Agilent Technologies
U3022AM06

User's and Service Guide

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

Agilent Technologies

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.

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).

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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U3022AM06

Introduction

This document describes how to use the U3022AM06 Multiport Test Set with the Agilent E8362B/C PNA, N5230A/C 2-Port or 4-Port PNA-L Network Analyzer, and the N5242A PNA-X for a 8 or 10-Port network analyzer solution.

Figure 1   N5230A/C 4-Port PNA-L with U3022AM06

Figure 2   E8362B 2-Port PNA-X with U3022AM06

Figure 3 **N5242A 2-Port PNA-X with U3022AM06**

Figure 4 **N5242A 4-Port PNA-X with U3022AM06**

Description

The Agilent U3022AM06 Multiport Test Set is a 6-Port mechanical switching extension test set. When the U3022AM06 PNA is combined with a E8362B/C PNA, N5230A/C PNA-L or N5242A PNA-X 2 or 4-Port Network Analyzer, the U3022AM06 provides a complete solution for 8 or 10-Port full crossbar measurements.

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

The E8362B/C PNA, N5230A/C PNA-L, and the N5242A PNA-X Network Analyzer's will be referred to as the PNA, PNA-L, and the PNA-X throughout this document.

Network Analyzer Requirement

- The Network Analyzer requires Option 551 (N-Port error correction and measurement capability).

- The E8362B/C PNA requires Option 014 to provide the test set interface connections and requires test set file u3022am06_p2.tsx.

- The N5230A/C PNA-L requires Option 145, 146, 245 and 246 to provide the test set interface connections and requires test set file u3022am06_p4.tsx *or* u3022am06_p2.tsx.

- The N5242A PNA-X requires Option 200 or 400 to provide the test set interface connections and requires test set file u3022am06_pnax_p2.tsx *or* u3022am06_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* Refer to .

- U3022AM06 Test Set Files - *http://na.tm.agilent.com/multiport* (see test set files link)

- Requires configurable test set option to provide test set interface.

Available Options

Test Set Options

The U3022AM06 has one available test set option:
Refer to "System Block Diagram" on page 84.

- Standard - mechanical switches low loss.

Accessory Options

Installation instructions are included in the option package.

- Option 1CM - Rack-mount Kit (5063-9215).
- Option 1CN - Front Handle Kit (5063-9228).
- Option 1CP - Rack-mount with front handle Kit (5063-9222).

Cable Options

The U3022AM06 has two available cable options:

- U3022A Option 030 provides the interface cable set and hardware to connect the test set to the PNA or PNA-L 2 or 4-Port.
- U3022A Option 042 provides the interface cable set and hardware to connect the U3022AM06 to the PNA-X 2 or 4-Port.

Verifying 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 Sales and Service Offices" on page 102. Keep the damaged shipping materials (if any) for inspection by the carrier and an Agilent Technologies representative.

Table 1 contains the accessories shipped with your U3022AM06.

Table 1   Content List

Agilent Part Number	Description	Qty
Common to the following Options		
9320-6636	Functional Test Certificate	1
9320-0333	Envelope-Cal Certificate	1
5023-0132	Locking Feet	1
8120-6818	Test Set I/O Cable	1
U3022-90006	U3022A Option M06 User's Guide	1
Option 030 (Cable-set for PNA, PNA-L 2 or 4-Port)		
U3022-20116	Port 1 Source to Source	1
U3022-20117	Port 1 Coupler Thru to Coupler Thru	1
U3022-20118	Port 1 Coupler Arm to Coupler Arm	1
U3022-20119	Port 1 Receiver to Receiver	1
U3022-20120	Port 2 Source to Source	1
U3022-20121	Port 2 Coupler Thru to Coupler Thru	1
U3022-20122	Port 2 Coupler Arm to Coupler Arm	1
U3022-20123	Port 2 Receiver to Receiver	1
U3022-80004	Label, Port 2	1
U3022-80006	Label, Port 9	1
U3022-80007	Label, Port 10	1
Z5623-20418	RF Cable Semi-rigid	4
Z5623-20419	RF Cable Semi-rigid	4
5063-9253	Kit Lock Feet	1
Option 042 (Cable-set for PNA-X 2 or 4-Port)		
U3042-20031	RF Cable Semi-rigid	1
U3042-20032	RF Cable Semi-rigid	1
U3042-20029	RF Cable Semi-rigid	1
U3042-20030	RF Cable Semi-rigid	1

Table 1   Content List

Agilent Part Number	Description	Qty
U3042-20041	RF Cable Semi-rigid	1
U3042-20042	RF Cable Semi-rigid	1
U3042-20043	RF Cable Semi-rigid	1
U3042-20044	RF Cable Semi-rigid	1
U3022-80006	Label (Port 9)	1
U3022-80007	Label (Port 10)	1
0515-2317	Screw	2
N5242-20138	Rear Lock Feet (right)	1
N5242-20139	Rear Lock Feet (left)	1

General Specifications

Specifications for the U3022AM06 Multiport Test Set (300 kHz to 26.5 GHz) are characteristic for the System performance of the PNA and Test Set. Actual performance of the system is based on the customers PNA and options that are used with the test set. A functional certificate is only offered for the U3022AM06.

When connected to a PNA, 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 PNA and also reduces dynamic range. The reflection tracking values measured in the "Operational Check" on page 67 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, x4)

Power Requirements

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

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

- Air conditioning equipment (or other motor–operated equipment) should not be placed on the same ac line that powers the Test Set and PNA.

- Table 2 contains the maximum wattage for all instruments. This table can be used to determine the electrical and cooling requirements.

Table 2   Power Requirements

Instrument	Maximum Wattage
N5242A	270
N5230A/C	350
U3022AM06	350
E8362B	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 the E8362B/C, N5230A/C PNA-L and N5242A User's Guide for environmental specifications.

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.

This product is designed for use in INSTALLATION CATEGORY II and POLLUTION DEGREE 2.

Environmental Tests

The U3022AM06 complies with all applicable safety and regulatory requirements for the intended location of use and have been evaluated to assure that they are consistent with Agilent quality and reliability goals. On the basis of that evaluation, the following environmental tests have been deemed unnecessary and have not been performed: temperature, humidity, shock, vibration, altitude and power line conditions.

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 2.

Required Conditions for Accuracy Enhanced Measurement

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

Dimensions and Space Requirements

Standard installation of the U3022AM06 and PNA includes configuration and installation on a customer provided lab bench, or table top of adequate size and strength.

Table 3   Instrument Dimensions

Model	Weight	Height	Width	Depth
E8362/3/4B/C	29 kg (64 lb, ±0.5 lb)	26.7 cm (10.5 in)	42.5 cm (16.7 in)	42.6 cm (16.8 in)
N5242A	34.5 kg (78 lb, ±0.5 lb)	26.7 cm (10.5 in)	42.5 cm (16.7 in)	50.8 cm (19.7 in)
N5230A/C	29.7 kg (65.5 lb, ±0.5 lb)	27.9 cm (11 in)	48.3 cm (19 in)	50.8 cm (19.7 in)
U3022AM06	11.4 kg (25 lb)	19.1 cm (7 in)	42.5 cm (16.7 in)	43.2 cm (17 in)

Frequency Range and Maximum Power Levels

Table 4   Usable Frequency Range

Instrument	Frequency
N5230A/C(PNA-L)	300 kHz to 20 GHz
N5242A(PNA-X)	10 MHz to 26.5 GHz
E8362B/C	10 MHz to 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. See Table 5.

Table 5   Power Levels

Maximum U3022AM06 Test Port RF Power Levels:	
PORT 3-8	+27 dBm 0 Vdc
Maximum U3022AM06 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 PNA specifications to determine the maximum input power levels for the PNA 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 U3022AM06 Multiport Test Set are typical. System performance for the PNA and Test Set are only characteristic and intended as non warranted information. A functional certificate is provided for the U3022AM06 only.

