Agilent U3042AE08 Test Set User Guide

http://www.manuallib.com/agilent/u3042ae08-test-set-user-guide.html

This document describes how to use the U3042AE08 Multiport Test Set with the Agilent N5230C 4-Port PNA-L Network Analyzer and the N5242A PNA-X for a 12-Port Network Analyzer solution.

Agilent Technologies
U3042AE08

User's Guide

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

Agilent Technologies

Manufacturing Part Number: U3042-90002

Printed Date: August 2012
Supersede: February 2011

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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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Introduction

This document describes how to use the U3042AE08 Multiport Test Set with the Agilent N5230C 4-Port PNA-L Network Analyzer and the N5242A PNA-X for a 12-Port Network Analyzer solution.

Figure 1 N5230C 4-Port PNA-L with U3042AE08

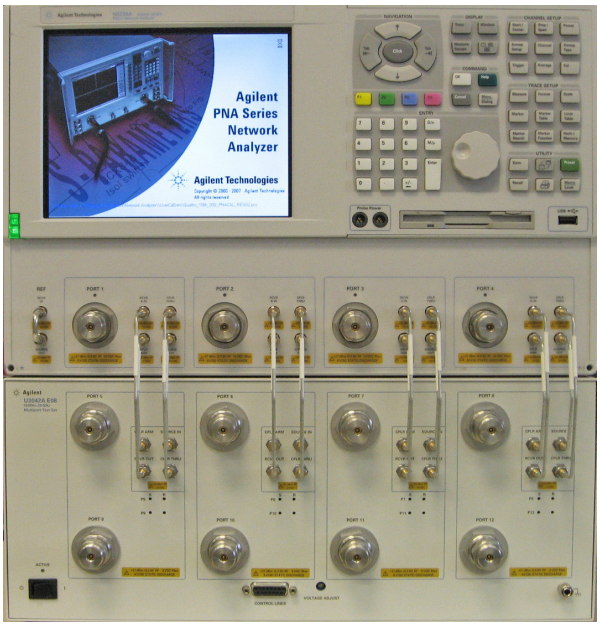


Figure 2 N5242A 4-Port PNA-X with U3042AE08

Description

The Agilent U3042AE08 Multiport Test Set is a 8-Port solid-state extension test set. When combined with a 4-Port N5230C PNA-L or N5242A PNA-X Network Analyzer, the U3042AE08 Test Set provides a complete solution for 12-Port full crossbar measurements.

The U3042AE08 Test Set is directly controlled by the network analyzer, no external personal computer or software is required.

The N5230C PNA-L and N5242A PNA-X Network Analyzer's will be referred to through out this document as the PNA-L and the PNA-X. If the information pertains to both products they will be referred to as analyzer. The U3042AE08 will be referred to as the test set.

Network Analyzer Requirement

- The Network Analyzer requires Option 551 (N-Port error correction and measurement capability) is required for Multiport mode.
- The N5230C PNA-L requires Option 245, 145, 246 or 146 to provide the test set interface connections and requires test set file u3042ae08_p4.tsx.
- The N5242A PNA-X requires Option 400 to provide the test set interface connections and requires test set file u3042ae08_pnax_p4.tsx.

More network analyzer 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*
- U3042AE08 test set files - *http://na.tm.agilent.com/multiport* (see test set files link)

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

Available Options

Test Set Options

The test set has three available options:
Refer to "System Block Diagram" beginning on page 59.

- Standard - solid state switches for fast switch speed and improved switch life. (No Option 001 or 002 on the serial tag).
- Option 001 solid state switches with amplifiers to improve dynamic range.
- Option 002 solid state switches with amplifiers and bias-tees for each port.

NOTE The Options 700, 001, and 002 limit the frequency range due to blocking capacitors in the switches and amplifier performance. Solid state switches degrade frequencies below 2 MHz, and 001 or 002 amplifiers degrade performance above 18 GHz.

Accessory Options

Installation instructions are included in the option package.

- Option 1CM - Rackmount Kit (5063-9215).
- Option 1CN - Front Handle Kit (5063-9228).
- Option 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.
- U3021PL3 Option 442 provides the interface cable set and hardware to connect the test set to the PNA-X.

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 and options that are used with the test set. A functional certificate is only offered for the U3042AE08.

NOTE When connected to a network analyzer, this test set will degrade the performance at the test ports. The internal switch paths reduce test port power and 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 "Operational Check" on page 45 can be subtracted from the analyzers dynamic range to determine the approximate performance of the system.

Power Requirements

Verify that the required ac power is available before installing the test set to the analyzer.

- 100/120/220/240 VAC (50/60Hz)
- 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.
- Table 1 contains the maximum wattage for all instruments. This table can be use to determine the electrical and cooling requirements.

Table 1 Power Requirements

Standard Equipment	
Instrument	**Maximum Wattage**
N5242A	450
N5230C	350
U3042AE04	350

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 your analyzer's standard documentation for environmental requirements. The PNA-L provides front panel access to the source outputs, receiver inputs and couplers for use with multiport test sets.

Environmental Tests

The test set 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. Air conditioning capacity must be consistent with the BTU ratings given in Table 1.

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.

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 includes configuration and installation 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.

Table 2 Instrument Dimensions

Model	Weight	Height	Width	Depth
U3042AE08	11.4 kg (25 lb)	19.1 cm (7.5 in)	42.5 cm (16.7 in)	43.2 cm (17 in)

Frequency Range and Maximum Power Levels

Table 3 Usable Frequency Range

Model	Standard	001 or 002
N5230C(PNA-L)	10 MHz to 20 GHz	10 MHz to 20 GHz
N5242A(PNA-X)	10 MHz to 26.5 GHz	10 MHz to 26.5 GHz (significantly degraded performance above 20 GHz)

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.

Table 4 Power Levels

Maximum U3042AE08 Test Port RF Power Levels:	
PORT 5-12	+27 dBm 0 Vdc
Maximum U3042AE08 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

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.

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

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.

NOTE Typical specifications are based on 1 to 2 units performance. Refer to Table 5, Table 14 and Table 15 on page 46.

Table 5 Typical Reflection Tracking N5230C

Frequency	Standard 700	Option 001	Option 002
300 kHz to 10 MHz[1]	–80	–100	–100
10 MHz to 4 GHz	–2	+2	+1
4 GHz to 6 GHz	–7	+1	+0
6 GHz to 10.5 GHz	–8	–2	–3
10.5 GHz to 13.5 GHz	–13	–3	–4
13.5 GHz to 15 GHz	–15	–3	–4
15 GHz to 20 GHz	–20	–13	–15

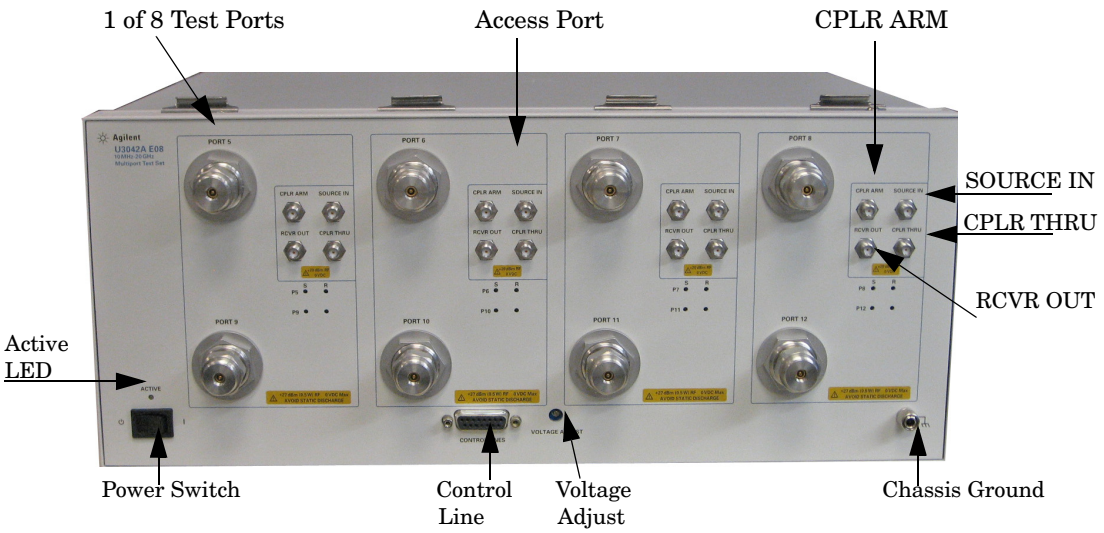
1. Generally improves at 3 MHz to –6 dBm.

Table 6 Typical Reflection Tracking N5242A

Frequency	Standard 700	Option 001	Option 002
10 MHz to 50 MHz	–2	+5	+4
50 MHz to 500 MHz	–3	+5	+4
500 MHz to 3.2 GHz	–8	+2	+1
3.2 GHz to 10 GHz	–12	–2	–3
10 GHz to 16 GHz	–15	–4	–5
16 GHz to 20 GHz	–20	–13	–15
20 GHz to 24 GHz	–24	–21	–23
24 GHz to 26.5 GHz	–25	–35	–37

Front and Rear Panel Features

Figure 3 Front Panel (Multiport Test Set)



Test Ports – 3.5 mm Bulkhead (male)

- Port 5–12

Access Ports – 3.5 mm (female)

- SOURCE OUT
- CPLR THRU
- CPLR ARM
- RCVR (A-D) OUT

Chassis Ground

Chassis ground that is provided for ESD and safety connection.

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.

Control Lines and Voltage Adjust

For further information pertaining to control lines and voltage adjustments see “DUT Control Lines” on page 38.

Power Switch

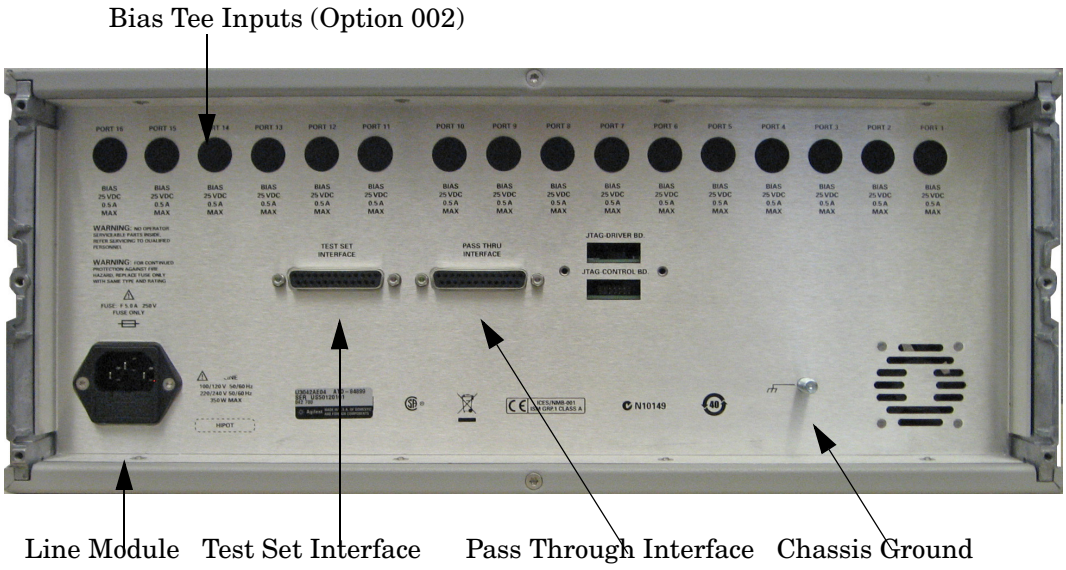
⏻ – Standby

| – ON (Active LED On)

Active LED

- When the test set's power switch is On and addressed by a analyzer, the LED is On.
- The LED is Off when the test set power switch is in Standby, or not addressed by a analyzer.

Figure 4 Rear Panel (Multiport Test Set)



Bias Tee Input (Option 002)

BNC Input connectors for Option 002.

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

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 5 illustrates where the fuses are located and how to access them.

Available Fuses

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

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.**

Figure 5 Line Fuse

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

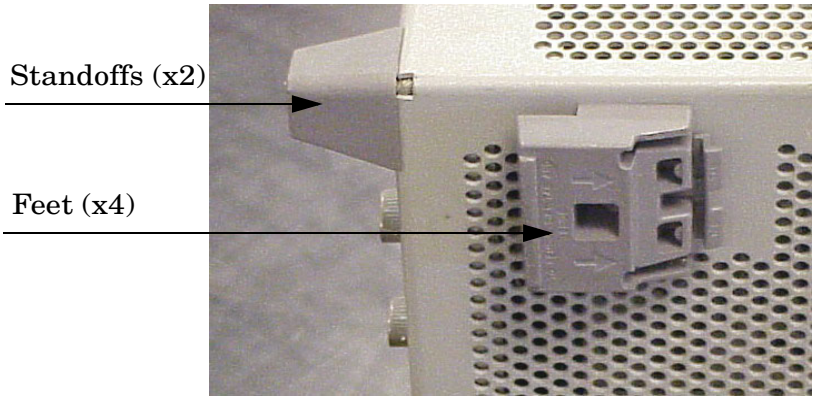
System Setup with N5230C

WARNING **The opening of covers or removal of parts is likely to expose dangerous voltages. Disconnect the instrument from all voltage sources while it is being opened.**

Preparing the N5230C Network Analyzer

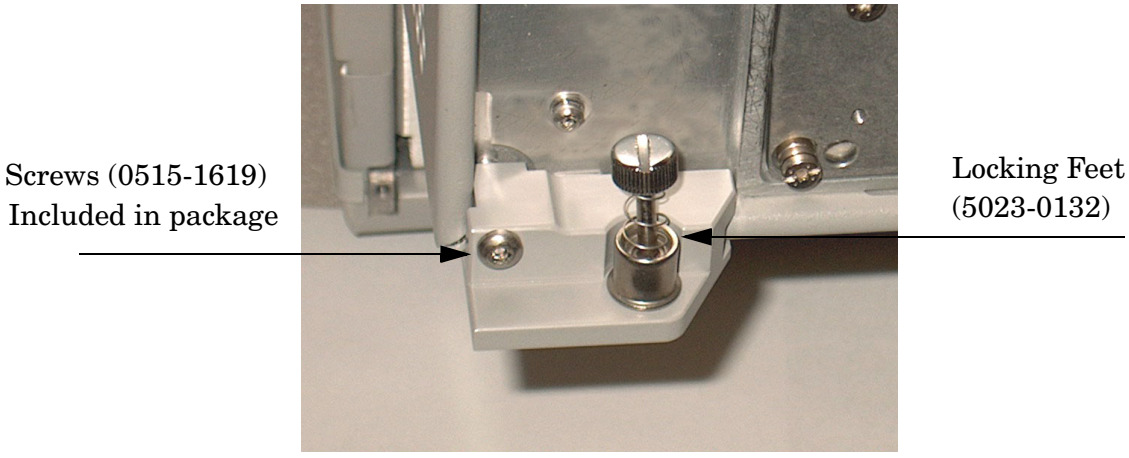
1. Remove the feet from the bottom of the network analyzer. Refer to Figure 6.
2. Remove the 2 lower standoffs and screws (0515-1619) from the rear panel on the network analyzer.

