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**

Warnings applicable to this instrument.

| | |
|---|---|
| **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** | **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.** |

| | |
|---|---|
| **WARNING** | **For continued protection against fire hazard replace line fuse only with same type and rating. The use of other fuses or material is prohibited.** |

| | |
|---|---|
| **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 being opened.** |

| | |
|---|---|
| **WARNING** | **This product is designed for use in Installation Category II and Pollution Degree 2.** |

| | |
|---|---|
| **WARNING** | **No operator serviceable parts inside. Refer servicing to qualified personnel.** |

| | |
|---|---|
| **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.** |

## 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 that the instrument requires alternating current (ac) input.

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 ON.

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

This symbol indicates that the power line switch is in the OFF 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.

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

Direct Current.

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

N10149        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 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 Maschinenlaermrerordnung-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**

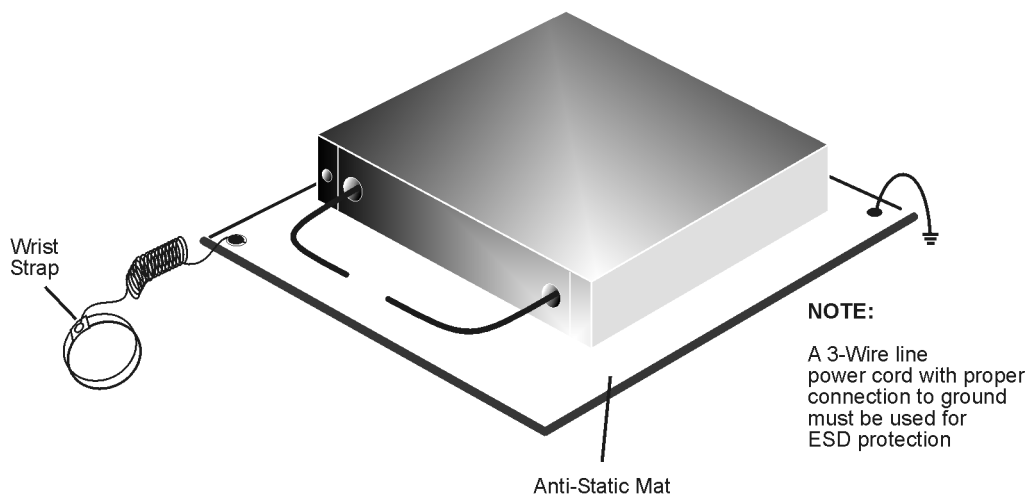Complies with European EMC Directive 2004/108/EC

- 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.

# Electrostatic Discharge Protection

Protection against electrostatic discharge (ESD) is essential while removing assemblies from or connecting cables to the analyzer. 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 (9300-0797) in front of your test equipment.

• *always* wear a grounded wrist strap (9300-1367) with grounding cord (9300-0980), connected to a grounded conductive table mat, having a 1 MΩ 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 (from your calibration kit) 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 67      ESD Protection Setup**



Wrist
Strap

NOTE:

A 3-Wire line
power cord with proper
connection to ground
must be used for
ESD protection

Anti-Static Mat

ku310b

# Agilent Support, Services, and Assistance

## Service and Support Options

The Test Set's standard 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*

You can also purchase accessories or documentation items on the Internet at:
*http://www.agilent.com/find*

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

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 Analyzer to Agilent for Service or Repair

You must always call the Agilent Technologies Instrument Support Center to initiate service before retuning your instrument to a service office.

**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 network analyzer to Agilent Technologies for service or repair:

• When sending the Test Set in for repair, please send your analyzer and cables. This will speed your repair turn around time, and verify proper operation of the complete system.

• Include a complete description of the service requested or of the failure symptoms, failed test and any error message.

• Always transport or ship the instrument using the original packaging if possible. If not, comparable antistatic packaging must be used.

• Contact Agilent for instructions on where to ship your analyzer.