NOTE	Typical specifications are based on 1 to 2 units performance. Refer to Table 6, Table 19 and Table 20 on page 68.

Table 6   Typical Reflection Tracking E8362B/C or N5230A/C

Frequency	Standard 700
300 kHz to 10 MHz[1]	−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

1. N5230A/C only.

Table 7   Typical Reflection Tracking N5242A

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 5   Front Panel (Multiport Test Set)
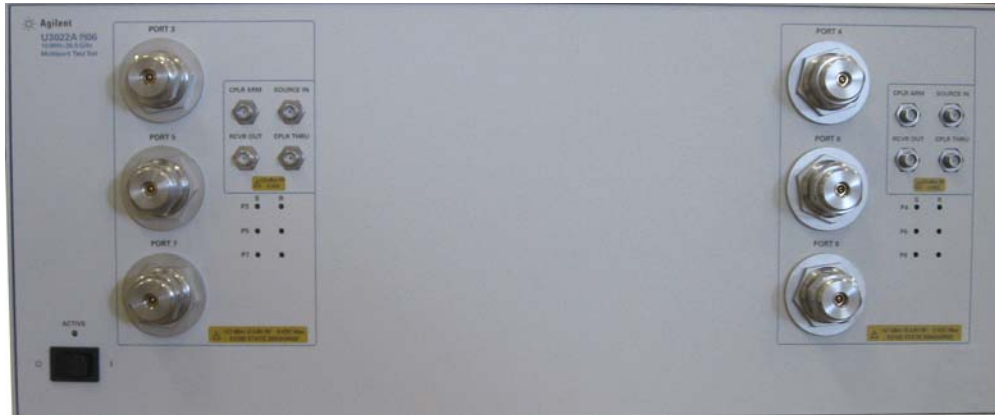
Active LED

- When the test set power switch is On and is connected and addressed by a PNA, the LED is On (illuminated).

- The LED is Off (not illuminated) when the test set power switch is in Standby, or not addressed by a PNA.

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.

Test Ports – 3.5 mm Bulkhead (male)

- Port 3–8

Access Ports – 3.5 mm (female)

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

Line Switch

⏻   – Standby

| – ON (Active LED On)

Figure 6   Rear Panel (Multiport Test Set)

Control Line   Voltage Adjust

Line Module   Test Set Interface   Pass Thru Interface
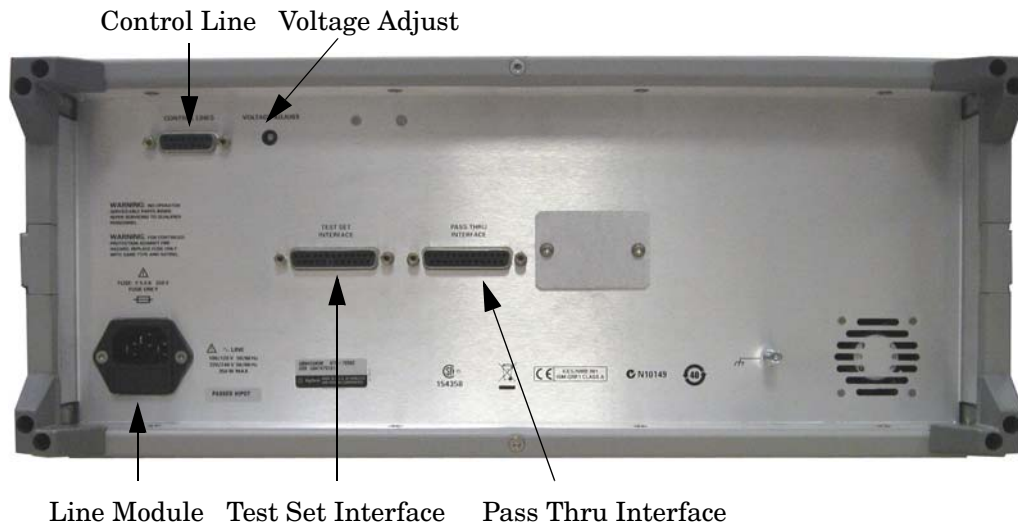
Control Lines and Voltage Adjust

For further information pertaining to control lines and voltage adjustments see "DUT Control Lines" on page 59.

Test Set Interface

The Test Set Interface connector is used to send address and data to the test set from the PNA.

Pass Through Interface

Connection to another test set.

Bias Tee Inputs - Option 002 (only)

BNC female Connectors.

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 7 **Line Fuse**

CAUTION This instrument has autoranging line voltage input; be sure the supply voltage is within the specified range.

System Setup with N5230A/C

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 while it is being opened.**

Preparing the N5230A/C Network Analyzer

1. Remove the feet from the bottom of the network analyzer. Refer to Figure 8.

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

Figure 8   Rear Bottom Feet

Standoffs (x2)

Feet (x4)
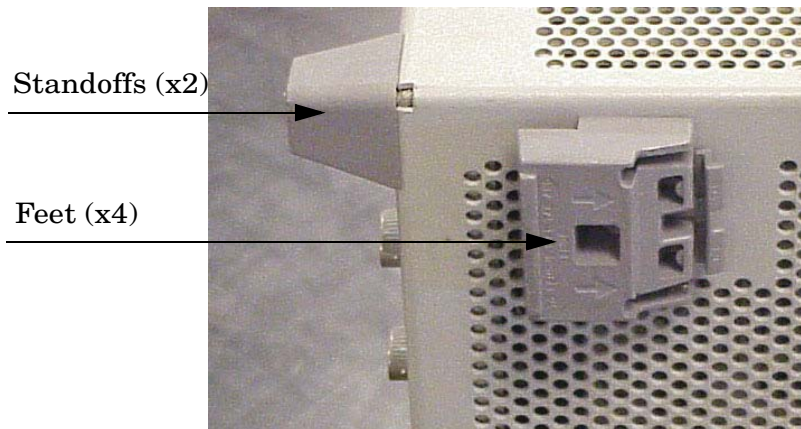
3. Install the two rear locking feet (5023-0132) onto the PNA-L, using the included screws (0515-1619), where the standoffs were removed. Refer to Figure 9.

Figure 9   Install Locking Feet
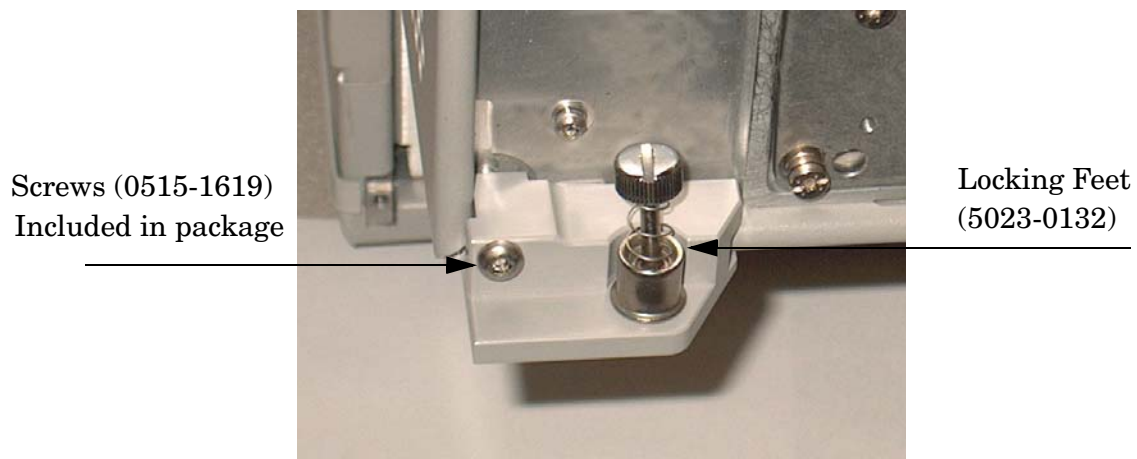
Screws (0515-1619)
Included in package

Locking Feet
(5023-0132)

4. 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 10.