Figure 6 Rear Bottom Feet



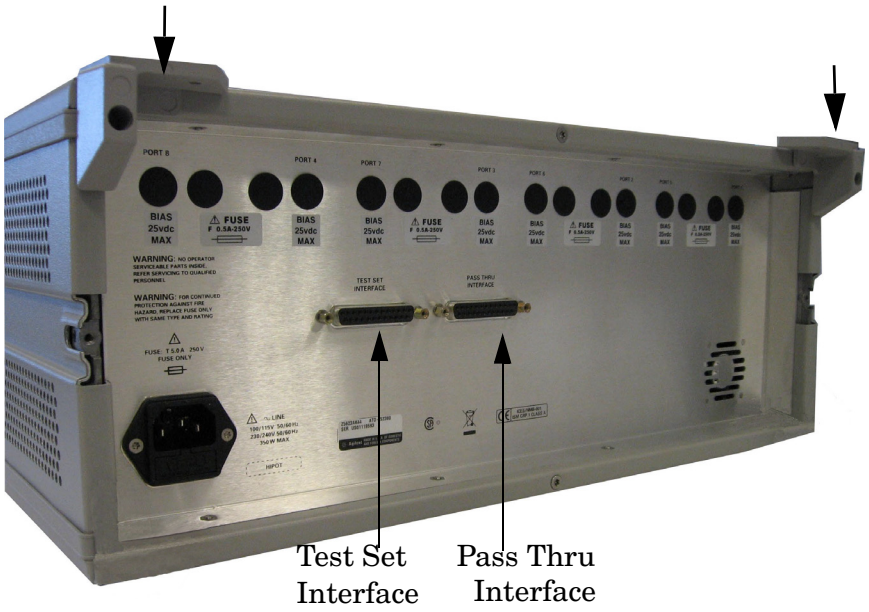
3. Install the two rear locking feet (5023-0132) onto the PNA-L, using the included screws (0515-1619), where the standoffs were removed. Refer to Figure 7.

Figure 7 Install Locking Feet



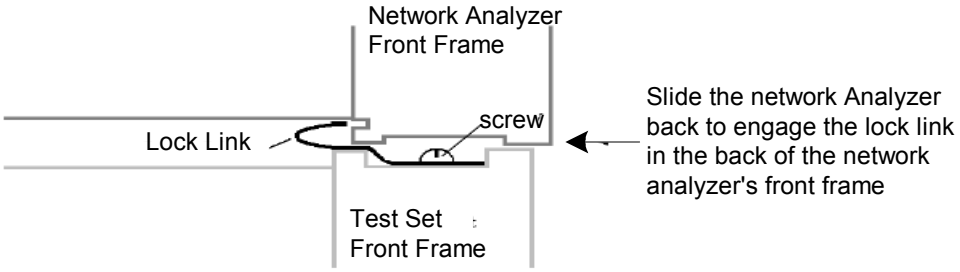
4. Remove the two standoffs and screws (0515-1619) from the rear panel on the test set.
5. Install the top left and right rear locking feet from the kit (5063-9253) using screws (0515-1244).

Figure 8 Rear Locking Feet



6. Place the network analyzer on top of the test set and ensure that the front frame of the network analyzer is positioned slightly forward of the locks that are attached to the test set. Slide the network analyzer back so the locks engage the front frame of the analyzer.

Figure 9 Locking the Analyzer's



7. Secure the network analyzer's lower locking feet to the test set upper locking feet, using the spring–loaded screws on the locking feet. Refer to Figure 10. If the network 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.

Figure 10 Locking Feet Screws

NOTE There are two Lock-Feet kits available. Refer to "Contacting Agilent" on page 68 for ordering information.

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

N5230C RF Interface Cable Connections

Figure 11 on page 15 illustrates the setup configuration of the test set and how it should be configured to the PNA-L.

1. Connect the RF interconnect cables, supplied with this option, from the PNA-L to the test set. Torque each cable to 8 in-lb. Refer to Table 7 and Figure 11 on page 15. The Z5623-20418 are the short cables and the Z5623-20419 are the long cables.

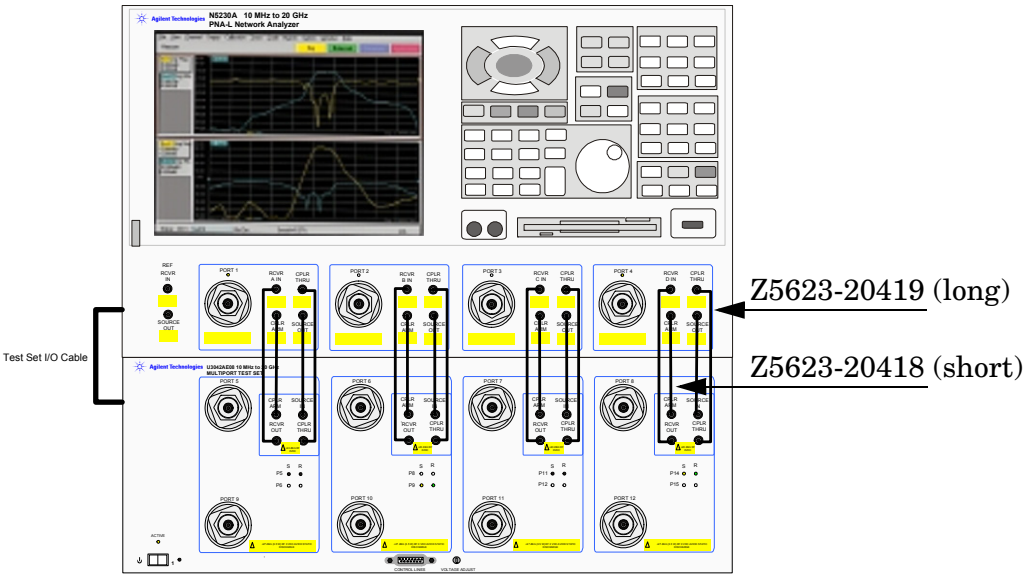
CAUTION Each end of the interconnect RF cables have a different length from the bend. When connecting the RF Interconnect cables be sure that the longer end from the bend is connected to the analyzer.

CAUTION Over torque will cause damage to the test set and may cause connectors to spin or become loose.

Table 7 N5230C Interface Cable Connection

RF Cables	From: PNA-L	To: Test Set
Z5623-20418	SOURCE OUT	SOURCE OUT
Z5623-20418	CPLR ARM	CPLR ARM
Z5623-20419	CPLR THRU	CPLR THRU
Z5623-20419	RCVR IN	RCVR OUT

Figure 11 N5230C RF Interface Connections



2. Connect the PNA-L test set I/O cable (8120-6818) to the test set interface on the rear panel. Refer to Figure 18 on page 20.

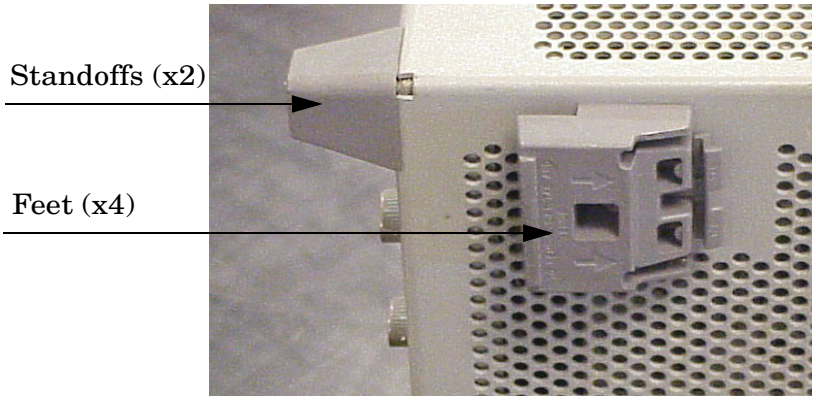
System Setup with N5242A

WARNING **The opening of covers or removal of parts is likely to expose dangerous voltages. Disconnect the instrument from all voltage sources while it is being opened.**

Preparing the N5242A Network Analyzer

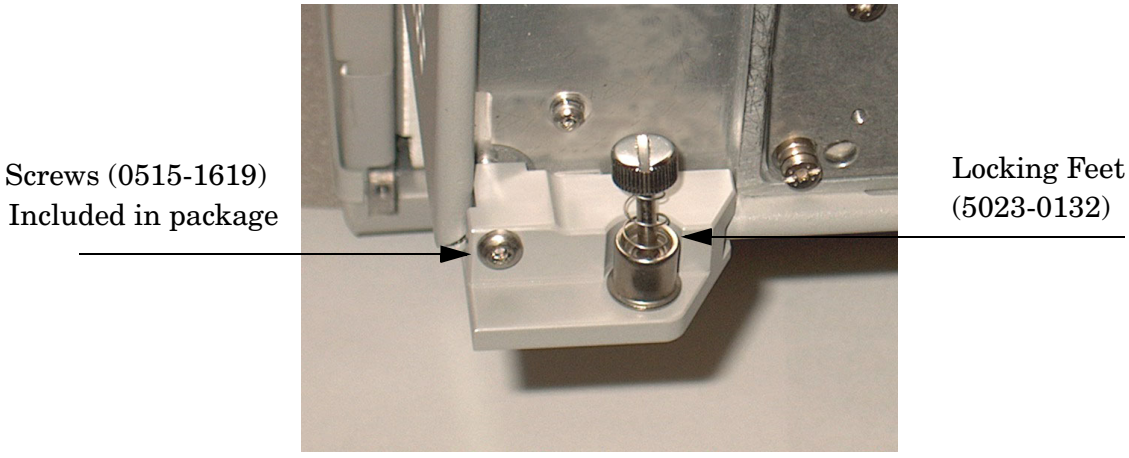
1. Remove the feet from the bottom of the network analyzer. Refer to Figure 12.
2. Remove the 2 lower standoffs and screws (0515-1619) from the rear panel on the network analyzer. Refer to Figure 12.

Figure 12 Rear Bottom Feet



3. Install the two rear locking feet (5023-0132) onto the PNA-X, using the included screws (0515-1619), where the standoffs were removed. Refer to Figure 13.

Figure 13 Install Locking Feet on N5242A

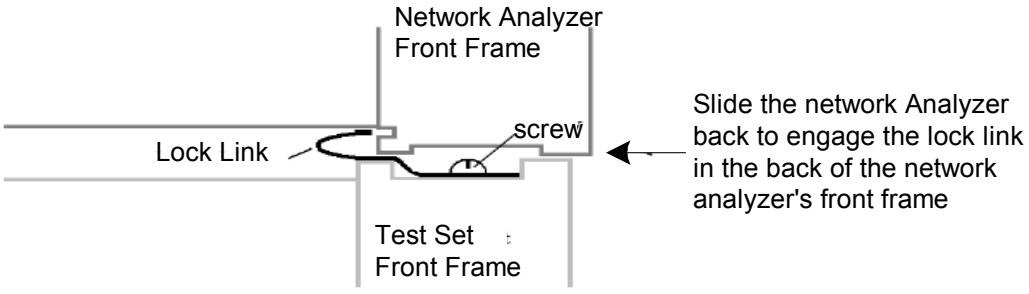


4. Install the two rear locking feet onto the test set. Looking at the front panel, the N5242-20138 is the right foot and the N5242-20139 is the left foot. Two screws (0515-2317) are included with this option. Refer to Figure 14.

Figure 14 Install Locking Feet on U3042AE08

5. Place the network analyzer on top of the test set and ensure that the front frame of the network analyzer is positioned slightly forward of the locks that are attached to the test set. Slide the network analyzer back so the locks engage the front frame of the analyzer. Refer to Figure 15.

Figure 15 Locking the Analyzer's



6. Secure the network analyzer's lower locking feet to the test set upper locking feet, using the spring–loaded screws on the locking feet. Refer to Figure 16. If the network 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.

Figure 16 Locking Feet Screws

NOTE There are two Lock-Feet kits available. Refer to "Agilent Support, Services, and Assistance" on page 68 for ordering information.

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

N5242A RF Interface Cable Connections

Figure 17 on page 20 illustrates the setup configuration of the test set and how it should be configured to the PNA-X. The cables have been supplied with U3021PL3 Option 442.

1. Connect the RF interconnect cables from the PNA-X 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 8 and Figure 17 on page 20.

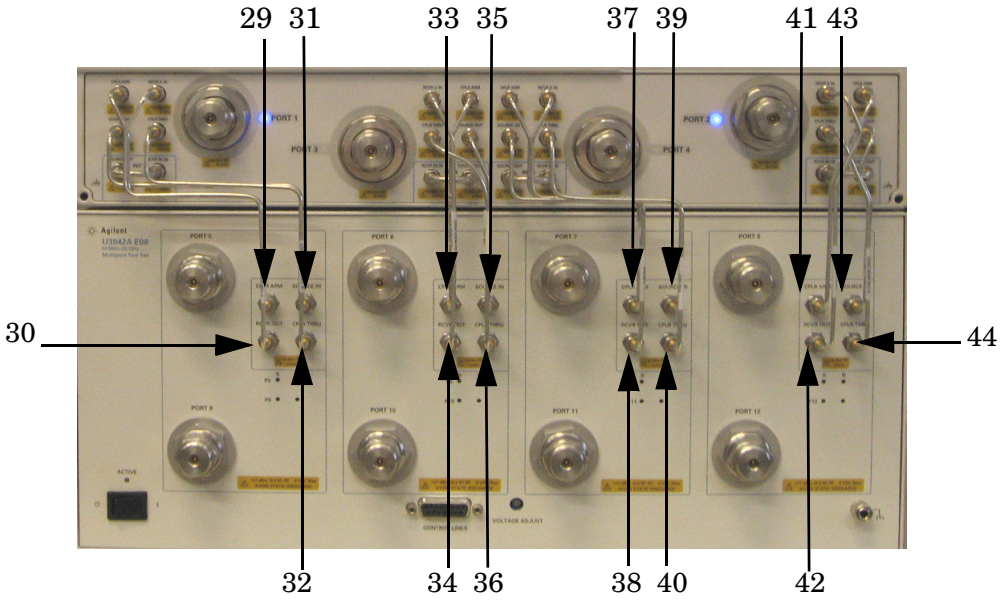
CAUTION Over torque will cause damage to the test set and may cause connectors to spin or become loose.