Figure 10   Locking the Analyzer's
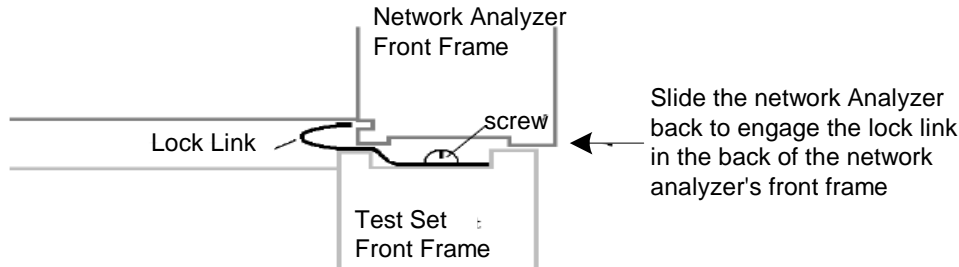
5. Secure the network analyzer's lower locking feet to the Test Set upper locking feet, using the spring–loaded screws on the locking feet. Refer to Figure 11. If the network analyzer's lower locking feet are not aligned with the screw holes in the Test Set's upper locking feet, loosen the screws securing the feet to the instrument slightly to align.

Figure 11   Locking Feet Screws

NOTE   There are two Lock-Feet kits available. Refer to "Contacting Agilent Sales and Service Offices" on page 102 for ordering information.

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

N5230A/C RF Interface Cable Connections

Figure 12 on page 19 illustrates the setup configuration of the U3022AM06 Multiport Test Set, and how it should be configured to the 4-Port 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. The Z5623-20418 are the short cables and the Z5623-20419 are the long cables. Refer to Table 8 and Figure 12 on page 19.

2. Place the port labels 9, 10 and 2 over Ports 2, 3 and 4.

- U3022-80004 (Port 2)

- U3022-80006 (Port 9)

- U3022-80007 (Port 10)

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.

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

Table 8   N5230A/C Interface Cable Connection (Option 030)

RF Cables	From PNA	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 12   N5230A/C RF Interface Connections

Port 9   Port 10   Port 2

Z5623-20419 (long)

Z5623-20418 (short)

3. Connect the PNA Test Set I/O cable (8120-6818) to the U3022AM06 Test Set Interface on the rear panel. Refer to .

E8362B/C or N5230A/C 2-Port Interface Cable Connections

Figure 12 on page 19 illustrates the setup configuration of the U3022AM06 Multiport Test Set and how it should be configured to the 2-Port PNA-L.
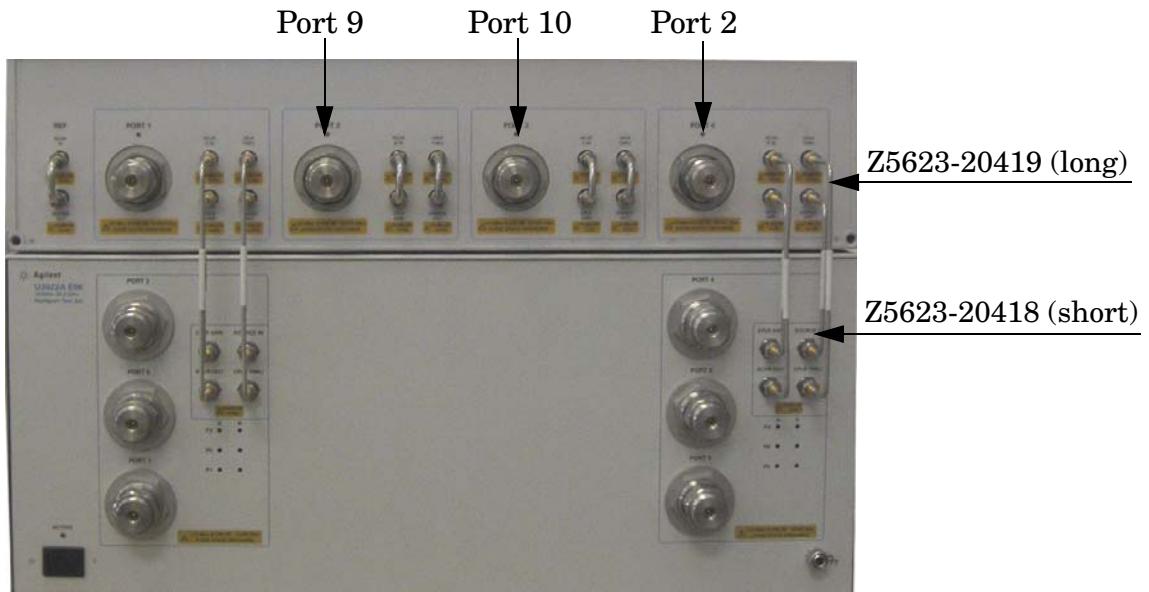
1. Connect the RF interconnect cables, supplied with this option, from the PNA-L to the Test Set. Torque each cable to 8 in-lb. The Z5623-20418 are the short cables and the Z5623-20419 are the long cables. Figure 13 on page 21 indicates the final two digits of the part number for each cable in Table 9.

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.

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

Table 9   E8362B/C or N5230A/C Interface Cable Connection (Option 030)

RF Cables	From PNA	To Test Set	Qty
U3022-20116	Port 1 SOURCE	SOURCE	1
U3022-20117	Port 1 COUPLER THRU	COUPLER THUR	1
U3022-20118	Port 1 COUPLER ARM	COUPLER ARM	1
U3022-20119	Port 1 RECEIVER	RECEIVER	1
U3022-20120	Port 2 SOURCE	SOURCE	1
U3022-20121	Port 2 CPLR THRU	CPLR THUR	1
U3022-20122	Port 2 CPLR ARM	CPLR ARM	1
U3022-20123	Port 2 RECEIVER	RECEIVER	1

Figure 13   E8362B/C or N5230A/C 2-Port
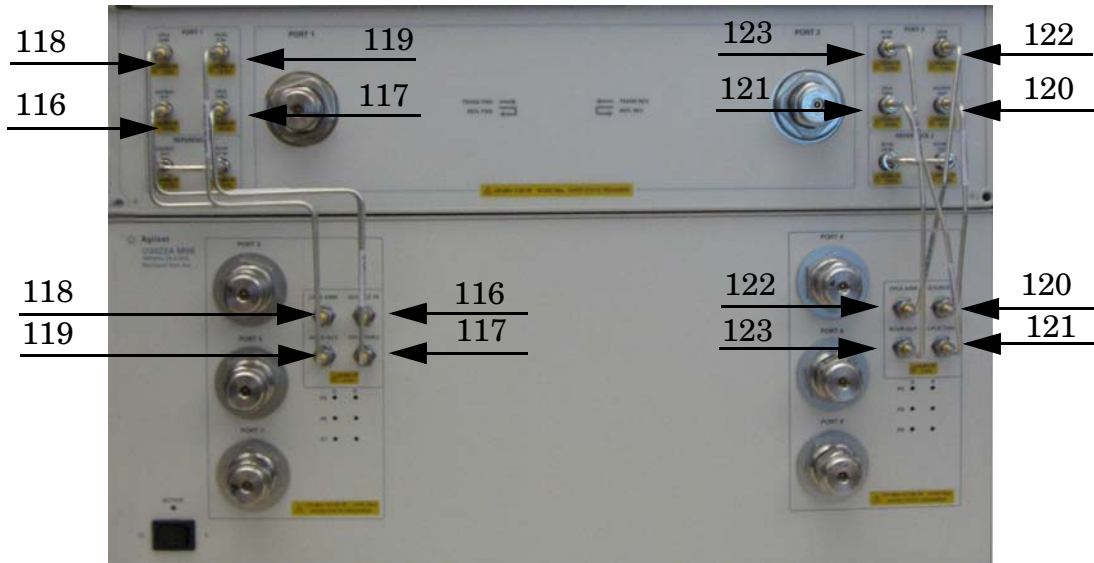
2. Connect the PNA Test Set I/O cable (8120-6818) to the U3022AM06 Test Set Interface on the rear panel. Refer to Figure 32 on page 43.