Table 8 N5242A RF Interface Cable Connection

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 17 indicates the final two digits of the part number for each cable.

Figure 17 N5242A RF Interface Cable Connections



2. Connect the PNA-X test set I/O cable (8120-6818) to the test set Interface on the rear panel.

Figure 18 N5242A Test Set I/O Cable Connection

Controlling the Test Set with N5230C or N5242A

This section will describe how to setup and operate the test set with the N5242A or N5230C.

The test set is considered a “slave” instrument. A N5230C or N5242A must be used to control the test set. There are three methods to control the test set. Multiport mode is recommended due to calibration and ease of use.

- Analyzer Multiport Mode firmware revision:
  N5242A Option 551 ≥ A.08.04.07
  N5230C Option 551 ≥ A.08.04.10

  The following test set file must be installed into network analyzer file directory:
  c:\Program Files\Agilent\Network Analyzer\testsets

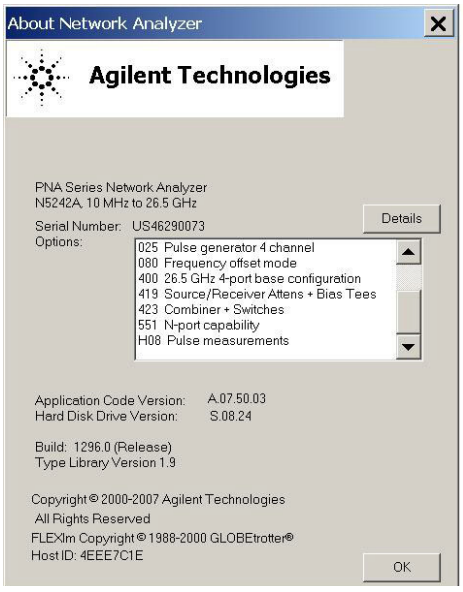
  4-Port PNA-L requires test set: u3042ae08_p4.tsx
  4-Port PNA-X requires test set: u3042ae08_pna_p4.tsx
- PNA Interface Control
- PNA GPIB Command Processor

Visit our website for firmware revision and downloads.
http://na.tm.agilent.com/pna/firmware/firmware.htm
http://na.tm.agilent.com/multiport/testsets/testset_files.html

N5230C and N5242A Multiport Mode for Option 551

The analyzer’s multiport mode selects the test set file that will enable the analyzer to control the test set. Multiport mode allows you to complete a N-Port calibration using the Cal Wizard application in the analyzer. Refer to the Help system for more information.

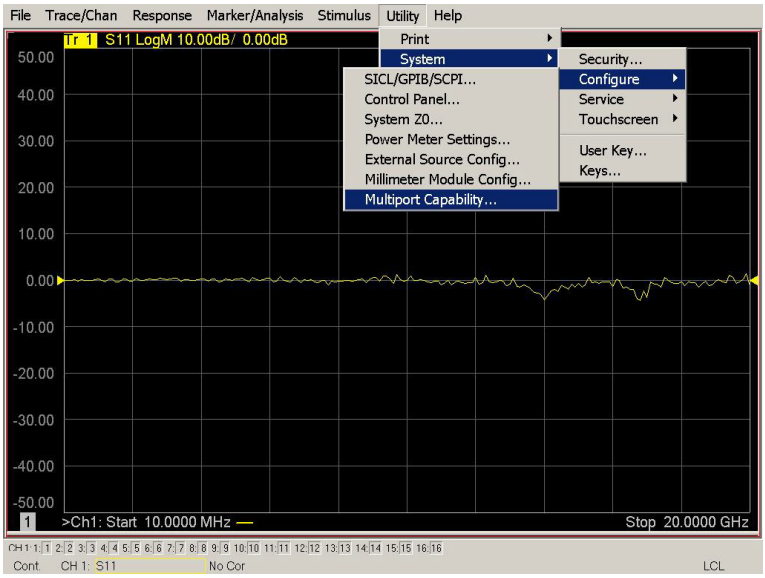
Figure 19 N5242A Options



How to Access Multiport Mode

The Option 551 must be installed for Multiport capability. To access the multiport application select **Utility** > **System** > **Configure** > **Multiport Capability**. See Figure 20.

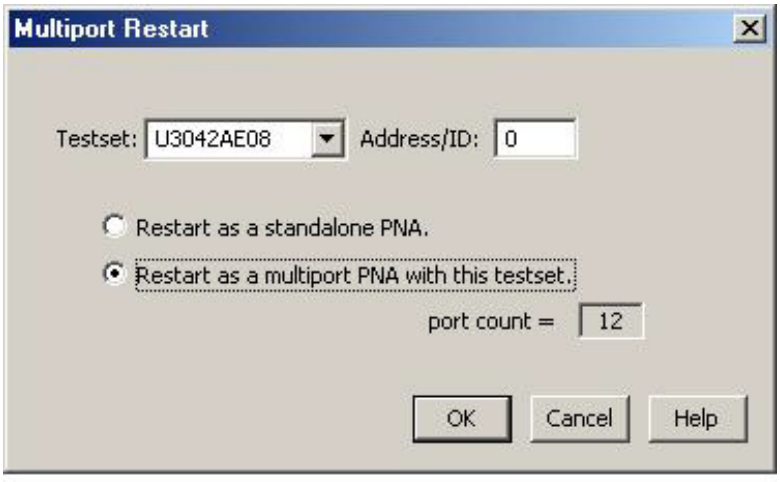
Figure 20 Selecting Multiport Mode



Select **U3042AE08** (12-Port System) from the test set drop-down menu and select **Restart as a Multiport PNA with this testset**. Press OK. The analyzer will restart the network application with the test set interface features. See Figure 21.

If the U3042E08 is not available in the Testset list, it will be necessary for you to copy the required test set file to the analyzer 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.

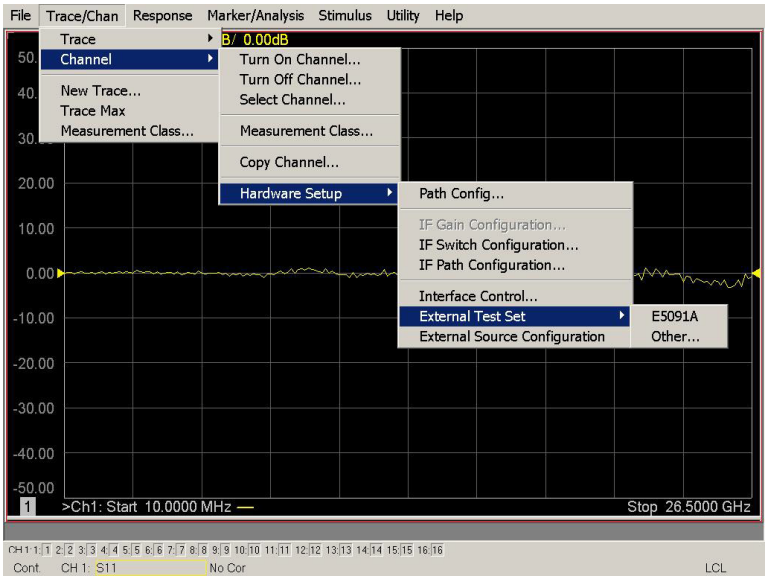
Figure 21 U3042AE08 Selection



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 U3042AE08 will be displayed as **External Test Set Control-U3042AE08**. See Figure 22, Figure 23 and Figure 24.

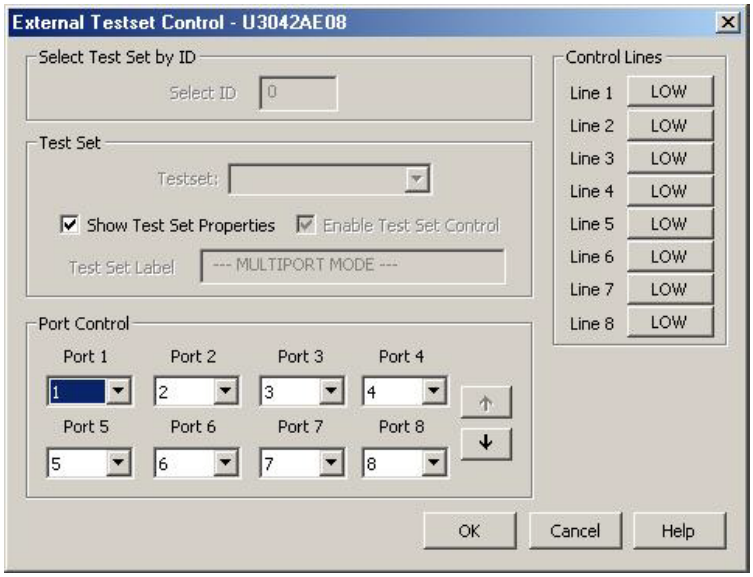
Figure 22 External Test Set Control



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.

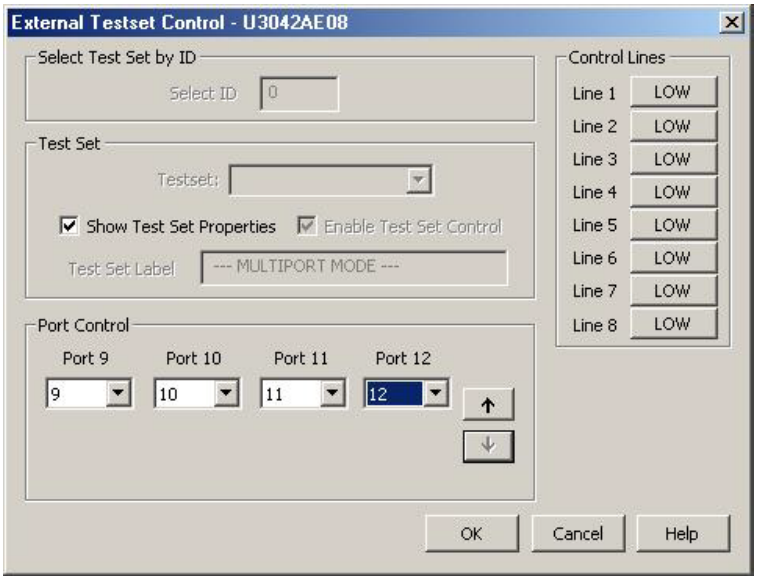
The **External Test Set Control-U3042AE08** also allows control of the DUT control lines, refer to "DUT Control Lines" on page 38. To change the state from LOW to HIGH, select the graphical user interface (GUI) for the specific control (LINE 1 thru 8) and then press OK. Each line can be controlled separately, see Figure 23.

Figure 23 External Test Set U3042AE08 (Port 1 - 8)



Select the **Port Control** down arrow for Ports 9 thru 12, as shown in Figure 24.

Figure 24 External Test Set U3042AE08 (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

S-Parameter Tab: Multiple S-Parameters can be made from the **New Measurement** menu. In the drop-down menu select **Trace** > **New Trace**. The **New Measurement** window allows the selection of any of the 144 S-Parameter's. Refer to Figure 26 and Figure 27.

Figure 26 New Trace Measure

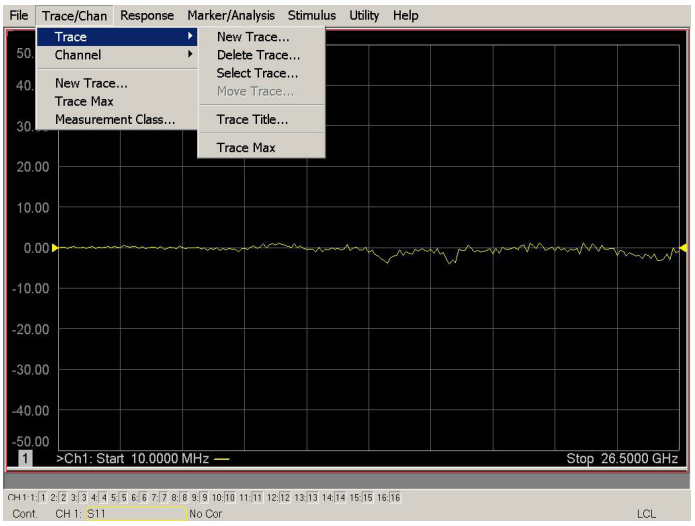


Figure 27 12-Port New Trace Measure (S11 - S55)

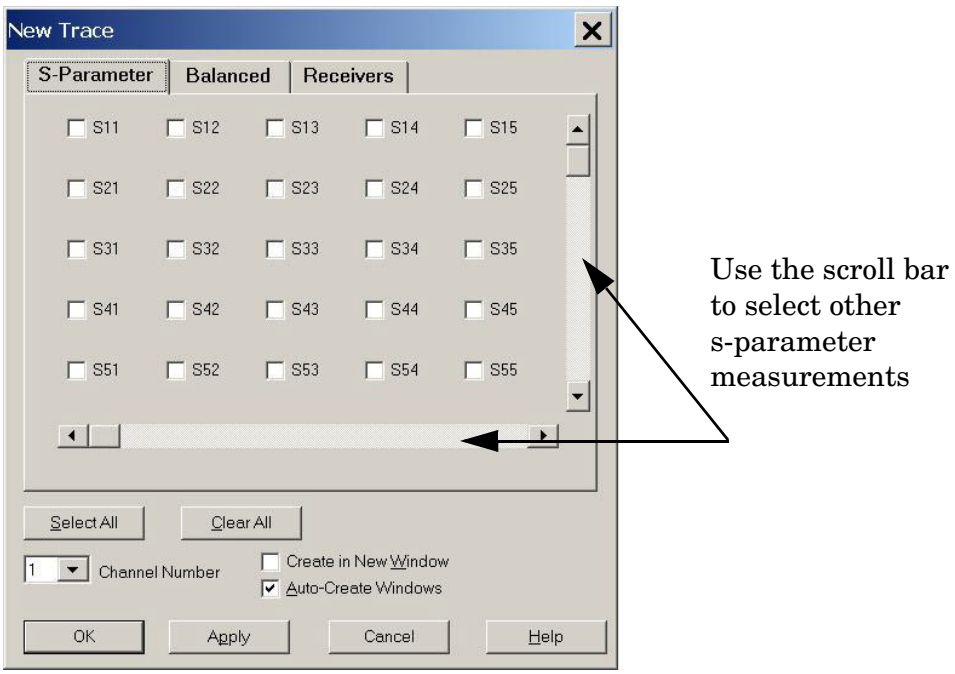
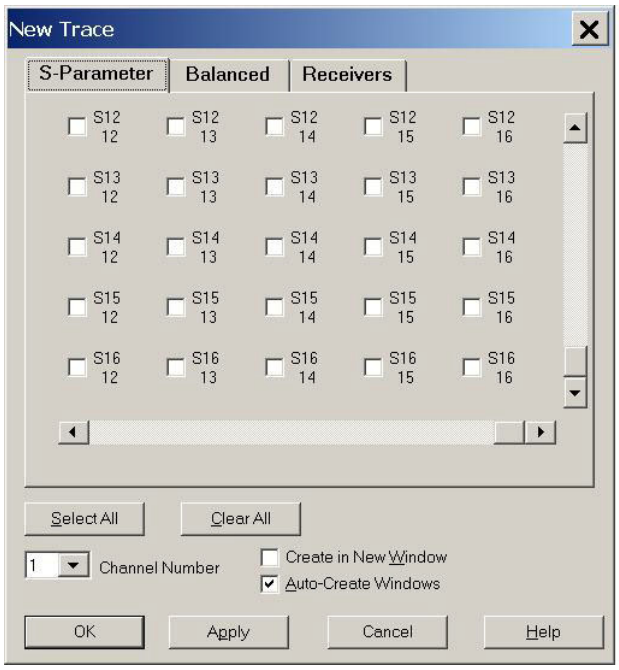


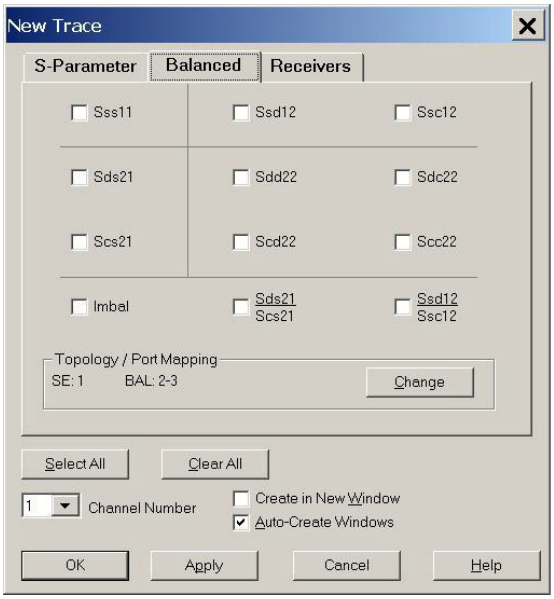
Figure 28 12-Port New Trace Measure (S88 - S1212)



Balanced Tab: Balanced Measurements can be configured by selecting the Balance tab in the **New Measurement** menu.

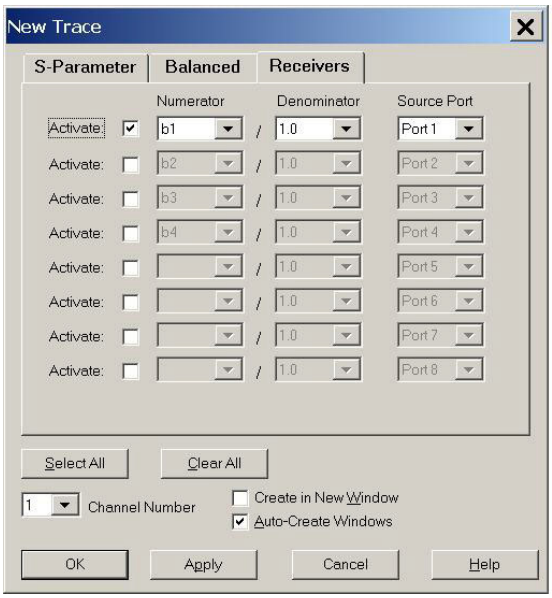
For more information on balanced (differential) component measurement, refer to the Application Note 1373-1 and 1373-2 (5988-5634EN and 5988-5635EN) at http://www.home.agilent.com. In the search menu type in "**Multiport and Balanced**."

Figure 29 Selecting Balanced Measurements



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

Figure 30 Receiver Measurements

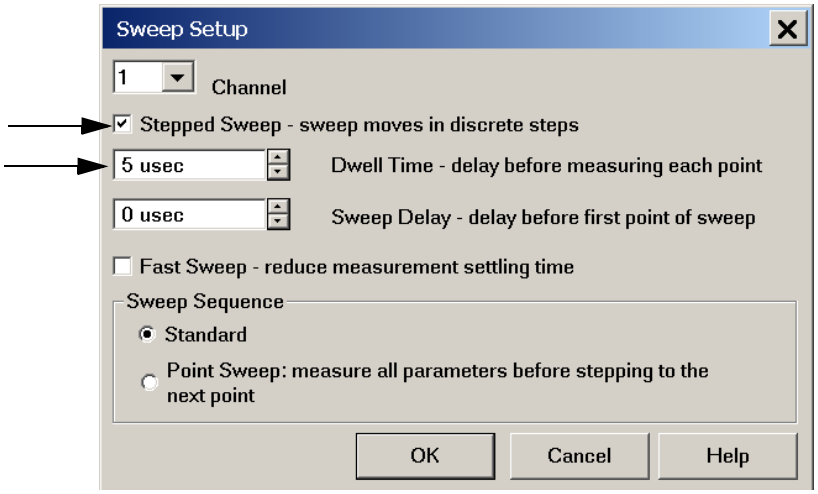


Sweep Setup for Multiport and Standalone Modes

When the test set is connected to the analyzer, 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. Only Stepped Sweep is available on all PNA models.

1. On the analyzer select **STIMULAS** > **Sweep** > **Sweep Setup**.
2. Select **Stepped Sweep**.
3. Set the **Dwell Time** to **5 μs** > **OK**.

Figure 31 ECal Characterization



N-Port Calibration with N5230C or N5242A

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.

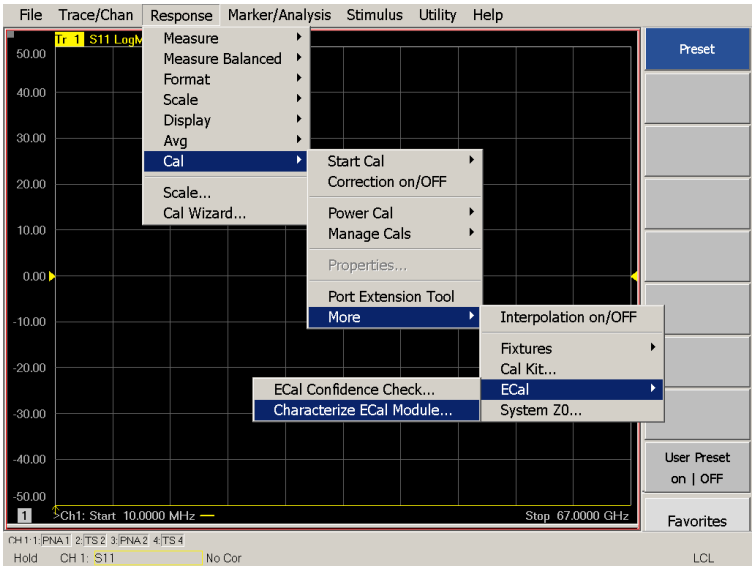
Characterize the ECal module with adapters that will not be used in the measurement of the DUT.

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.

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.

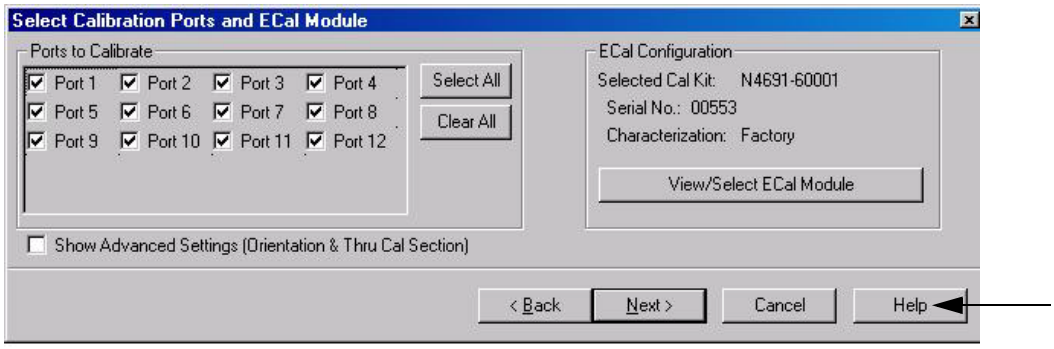
1. On the network analyzer select **Response > Calibration Wizard**.
   a. If using a mechanical cal kit, select **SmartCal**.
   b. If using an ECal module, select **ECal**.

Figure 32 ECal Characterization



2. Continue following the Cal Wizard prompts. On the “Select Calibration Ports and ECal Module” window, press **Select All** or select the ports you are calibrating and press **Next**.

Figure 33 12-Port Calibration



3. 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.
4. At the Calibration Completed prompt, select **Save As User Calset** and type the name desired. Press **Save.**
5. 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 Mode

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 System Menu, "Interface Control."

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

Other connectivity topics can be found in the PNA Series Network Analyzer's 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."

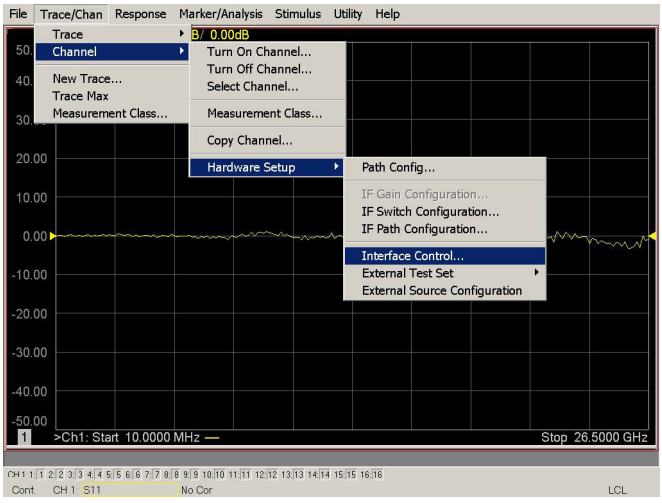
- A unique set of control data can be sent for each channel. In addition, a unique set of control data can be sent before the channel sweep starts and after the sweep ends.
- Interface Control settings can be saved and recalled from the Interface Control Dialog Box or with Instrument State Save and Recall.
- 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:

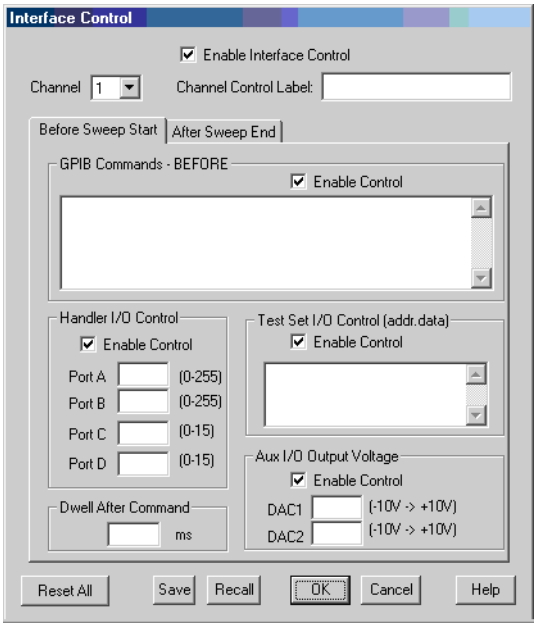
    1. GPIB Interface
    2. Material Handler Interface (not covered in this manual)
    3. Test Set Interface (not covered in this manual)
    4. Dwell Time (not covered in this manual)

How to Access Interface Control Mode

This section will describe how to setup and operate the test set with the PNA-X. To access the **Interface Control** application select **Trace/Chan** > **Channel** > **Hardware Setup** > **Interface Control** in the drop-down menu.

NOTE The PNA-X Series 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 Help menu, **InterfaceControl**. The application is shown below.





NOTE While using Interface Control, the PNA-X must be in GPIB System Controller mode. Once this is complete you must restart the analyzer application to go back to Talker/Listener.

Test Set I/O Address and Data using Control Interface with N5230C or N5242A

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 screen 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.

Enable Interface Control:

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.

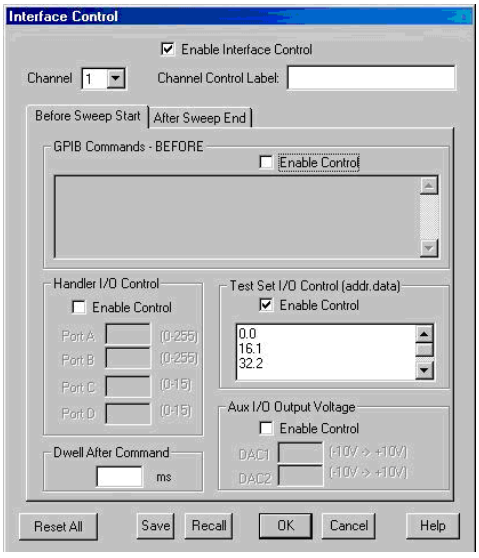
Test Set I/O Control (address data):

Provides control of the test set I/O Interface on the rear panel of the PNA-X. Used to control your test set.

Positive integer is used to select switch position or state of DUT control interface line.

Address and data are separated by a period. Entries should be separated by a new line, or carriage return.The front panel Enter key inserts a new line into the field. The number of test set I/O entries that can be entered is limited by the available memory of the PNA-X. See “Test Set I/O Interface Commands” on page 43.

0.0
16.1
32.2



Channel 1:

Specifies the channel number for dialog settings. Each channel is configured individually. The list box illustrates the channels that currently have measurements. There must be at least one measurement present in order to make the settings.

Channel Control Label:

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

Before Sweep Start– After Sweep End Tabs:

Commands /data for all four interfaces can be sent Before Sweep Start and After Sweep End. However, they are configured and enabled on separate tabs of the Interface Control dialog box. For example; to send GPIB commands Before and After a sweep, the Enable Control check box must be selected and commands entered on both the Before Sweep Start and After Sweep End tabs.