Controlling the Test Set with N5230A or E8362B

This section will describe how to setup and operate the U3022AM06 Multiport Test Set with the N5230A PNA-L or E8362B PNA Network Analyzer.

The U3022AM06 Multiport Test Set is considered a "slave" instrument. A PNA–L 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.

- PNA Multiport Mode (firmware revision $\geq$ (A.07.50.26) for the E8362B or N5230A Option 551). From the PNA drop-down menu and select **Help** > **About Network Analyzer**.

  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: u3022am06_p4.tsx
  2-Port PNA or PNA-L requires test set: u3022am06_p2.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

Installing New Firmware

Before installing new firmware into your PNA-L, you must store the mixer calibration files.

1. From the **Start** menu select **run** and enter **1** > **OK**.
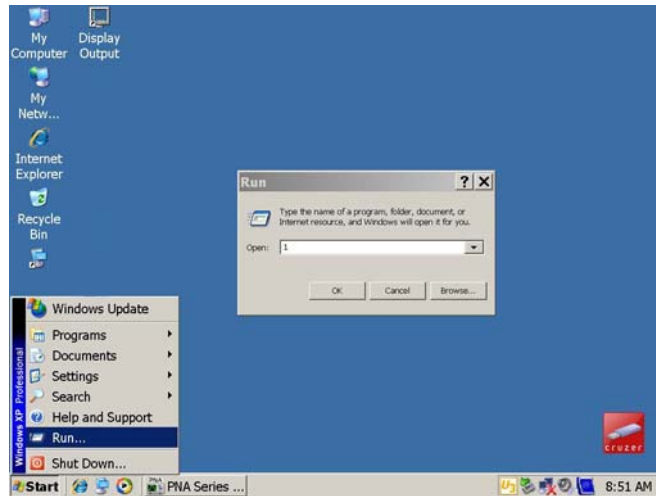
2. Command line "Enter a Choice:", using the front panel keys enter **[6]**.
3. Command line "Press any key to continue....", use any front panel key.
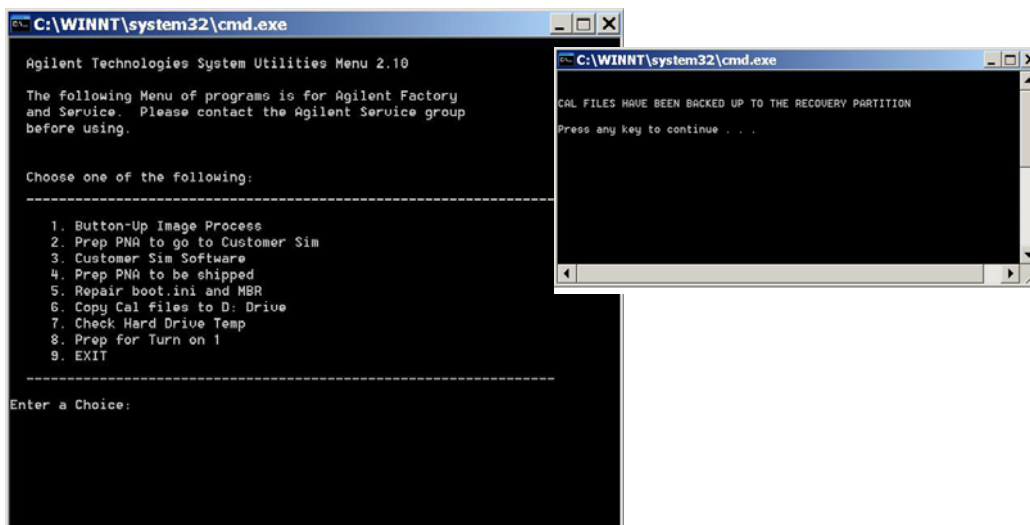
4. Copy the following three mxcalfiles from D:\CALFILES to c:\Program Files\
    Agilent\Network Analyzer.
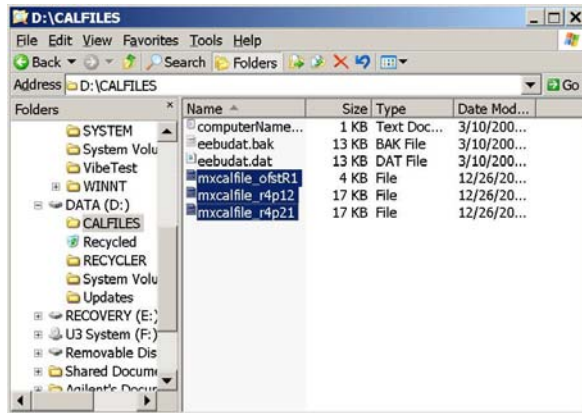
From   **To**
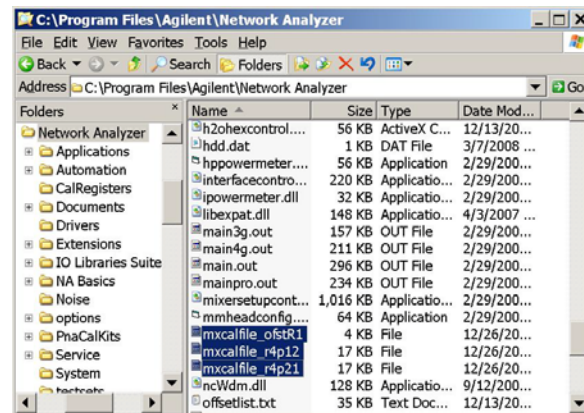
E8362B or N5230A Multiport Mode Option 551

The PNA Multiport Mode selects the test set file that will enable the PNA to control the
Test Set. The PNA Multiport Mode allows you to complete a N-Port calibration using the
Cal Wizard application in the PNA. Refer to the PNA System Help menu for more
information.

Figure 14   N5230A Options
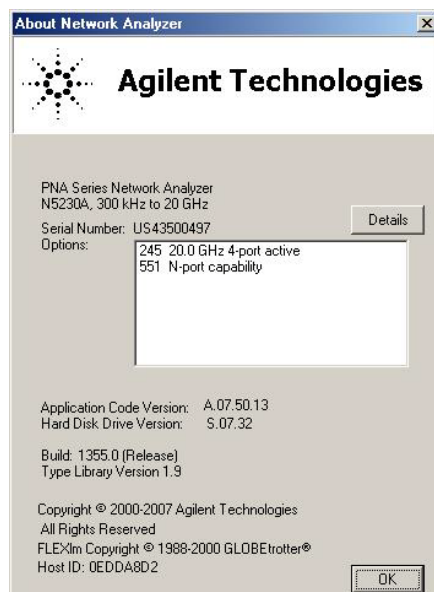
How to Access Multiport Mode