Before Sweep Start:

The data is sent before the first trace on the channel begins sweeping.

After Sweep End:

The data is sent after the last trace on the channel completes sweeping.

Address:

Positive integer is used to specify switch path to be controlled. Address also specifies output on specific ports. Refer to "Test Set I/O Interface Commands" on page 43.

Dwell After Command:

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.

Reset All:

Sets all fields on all channels to their default values.

Handler I/O Control and Aux I/O Output Voltage:

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

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.

NOTE Test set I/O Commands can be found in "Test Set I/O Interface Commands" on page 43. The Address and Data commands can be entered into the test set I/O control.

GPIB Control Mode

The GPIB Command Processor feature allows you to send remote commands and data to the analyzer's rear-panel GPIB connector and test set I/O connector. More information regarding the GPIB Command Processor can be found in the Help System menu.

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

Overview of the GPIB Control

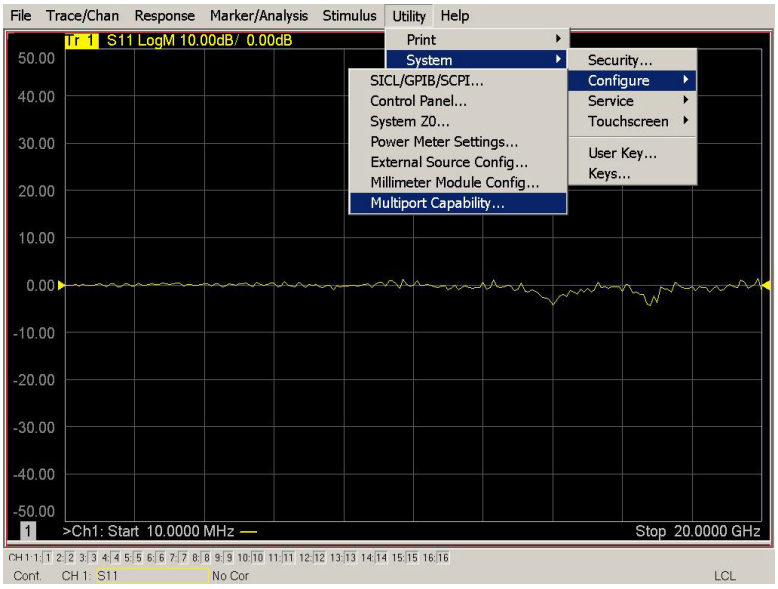
The GPIB Command Processor allows you to send address and data to control an external test set, without needing to create a remote program. The user is required to manually input address and data using the GPIB Command Processor Console in the Help menu.

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

How to Access GPIB Command Processor

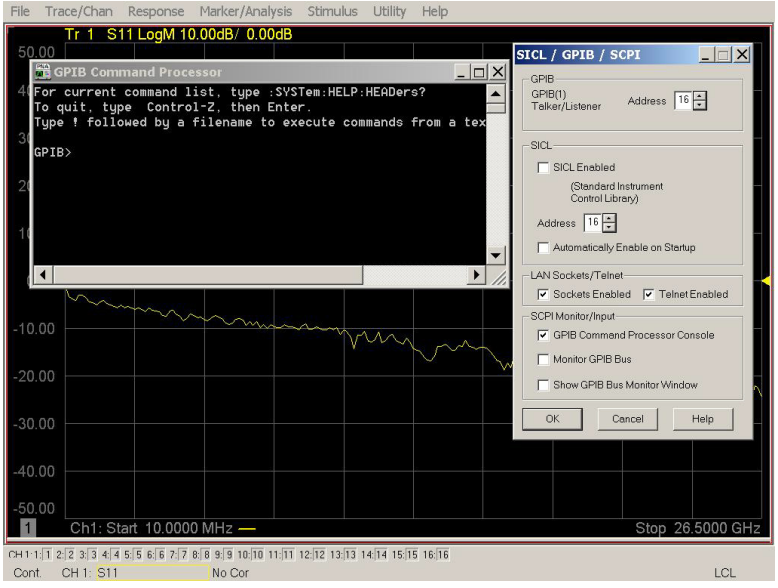
1. To access the GPIB Command Processor press: **Utility > System > Configure > SICL/GPIB/SCPI**.

Figure 34 Utility Configure



2. Check System Controller and GPIB Command Processor Console and select OK.

Figure 35 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

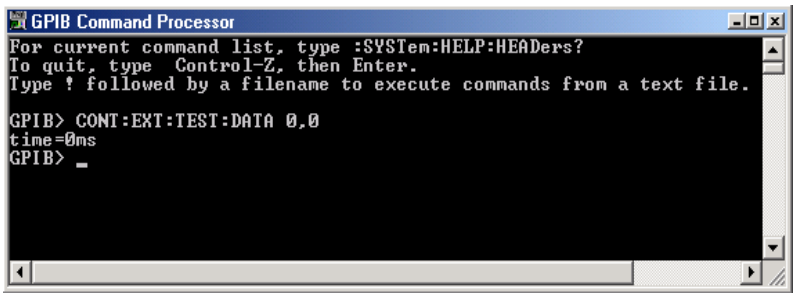
data: a integer number

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



Read Commands

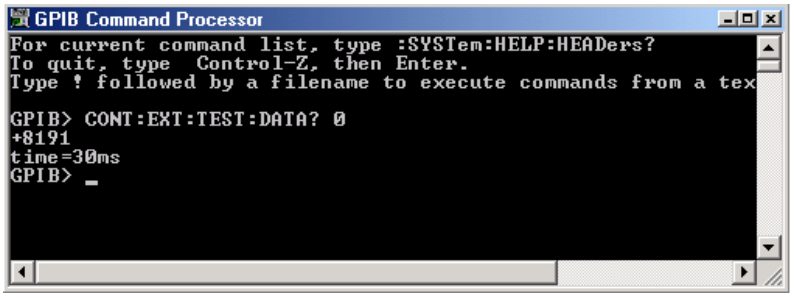
address: a integer number

Address is entered, data value will be returned. Commands should be executed with a carriage return (enter).

For example:

CONT:EXT:TEST:DATA? <address>
CONT:EXT:TEST:DATA? 0

Example: CONT:EXT:TEST:DATA? 0



This command reads the decimal equivalent of the binary data from the specified address. The example shown above illustrates address is 0 and the returned data is 8191. Refer to "Test Set I/O Interface Commands" on page 43.

DUT Control Lines

The 15 pin female D-Sub connector on the front panel provides 8 latched data connections that can be used to control your DUT. An adjustable voltage source (+2 to +5 Vdc) is provided on the front panel. A positive or negative external source can be used. Refer to Table 11 and Figure 39 on page 42.

Setting the DUT Control Interface

This section describes how to control the DUT control lines. Refer to "Controlling the Test Set with N5230C or N5242A" on page 21. For more information regarding the control lines, see Table 9 on page 38 and Table 10 on page 39.

Table 9 Test Set DUT Control Address and Data

Address	Data	Data AD12–AD0	Description	Bit Data 0= +Voltage 1= –Voltage
112	0	0000000000000	ALL DUT Control Lines set to 0 or + voltage	
112	255	0000001111111	ALL DUT Control Lines set to 0 or – voltage	
112	1	00000xxxxxxxB	DUT Control Line 1	0,1
112	2	00000xxxxxxBx	DUT Control Line 2	0,1
112	4	00000xxxxxBxx	DUT Control Line 3	0,1
112	8	00000xxxxBxxx	DUT Control Line 4	0,1
112	16	00000xxxBxxxx	DUT Control Line 5	0,1
112	32	00000xxBxxxxx	DUT Control Line 6	0,1
112	64	00000xBxxxxxx	DUT Control Line 7	0,1
112	128	00000Bxxxxxxx	DUT Control Line 8	0,1

Control Lines	Line 8	Line 7	Line 6	Line 5	Line 4	Line 3	Line 2	Line 1
Test Set I/O Bits	AD7	AD6	AD5	AD4	AD3	AD2	AD1	AD0
Bit Decimal Equivalent	128	64	32	16	8	4	2	1
Example 1 Data = 0	0	0	0	0	0	0	0	0
Example 2 Data = 21	0	0	0	1	0	1	0	1

X indicates unknown user bit state

B indicates bit of interest

To select a Test Set DUT control line configuration, all 8 DUT control lines must be set. To do this you must add AD7 to AD0 binary number and convert this to a decimal equivalent.

NOTE All DUT control lines must be set with each command sent. Logic 0 = high

Figure 36 DUT Control Line Pin Assignment

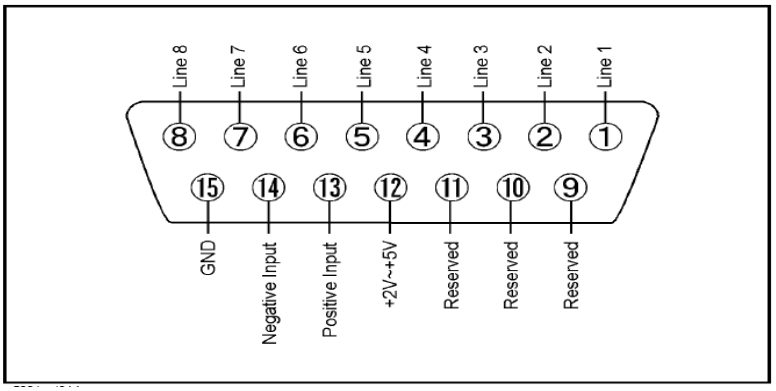


Table 10 DUT Control Line Pin Assignment

Pin Number	Signal Name	Description
1	Line 1	Output port of line 1
2	Line 2	Output port of line 2
3	Line 3	Output port of line 3
4	Line 4	Output port of line 4
5	Line 5	Output port of line 5
6	Line 6	Output port of line 6
7	Line 7	Output port of line 7
8	Line 8	Output port of line 8
9		Not used
10		Not used
11		Not used
12	+2 V to +5 V	The voltage input to pin 13. (The voltage can be varied by rotating the voltage adjustment trimmer on the front panel).
13	Positive Input	Input a signal that is outputted when each line is high from pin 12 or external dc power supply.
14	Negative Input	Input a signal that is outputted when each line is low from the external dc power supply. Able to output 0 V as low from the each line by connecting to pin 15.
15	Gnd	ground terminal

Setting the Variable Source Voltage

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

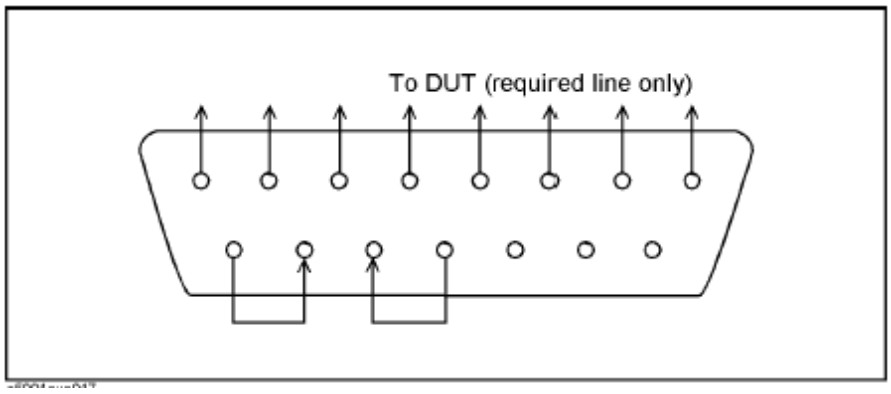
1. Turn On the test set.
2. Measure the voltage between pin 12 and 15 using a multimeter.
3. Rotate the voltage adjustment trimmer on the front panel until the multimeter indicates the appropriate voltage.

Connecting to the DUT Control Lines

Figure 37 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 37 Control Line Connector



Using an External Power Supply

Figure 37 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. Turning 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. Turning Off the power supply.
2. Turning Off the test set.
3. Disconnect the DUT.

Figure 38 U3042AE08 to the DUT and External DC Power Supply

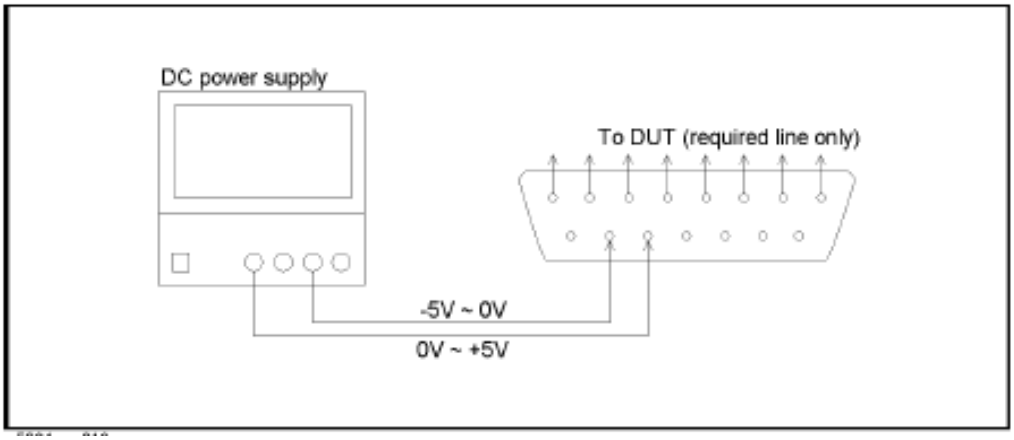
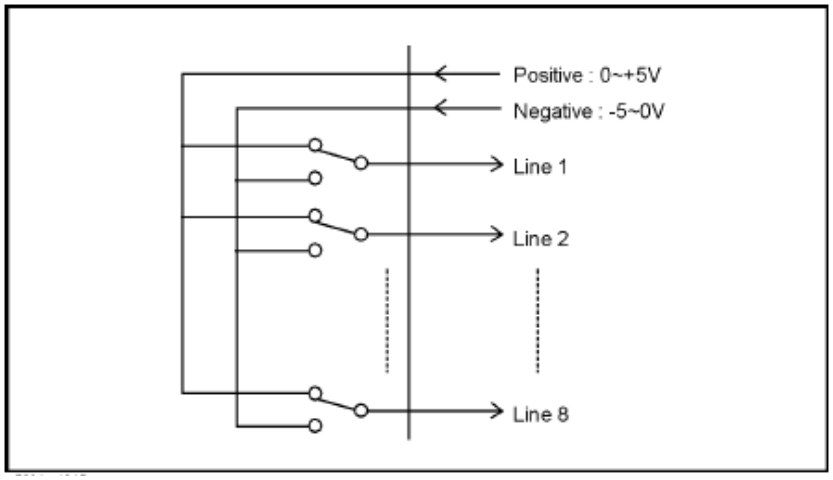


Table 11 DUT Control Specifications

Item	Specifications
Connector Shape	15–pin female D–Sub
Voltage Range:	
Positive Input	0 to +5 V
Negative Input	–5 to 0 V
Maximum Current	100 mA (in total of each line)
Impedance	< 10 Ω
Range of Variable Voltage	+2 to +5 V

Figure 39 Block Diagram of DUT Control



Test Set I/O Interface Commands

Switch Address and Data

To select a test set port configuration internal RF switches must be set to complete the source and receiver paths. To do this you must determine the address and data command value for each port.