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

Figure 15   System Configuration
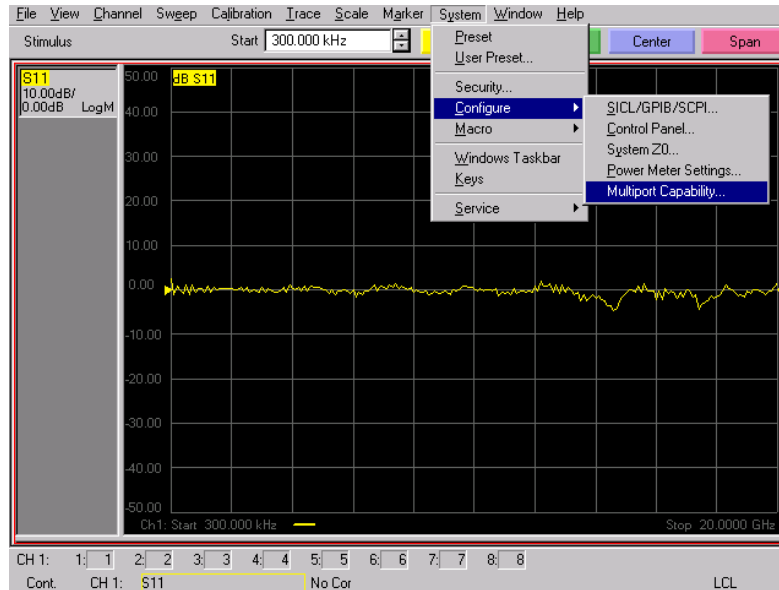
2. Select **U3022AM06** (8 or 10-Port System) from the test set drop-down menu and select **Restart as a Multiport PNA with this test set** > **OK**. The PNA will restart the network analyzer application with the U3022AM06 Multiport Test Set interface features.

If the U3022M08 is not available in the testset list, it will be necessary for you to copy the required test set file to the PNA 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 16   U3022AM06 Selection
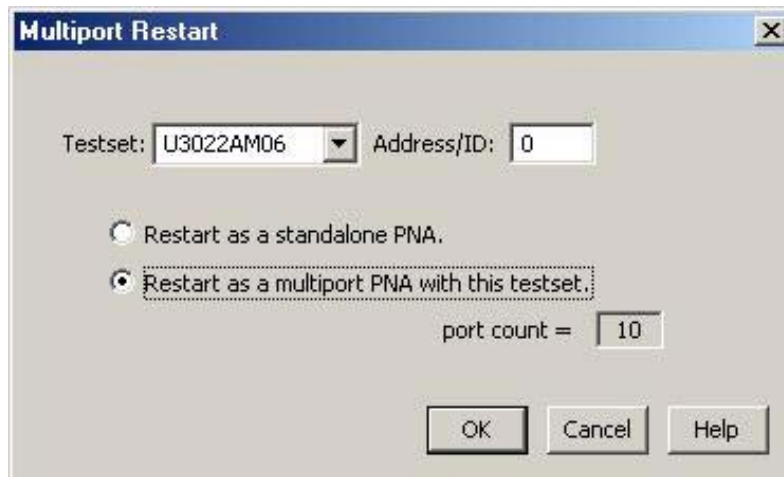
External Test Set Control Feature

NOTE   If you are using a 2-Port PNA, Ports 9 and 10 are not available. The following graphics illustrate a 10-Port configuration.

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1. To verify that the network application has the U3022AM06 interface features, select **Channel > External Test Set > Other**. The U3022AM06 will be displayed as **External Test Set Control-U3022AM06**. See Figure 17.

   This menu will allow the physical Ports 1 thru 8, or 1 thru 10 to be identified as any port for your convenience. For example; Port 5 can be named Port 2.

2. The **External Test Set Control-U3022AM06** also allows control of the DUT control lines, refer to "DUT Control Lines" on page 59. To change the state from LOW to HIGH, select the graphical user interface (GUI) for the specific control (LINE 1 thru 8) and select **OK**. Each line can be controlled separately.

Figure 17   External Test Set U3022AM06 (Port 1 - 10)
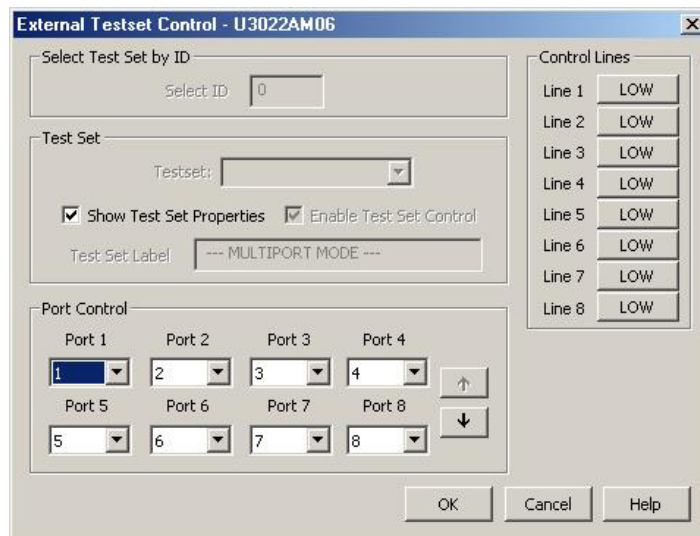
3. In the **Port Control** panel select the down arrow for Ports 9 and 10, see Figure 18.

Figure 18   External Test Set U3022AM06 (Port 9 - 10)
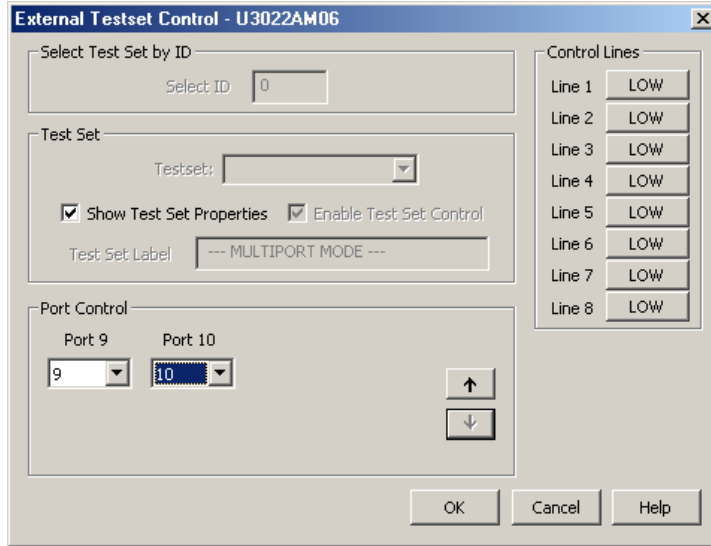
Trace Measure S-Parameter

S-Parameter selection can be accomplished using Trace Measure menu. Select **Trace > Measure**. Use the drop-down menus to select 1 of 64 to 100 S-Parameters for the 8-Port or 10-Port system, see Figure 19 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 19   N5230A Trace Measure
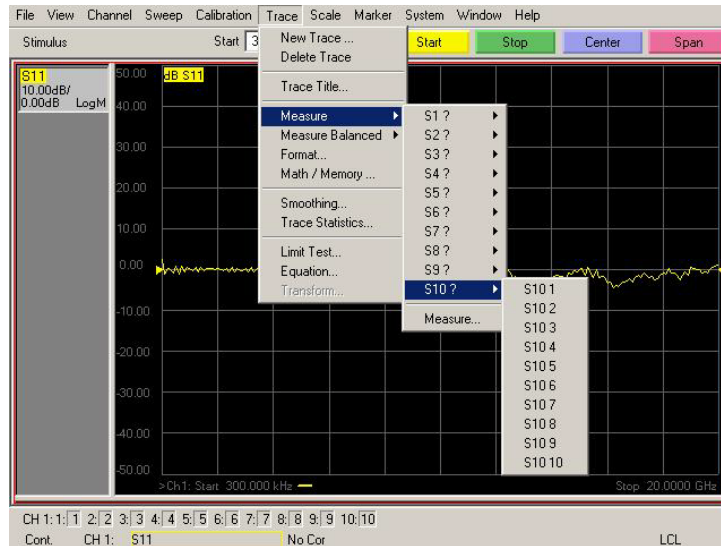
New Trace Measure S-Parameter

S-Parameter Tab:

Multiple S-Parameters can be made from the New Trace dialog box. In the drop-down menu select **Trace** > **New Trace**. The New Trace dialog box allows the selection of any of the 64 to 100 S-Parameter's. See Figure 20 and Figure 21.

Figure 20   8-Port New Trace Measure (S11 - S55)
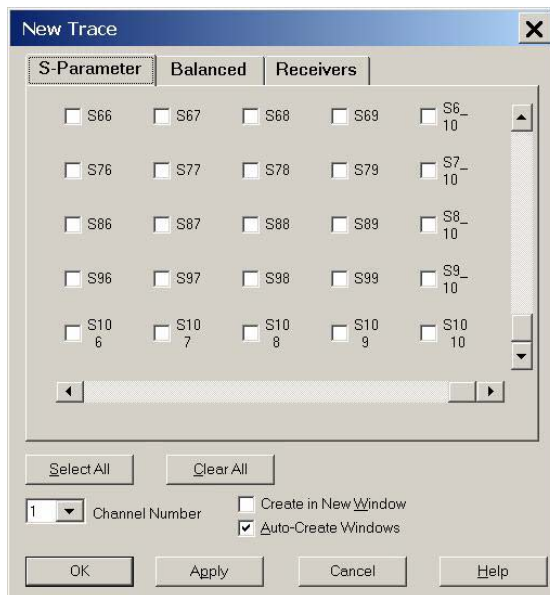
Figure 21   10-Port New Trace Measure (S66 - S1010)
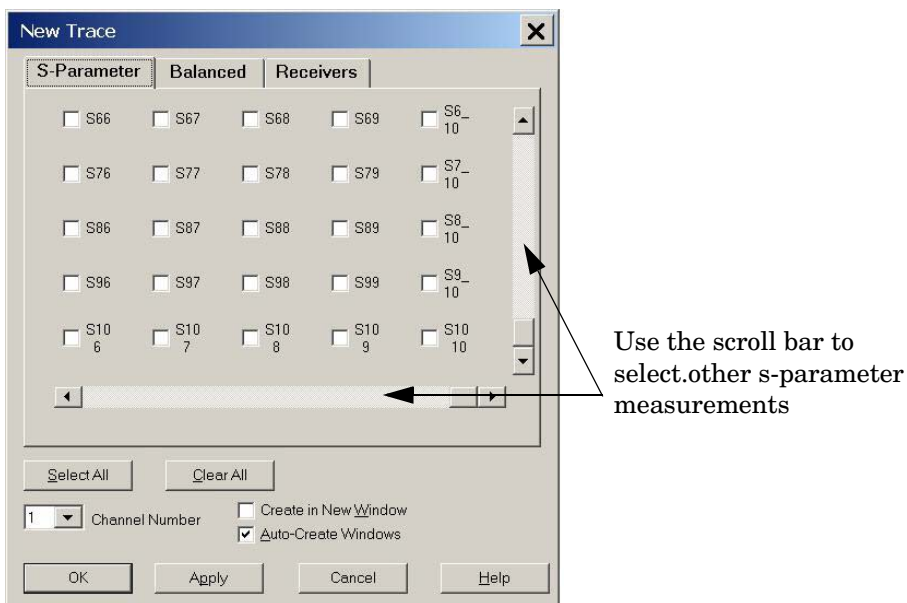
Use the scroll bar to select.other s-parameter measurements

Balanced Tab: Balanced Measurements can be configured by selecting the **Balance** tab in the New Measurement dialog box. Refer to Figure 22.

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 22   Balance
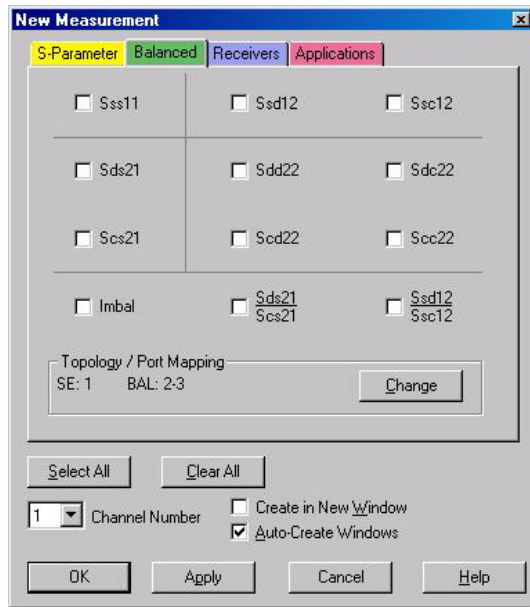
Receiver Tab: The S-Parameter measurements can be ratioed with selectable Denominators for each port and receiver. Refer to the standard N5230A PNA-L documentation for more information.

Figure 23   Receiver Ports
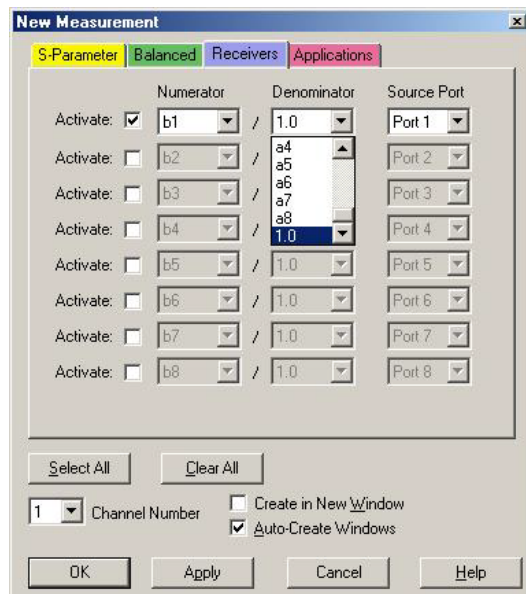
N-Port Calibration with E8362B or N5230A

It is recommended that you perform an ECal characterization to minimize the connections required for multiple port calibration, refer to Figure 24. The N4691B Option M0F is recommended with cable (85131F) if you are calibrating at the PNA 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. If measurement errors occur, ensure the newest version of firmware is installed on the PNA.

Consult with Agilent Service or the firmware web page for the latest PNA, PNA-L or PNA-X Option 551 firmware revisions and history.
htt:\\na.tm.agilent.compna\firmware\firmware.htm

1. To perform an ECal characterization select **Calibration** > **Characterize ECal Module** and follow the prompts and save the ECal characterization file, see Figure 24. Refer to the system Help menu for ECal characterizing information.

2. To perform an N-Port Calibration on the network analyzer select **Calibration** > **Calibration Wizard**. Continue following the prompts, see Figure 24.

    a. If using a mechanical cal kit, select **SmartCal**.

    b. If using an ECal module, select **ECal**.

Figure 24   ECal Characterization and Calibration Wizard
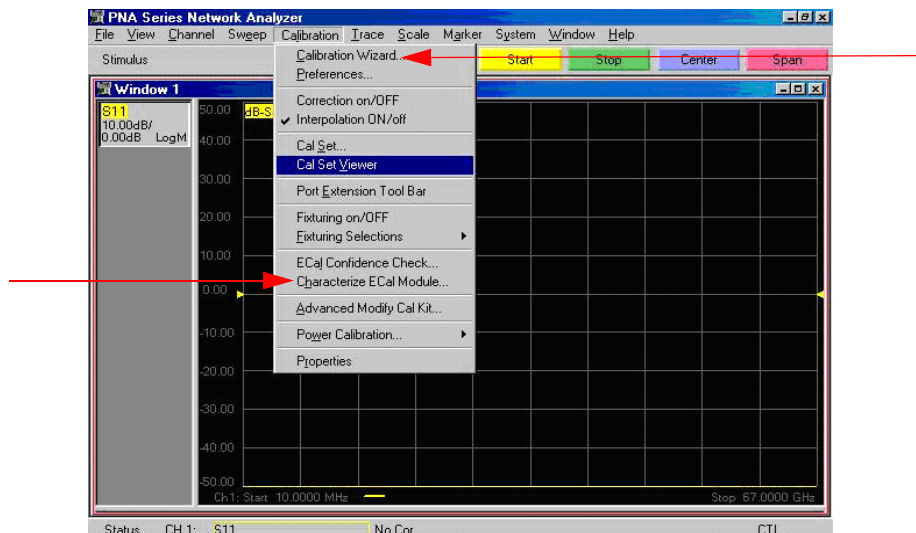
3. On the Select Calibration Ports and ECal Module dialog box, select **Select All,** or select the ports you are calibrating > select **Next**. If an ECal characterization has been done, select **View/Select ECal Module** and select the previously saved user file from step 1.