The address is the first value in the test set I/O control or GPIB data command. The data is the second value, which selects the source and receiver paths of the ports.

Example 1: Refer to Figure 40 on page 44.

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

Port 9 is the Source and Port 10 is the Receiver.

Source Port 9 = address 0, data 8 and Receiver Port 10 = address 16, data 128.
Two separate commands must to be sent, you may use the same dialog box. Send address 0 and data 8 in one command line, and address 16 and data 128 in the second line. Refer to "Interface Control Mode" on page 31 and in "GPIB Control Mode" on page 35.

For further information refer to "How to Access Interface Control Mode" on page 32 and "How to Access GPIB Command Processor" on page 36.

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 2 and Receiver Port 9 = address 0, data 128. The data values are added together, the entry will be 0.130.

Refer to Figure 52, "U3042AE08 Standard Configuration," for in-depth RF path information.

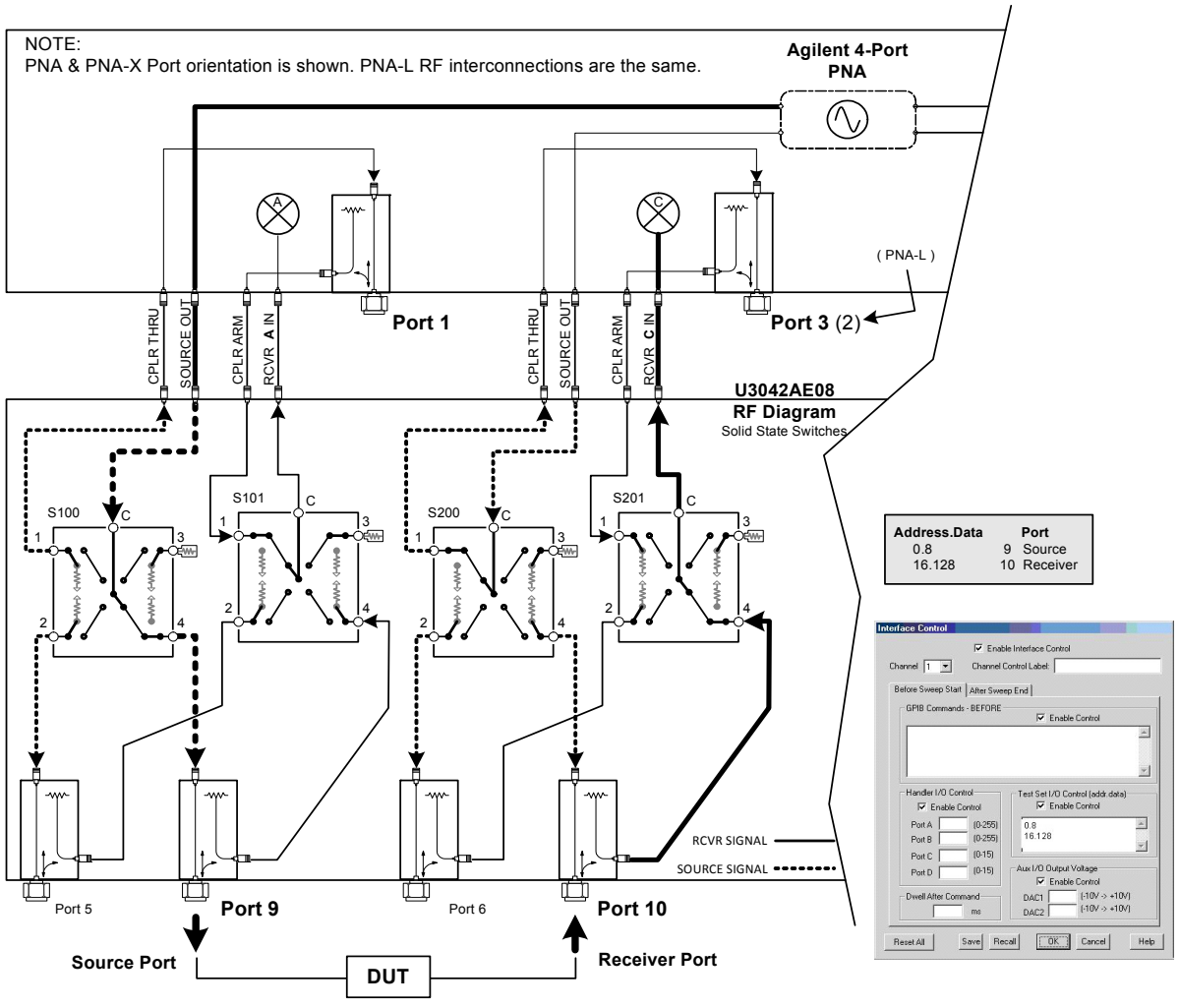
Table 12 N5230C PNA-L Source and Receiver Address and Data

Address		Source Path			Receiver Path		
	Data	1	2	8	16	32	128
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 13 N5242A PNA-X Source and Receiver Address and Data

Address		Source Path			Receiver Path		
	Data	1	2	8	16	32	128
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 40 Address and Data Example 1 (Port 9 and 10)



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.

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 U3042AE08.

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 14 and Table 15 on page 46.

Table 14 N5230C Operation Verification Limit for Reflection Tracking[1]

Frequency	Standard Port 1-12[2]	Option 001 or 002 Port 1-12
10 MHz to 4 GHz	–10.0 dB	0 dB
4 GHz to 6 GHz	–13.0 dB	–2.5 dB
6 GHz to 10 GHz	–16.0 dB	–5.0 dB
10 GHz to 15 GHz	–17.0 dB	–7.5 dB
15 GHz to 20 GHz	–25.0 dB	–15.0 dB

1. Reflection Tracking takes into account Source Loss, Receiver Loss, Margin, and analyzer's Mixer Cal.
2. A standard unit is one without Options 001 or 002.

Table 15 N5242A Operation Verification Limit for Reflection Tracking[1]

Frequency	Standard[2] Port 1-12	Options 001 or 002 Port 1-12
10 MHz to 4 GHz	–10.0 dB	0 dB
4 GHz to 6 GHz	–13.0 dB	–2.5 dB
6 GHz to 10 GHz	–16.0 dB	–5.0 dB
10 GHz to 15 GHz	–17.0 dB	–7.5 dB
15 GHz to 20 GHz	–25.0 dB	–15.0 dB
20 GHz to 26.5 GHz	–30.0 dB	–40 dB

1. Reflection Tracking takes into account Source Loss, Receiver Loss, Margin, and analyzer's Mixer Cal.
2. A standard unit is one without Options 001 or 002.

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

Equipment Required

The Agilent U3042AE08 requires that the user be familiar with the equipment and components listed in Table 16.

This section provides an equipment list and setup of the analyzer and test set.

Table 16 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* N5242A Option 400 and 551	1
Set of interconnect cables (analyzer and Test Set), see "N5230C RF Interface Cable Connections" on page 15.	1

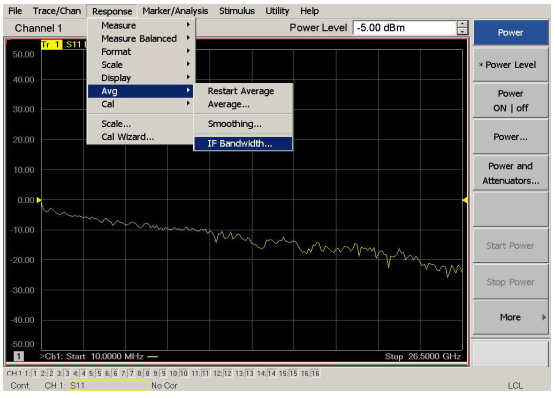
Operational Check Procedure

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 analyzer if you are performing the Operator's Check. The analyzer will indicate false failures if the test set is connected.

Preparing the N5230C or N5242A

1. Connect the test set to the N5242A 4-Port PNA-X using the interconnect cables as shown in Figure 17 on page 20 and Table 8 on page 19. If you are using a N5230C, refer to Figure 11 on page 15 and Table 7 on page 15.
2. Turn On the test set.
3. On the analyzer, press **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 analyzer is in 12-Port. See the bottom of the measurement window.
   a. If only four S-Parameters are listed, press **Utility** > **System** > **Configure** > **Multiport Capability**. On the Multiport Restart dialog, select **Restart as multiport PNA with this test set**. Select **U3042AE08** (12-Port).
5. Press **Preset.**
6. Verify that the **[Stop Frequency]** is set to **[20 GHz]** or **[26.5 GHz].**
7. Verify that the **[Start Frequency]** is set to **[10 MHz]**.
8. Verify that the **[Power]** is to set to **[–5 dBm]**.
9. Select **Response** > **Avg > IF Bandwidth** > **100 Hz**.
10. Select **Stimulus** > **Sweep** > **Number of Points** > **401**.
11. Connect the ECal module to the analyzer's USB port on the front or rear panel. This procedure assumes you are using a ECal. If you are not, see "N5230C or N5242A 1-Port Calibration and Verification Procedure" step 2.
12. Allow the ECal module, test set and analyzer to warm up for a minimum of 30 minutes.

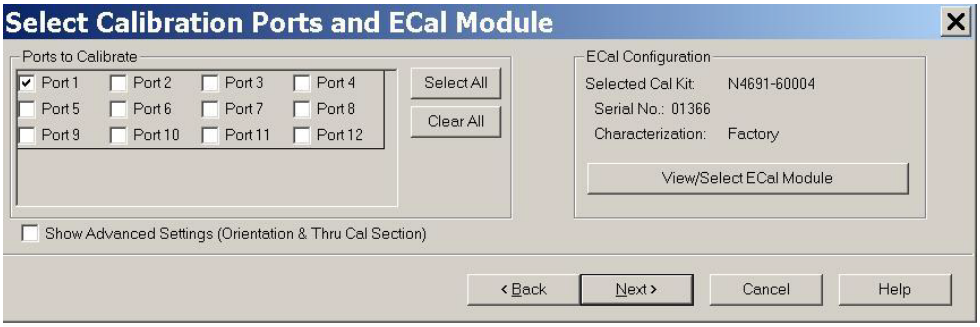
Figure 41 Setting the IF Bandwidth



N5230C or N5242A 1-Port Calibration and Verification Procedure

1. Connect the ECal or the mechanical cal kit to Port 1 or the port you are testing. Refer to Figure 2 on page 2. Torque to 8 in-lb. For more information press the **Help** button, see Figure 42.
2. Perform a 1-Port Calibration on Port 1. On the analyzer, press **Response** > **CAL** > **Start Cal** > **Calibration Wizard**.
   a. If using a mechanical cal kit, select **SmartCal**.
   b. If using an ECal module, select **ECal**.
3. Continue following the Cal Wizard prompts. In the "Select Calibration Ports and ECal Module" window, press **Clear All** and select **Port 1,** then press **Next**.

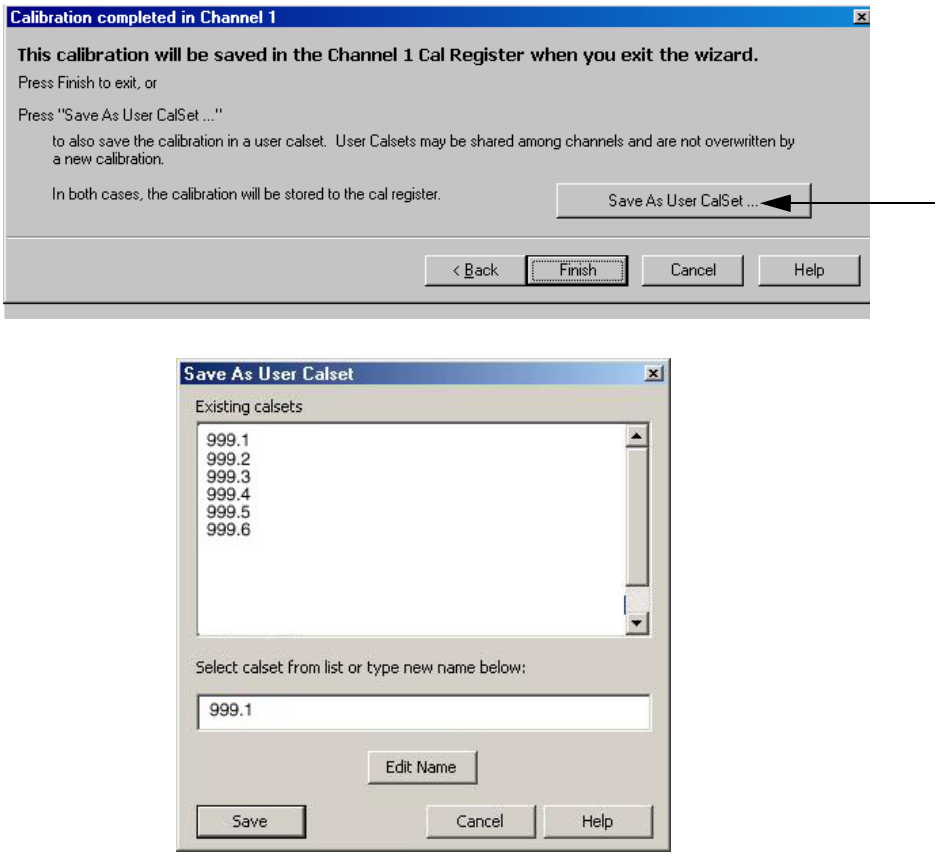
Figure 42 1-Port Calibration



4. Continue to follow the prompts until the "Calibration Completed" window appears.
5. At the Calibration Completed prompt, select **Save As User Calset** and type the name **999.1**. Overwrite the Calset if it already exists. Press **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. See Figure 43. Use the numeric keypad on the analyzer's front panel to enter "999.1."

Figure 43 Calibration Complete



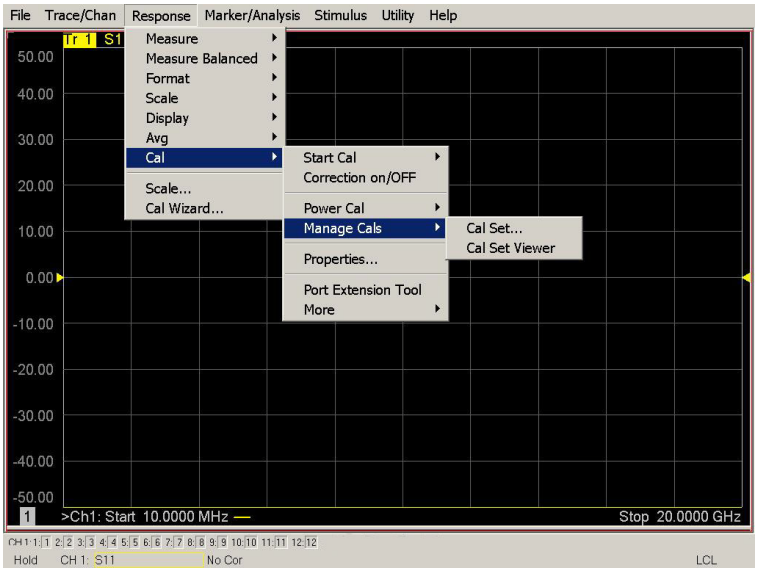
6. Repeat step 1 thru step 5 (1-Port Calibration Procedure) for Ports 2 thru 12. When finished, there should be sixteen Cal Sets saved with the titles “999.1” thru “999.12” (12-Port).

   If you are using an ECal module you can verify the individual port calibration by selecting **Response** > **CAL** > **More** > **ECAL** > **ECAL Confidence Check**. For further information refer to the Help menu.

7. Press **Trace/Chan** > **Trace** > **Delete Trace**. There should be no traces on the display.

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

Figure 44 Calibration, Cal Set Viewer



9. From the Cal Sets drop-down menu, select **999.1** and check **Enable**. Select the **Reflection Tracking(1,1)** term in the center drop-down menu and ensure that the **Enable** and **Error Terms** are selected.

NOTE You may also create a table on the analyzer which enables you to enter the limit line stimulus and response values. Select Limit Test ON and Limit Line ON, and press Show Table. See Figure 45.

Figure 45 Setting the Test Limits

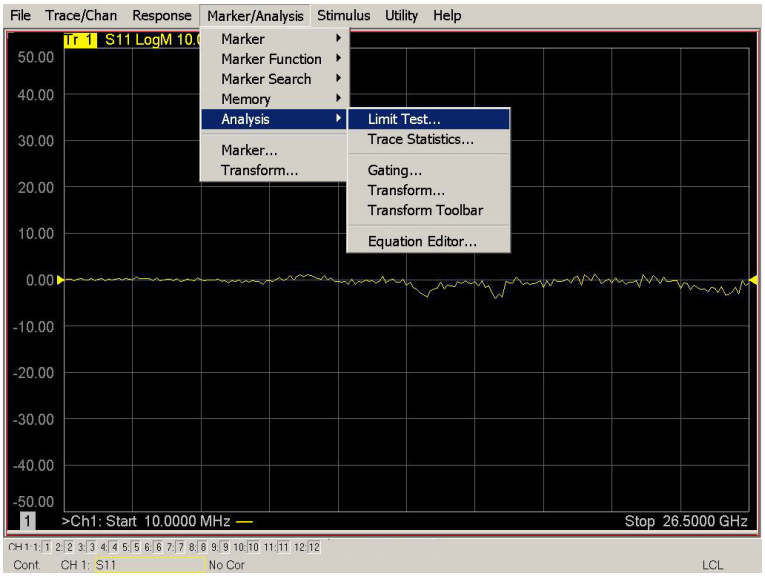


Figure 46 Option 001 or 002 Reflection Tracking Trace (Port 1-12) with N5230C

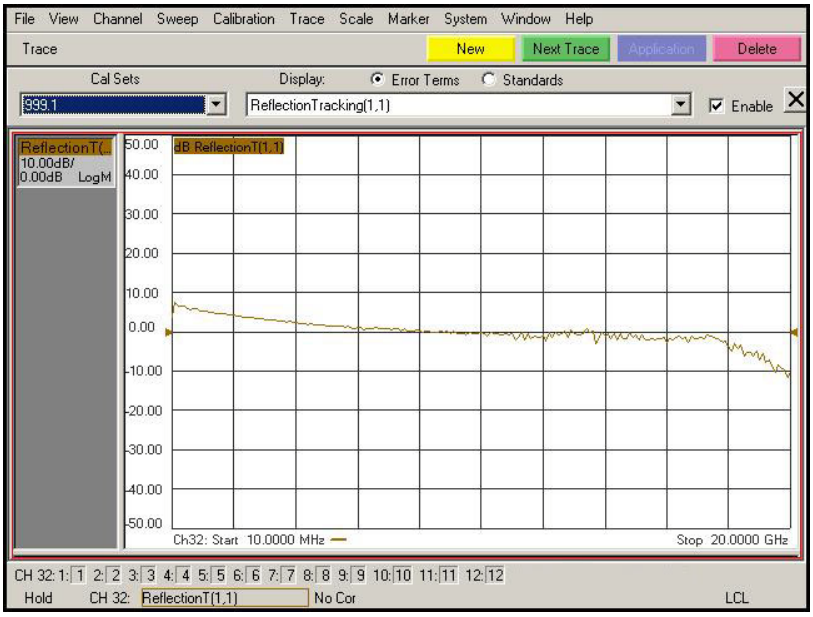
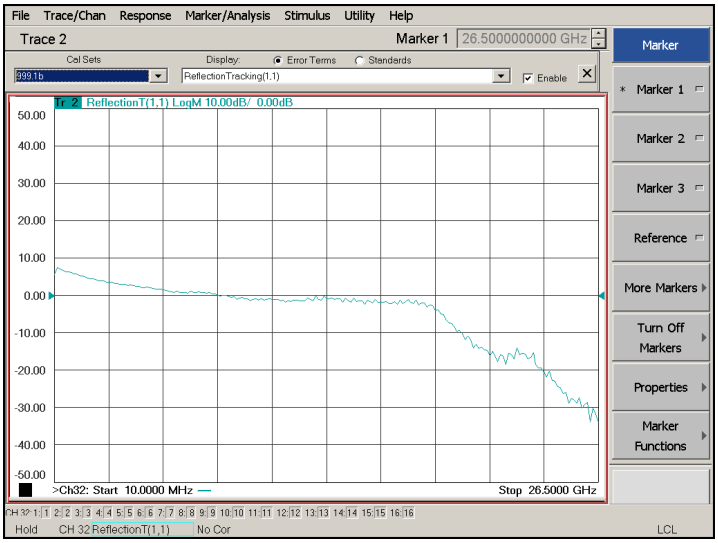


Figure 47 Standard Reflection Tracking Trace (Port 1-12) with N5230C

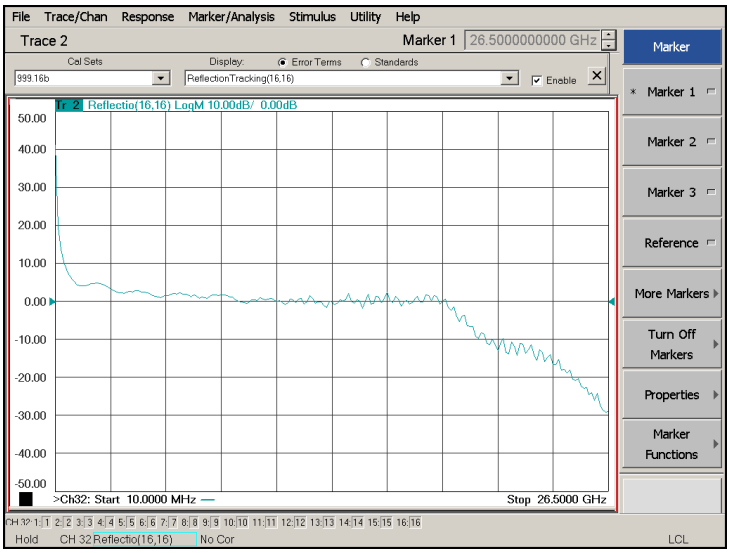
Figure 48 Option 001 or 002 Reflection Tracking Trace (Port 1-4) with N5242A



10. Compare the Reflection Tracking (1,1) trace to the appropriate limits in Table 14 on page 45 (N5230C) or Table 15 on page 46 (N5242A). 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.

11. Repeat step 9 and step 10 for Cal Sets “999.1” thru “999.12” (12-Port).

Figure 49 Option 001 or 002 Reflection Tracking Trace (Port 5-12) with N5242A



NOTE Response from 10 MHz to 500 MHz is normal due to the PNA-X Couplers in comparison to the test set bridges. The bridges have more gain in the coupled

RF path.

Figure 50 Standard Reflection Tracking Trace (Port 1-4) with N5242A

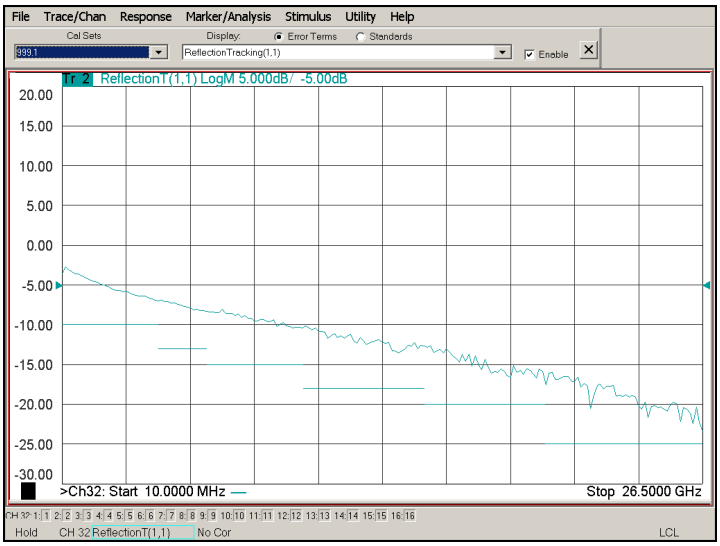
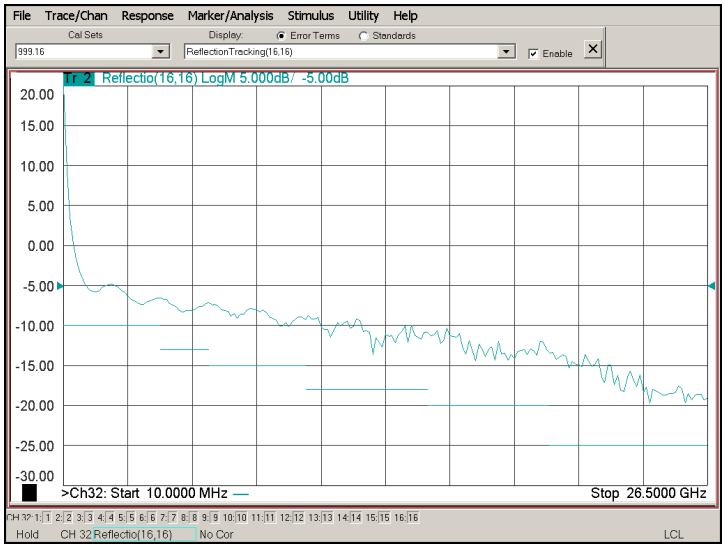


Figure 51 Standard Reflection Tracking Trace (Port 5-12) with N5242A



NOTE Response from 10 MHz to 500 MHz is normal due to the PNA-X couplers in comparison to the test set bridges. The bridges have more gain in the coupled RF path.

Troubleshooting Operational Check Failures

If your test results fail the Operational Check limits, verify following:

1. Ensure that the test set is turned on and connected properly to the analyzer.
2. Check all appropriate network analyzer and test set connectors for damage, cleanliness, and proper torque.
3. Repeat the relevant 1-Port calibrations.
4. Verify that the stand-alone network analyzer is operating properly and meeting its published specifications.

Interconnect Cable Verification

1. Connect the test set to the analyzer and select Multiport mode.
2. Verify the Source Interconnect RF cables (Source Out and CPLR THRU).
   a. Remove the Receiver and CPLR ARM interconnect cables and install the standard jumpers.
   b. Connect two RF cables on Port-1 to Port-2 and Port-3 to Port-4 on the analyzer.
   c. Set the analyzer to measure Trace S12, S21, S34 and S43, and verify that there are no power holes. If S12, or S34 has a power hole check the Port-2, or Port-4 Source interconnect cables and test set connectors for damage. If S21, or S43 has a power hole check the Port-1, or Port-3 Source interconnect cables and test set connectors for damage.
3. Verify the Receiver Interconnect RF cables (Receiver A IN or B IN and CPLR ARM).
   a. Re-install the Receiver and CPLR ARM interconnect cables.
   b. Remove the Source Out and CPLR THRU interconnect cables and install the standard jumpers.
   c. Set the analyzer to measure Trace S12, S21, S34 and S43. Verify that there are no power holes. If S12 or S34 has a power hole check Port-1, or Port-3 Receiver Interconnect cables and test set connectors for damage. If S21, or S43 has a power hole check Port-2, or Port-4 Receiver Interconnect cables and test set connectors for damage.
4. If the problem still exists, connect the standard jumpers to the analyzer (Source and Receiver) and verify the Source Out to CPLR THRU and A/B IN to CPLR ARM switch paths.
   a. Connect two RF cable, one to Port-1 and one to Port-2.
   b. Set the analyzer to measure trace S12 (all standard jumpers connected).
   c. Connect the Port-1 cable to Source Out and Port-2 cable to CPLR THRU connectors on the test set. If a power hole still exists refer to “Contacting Agilent” on page 68.
   d. Connect Port-1 to Receiver A IN or B IN and Port-2 to CPLR ARM connectors on the test set. If a power hole still exists refer to “Contacting Agilent” on page 68.

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

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

Description	Agilent Part Number
Test Set I/'O Cable	8120-6818
RF Cable, Semi-rigid	Z5623-20418
RF Cable, Semi-rigid	Z5623-20419
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

Description	Agilent Part Number
Screw	0515-2317
PNA-X Test Set Rear Lock Feet (right)	N5242-20138
PNA-X Test Set Rear Lock Feet (left)	N5242-20139
PNA-L or PNA-X Locking Feet	5023-0132
PNA-L Test Set Locking Feet	5063-9253
User's Guide (Option E08)	U3042-90002

Theory of Operation

The following is a description of the operation of the test set. Reference the test set block diagrams shown in Figure 52 on page 59. This section assumes the user has a general understanding of couplers, switches, and network analyzers.