Figure 25   8 or 10-Port Calibration
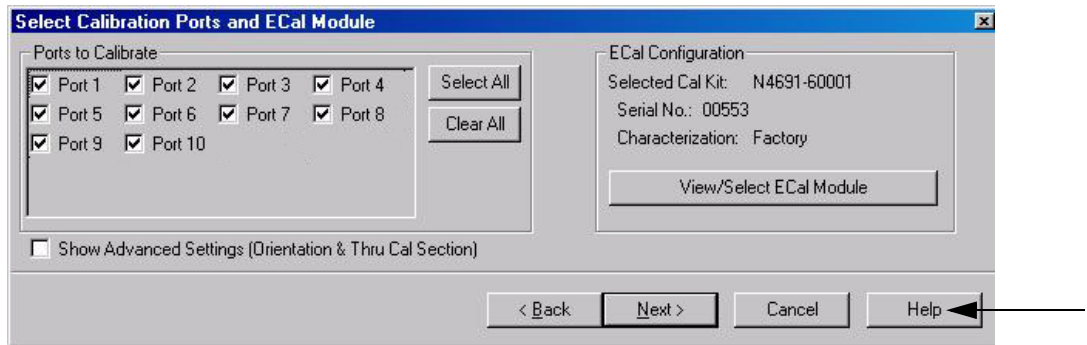
4. Connect the ECal or the mechanical cal kit to the ports you are calibrating following the Cal Wizard prompts and select **Measure** after each connection.

5. At the Calibration Completed prompt, select **Save As User Calset** and type the name desired. Select **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 PNA is in standard (non-multiport) mode.

E8362B or N5230A Interface Control

NOTE	The interface control will not function properly when using the mutliport mode. The multiport mode will reset the switch path commands of the interface control. It is recommended that the PNA 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 U3022AM06 Multiport Test Set. Applications and feature information can be found in the PNA's System **Help** 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 System 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 PNA Series Network Analyzer System **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 Settings with N5230A

This section will describe how to setup and operate the U3022AM06 Multiport Test Set with the E8362B/C or N5230A Series Network Analyzer. To access the Interface Control application select **Channel > Interface Control** in the drop-down menu.

NOTE   The Agilent E8362B and N5230A PNA–L Series Network Analyzer comes with the Interface Control application. Please review this application before connecting the U3022AM06 Test Set to the PNA. Information regarding this application can be found in the PNA System **Help** menu > **InterfaceControl**. The application is shown below.
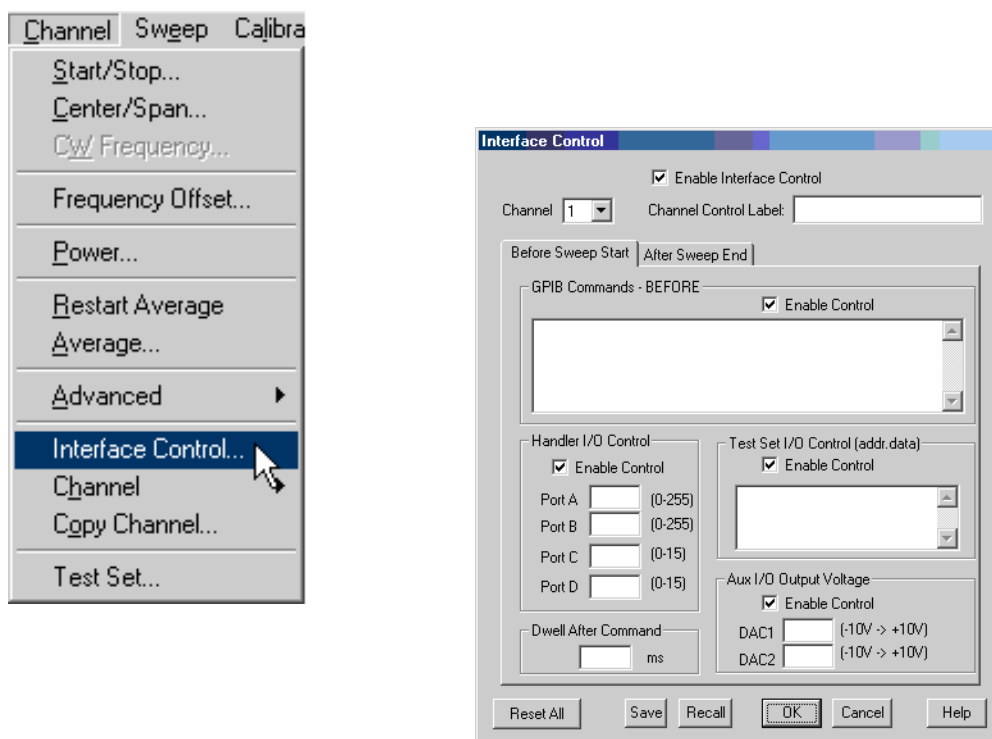
NOTE   While using Interface Control, the PNA must be in GPIB System Controller mode. Once this is complete you must restart the PNA application to go back to Talker/Listener.

Test Set I/O Address and Data using Control Interface with N5230A

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 PNA screen and the Channel Trigger State is set
                  to Hold. You must fix the condition that caused the error, then change the
                  Channel TriggeState 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.

Channel:

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 Label:

Specifies the label to be displayed on the PNA 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 PNA 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. The address also specifies
outputs on specific ports. Refer to "Test Set I/O Interface Commands" on page 64.

- 112 = DUT Control
- 0 = Ports 1, 3, 5 and 7
- 16 = Ports 2, 4, 6 and 8

Data:

Positive integer is used to select switch position or state of DUT control interface line. Refer to Table 15 on page 65 through Table 18 on page 66.

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

For example:

**0.0
16.1
32.2**

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 only by the available memory of the PNA. See "Test Set I/O Interface Commands" on page 64.

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.

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 PNA 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   U3022AM06 Test Set I/O Commands can be found in Table 15 on page 65 through Table 18 on page 66. The Address and Data commands can be entered into the Test Set I/O control.