RF Switch Components

There are eight quad switches. The switches select the RF paths from the analyzer's source and receiver through interconnect cables to test set port paths 5 thru 12.

S100 - Source to Ports (1, 5 and 9)

Switch 100 provides control of the Source path from Port 1, 5 and 9 to the test set. In the state shown in the block diagram, switch 100 routes the RF Source back to Port 1 and the test set Source paths to ports 5, 9 and 13 are terminated.

S200 - Source to Ports (2, 6 and 10)

Switch 200 provides control of the Source path from Port 2, 6 and 10 to the test set. In the state shown in the block diagram, switch 200 routes the RF Source back to Port 2 and all unused test set ports (2, 6 and 10) Source paths are terminated.

S300 - Source to Ports (3, 7 and 11)

Switch 300 provides control of the Source path from Port 3, 7 and 11 to the test set. In the state shown in the block diagram, switch 300 routes the RF Source back to Port 3 and all unused test set ports (3, 7 and 11) source paths are terminated.

S400 - Source to Ports (4, 8 and 12)

Switch 400 provides control of the Source path from Port 4, 8 and 12 to the test set. In the state shown in the block diagram, switch 400 routes the RF Source back to Port 4 and all unused test set ports (4, 8 and 12) Source paths are terminated.

S101 - Receiver to Ports (1, 5 and 9)

Switch 101 provides control of the A Receiver path from Port 1, 5 and 9 to the test set. In the state shown in the block diagram, switch 101 routes the Coupler Arm from Port 1 to the A Receiver and all unused test set ports (5 and 9) Coupler Arm paths are terminated.

S201 - Receiver to Ports (2, 6 and 10)

Switch 201 provides control of the A Receiver path from Port 2, 6 and 10 to the test set. In the state shown in the block diagram, switch 201 routes the Coupler Arm from Port 2 to the A Receiver and all unused test set ports (2, 6 and 10) Coupler Arm paths are terminated.

S301 - Receiver to Ports (3, 7 and 11)

Switch 301 provides control of the A Receiver path from Port 3, 7 and 11 to the test set. In the state shown in the block diagram, switch 301 routes the Coupler Arm from Port 3 to the A Receiver and all unused test set ports (3, 7 and 11) Coupler Arm paths are terminated.

S401 - Receiver to Ports (4, 8 and 12)

Switch 401 provides control of the B Receiver from PNA Port 4, 8 and 12 to the test set. In the state shown in the block diagram, switch 401 routes the Coupler Arm from Port 4 to the B Receiver and all unused test set ports Coupler Arm paths are terminated.

RF Coupler Components

Test set ports (5 - 12) provide the signal separation of the source and receiver paths. The test set ports can either stimulate or receive a signal to the DUT.

System Block Diagram

Figure 52 U3042AE08 Standard Configuration

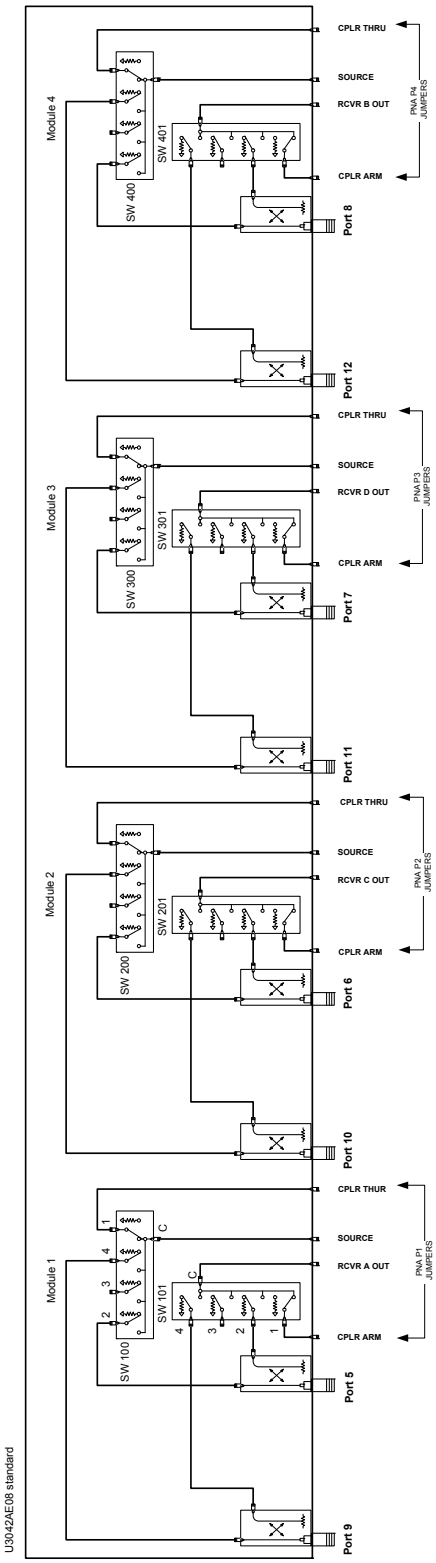


Figure 53 U3042AE08 Option 001 Configuration

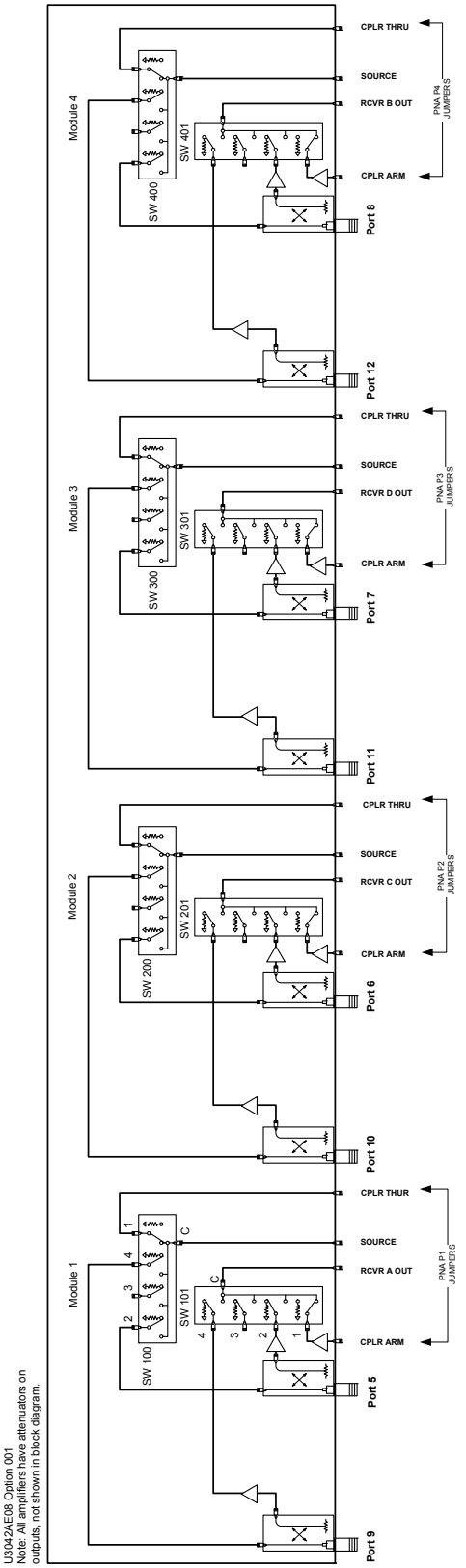
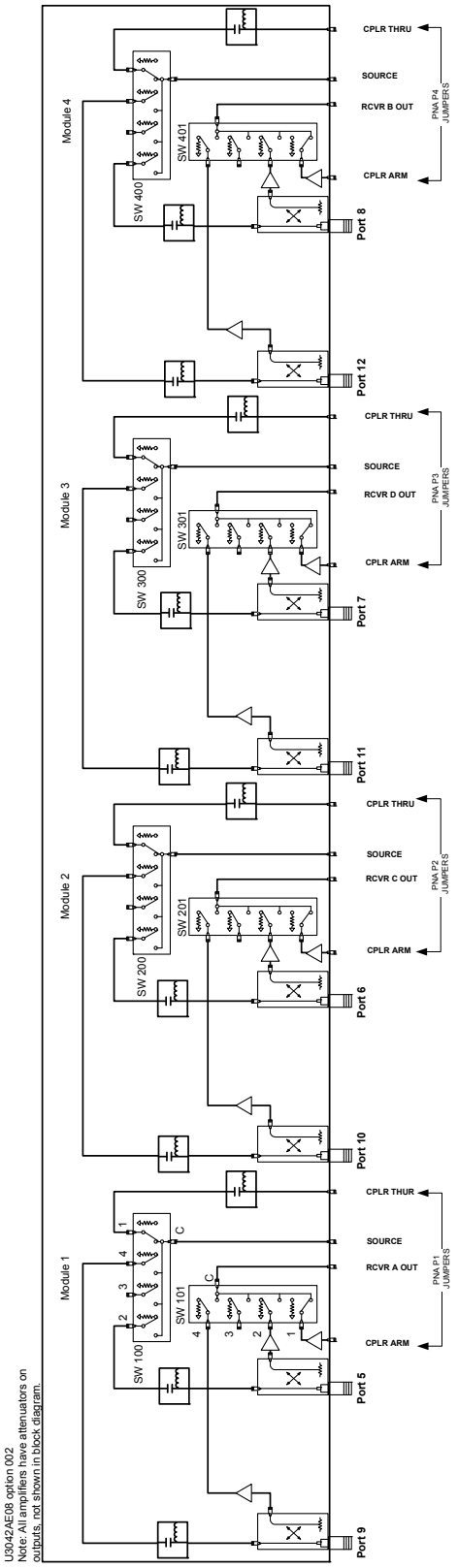


Figure 54 U3042AE08 Option 002 Configuration



Safety and Information

Introduction

Review this product and related documentation to familiarize yourself with safety markings and instructions before you operate the instrument.

This product has been designed and tested in accordance with accepted industry standards, and has been supplied in a safe condition. The documentation contains information and warnings that must be followed by the user to ensure safe operation and to maintain the product in a safe condition.

Safety Earth Ground

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

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

Declaration of Conformity

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

Statement of Compliance

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

Before Applying Power

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

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

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

CAUTION 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.

CAUTION Before switching on this instrument, make sure the supply voltage is in the specified range.

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.

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	**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	**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 opening.**

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

WARNING	**The detachable power cord is the instrument disconnecting device. It disconnects the mains circuits from the mains supply before other parts of the instrument. The front panel switch is only a standby switch and is not a LINE switch (disconnecting device).**

Connector Care and Cleaning Precautions

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

WARNING	**To prevent electrical shock, disconnect the "Agilent Technologies U3042AE08" from mains electrical supply before cleaning. Use a dry cloth or one slightly dampened with water to clean the external case parts. Do not attempt to clean internally.**

WARNING	**If flammable cleaning materials are used, the material shall not be stored, or left open in the area of the equipment. Adequate ventilation shall be assured to prevent the combustion of fumes, or vapors.**

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 instruction 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 (CISPR 11, Clause 54)

ICES/NMB-001

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

The AC symbol indicates the required nature of the line module input power.

IP 2 0

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

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

Indicates the time period during which no hazardous or toxic substance elements are expected to leak or deteriorate during normal use. Forty years is the expected useful life of the product.

This symbol on all primary and secondary packaging indicates compliance to China standard GB 18455-2001.

Battery Collection

Do not throw batteries away but collect as small chemical waste, or in accordance with your country's requirements. You may return the battery to Agilent Technologies for disposal. Refer to "Contacting Agilent" on page 68 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

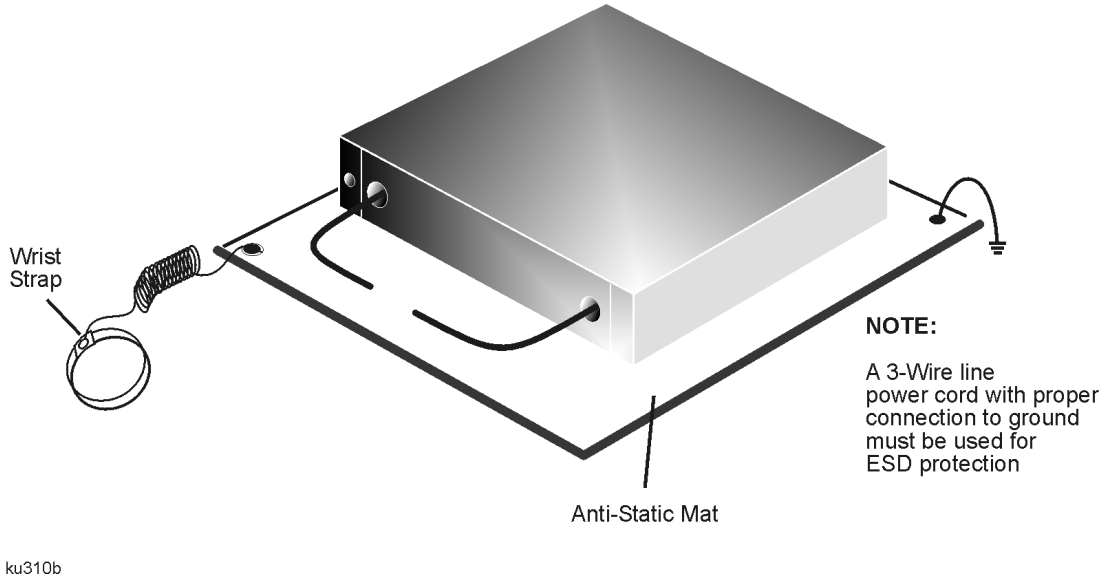
- IEC/EN 61326-1
- CISPR Pub 11 Group 1, class A
- AS/NZS CISPR 11
- This ISM device complies with Canadian ICES-001.
  Cet appareil ISM est conforme a la norme NMB du Canada.

Electrostatic Discharge Protection

Protection against electrostatic discharge (ESD) is essential while removing assemblies from or connecting cables to the network 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 55 ESD Protection Setup



Agilent Support, Services, and Assistance

Service and Support Options

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

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

Contacting Agilent

Assistance with test and measurements needs and information or finding a local Agilent office are available on the Web at:
http://www.agilent.com/find/assist

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

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

Shipping Your Product to Agilent for Service or Repair

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

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

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