E8362B or N5230A 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 Series Network Analyzer System 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 Series Network Analyzer System 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 select **[Menu/Dialog]** then tab to **System** > **Configure** > **SICL/GPIB.**
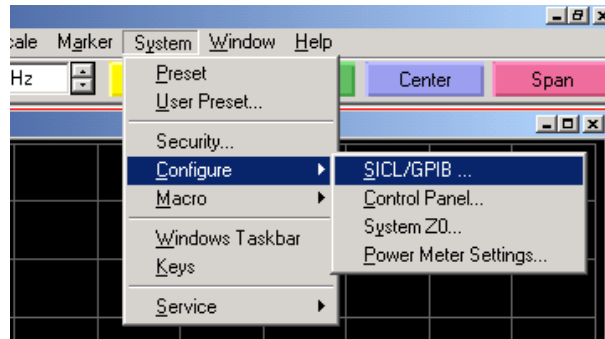
2. Select **System Controller** and **GPIB Command Processor Console** and select **OK**.
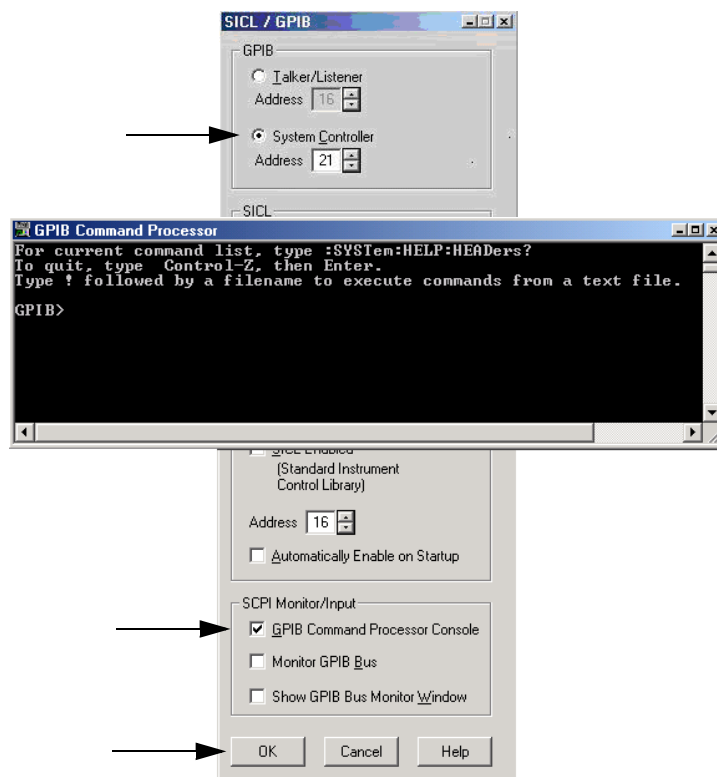
| NOTE | If the PNA is not in System Controller mode, an error message appears and the GPIB Command Processor is disabled. To correct this situation, place the PNA in System Controller mode and restart the GPIB Command Processor Console. |

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 Table 15 on page 65.

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 26.

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

Figure 26   Rear Bottom Feet

Standoffs (x2)

Feet (x4)
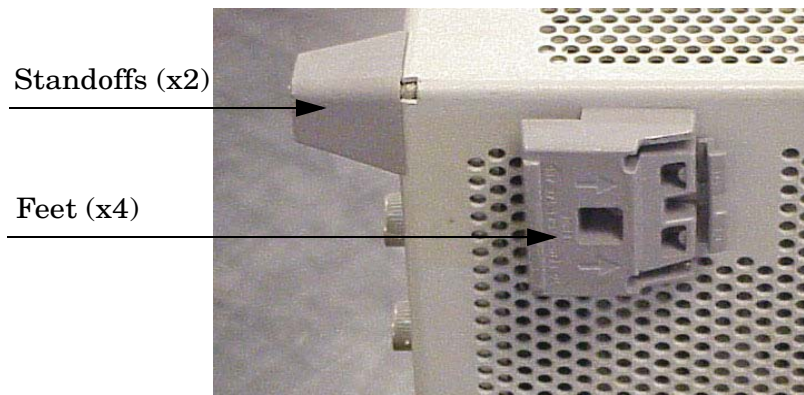
3. Install the two rear locking feet (5023-0132) onto the PNA-X, using the included screws (0515-1619), where the standoffs were removed. Refer to Figure 27.

Figure 27   Install Locking Feet on N5242A

Screws (0515-1619)
Included in package

Locking Feet
(5023-0132)
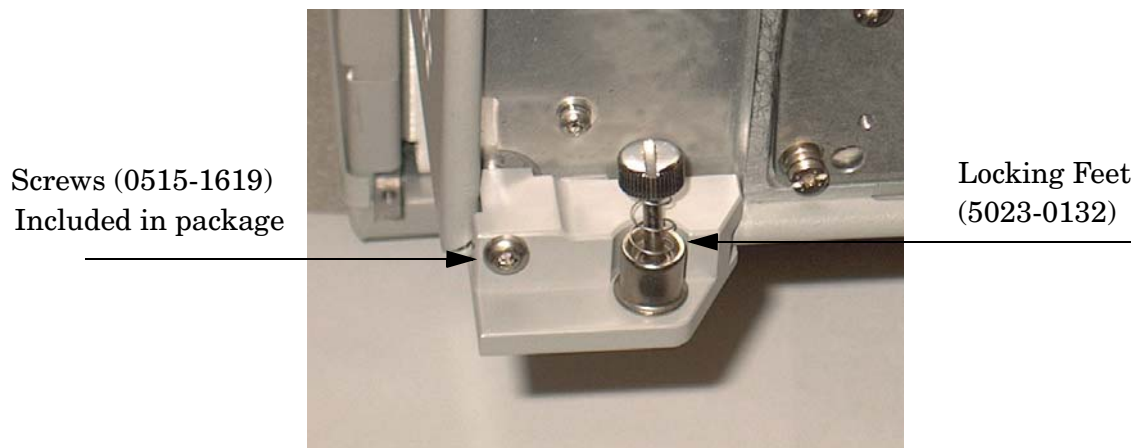
4. Install the two rear locking feet onto the U3022AM06. Looking at the front panel, the N5242-20138 is the right foot and the N5242-20139 is the left foot. Two screws (0515-2317) are included with this option. Refer to Figure 28.

Figure 28   Install Locking Feet on U3022AM06

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 29.

Figure 29   Locking the Analyzer's
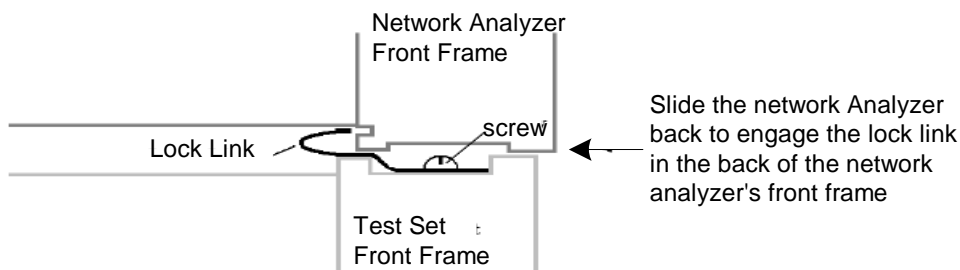
6. Secure the network analyzer's lower locking feet to the Test Set upper locking feet, using the spring–loaded screws on the locking feet. Refer to Figure 30. If the network analyzer's lower locking feet are not aligned with the screw holes in the Test Set's upper locking feet, loosen the screws securing the feet to the instrument slightly to align.

Figure 30   Locking Feet Screws

NOTE	There are two Lock-Feet kits available. Refer to "Contacting Agilent Sales and Service Offices" on page 102 for ordering information.

- PNA – 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 31 illustrates the setup configuration of the U3022AM06 Multiport Test Set and how it should be configured to the PNA-X. The cables have been supplied with Option 042.

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. Figure 31 indicates the final two digits of the part number for each cable in Table 10.

2. Place the port labels 9 and 10 over Ports 3 and 4.

- U3022-80006 (Port 9)
- U3022-80007 (Port 10)

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

Table 10   N5242A RF Interface Cable Connection (Option 042)

Numeric Order	RF Cables	From PNA-X	To Test Set
1	U3042-20031	Port 1 SOURCE OUT	Ports 3, 5 and 7 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	U3042-20041	Port 2 CPLR ARM	Ports 4, 6 and 8 CPLR ARM
6	U3042-20043	Port 2 SOURCE OUT	Port 8 SOURCE IN
7	U3042-20044	Port 2 CPLR THRU	Port 8 CPLR THRU
8	U3042-20042	Port 2 RCVR B IN	Port 8 RCVR OUT

Figure 31   N5242A RF Interface Cable Connections
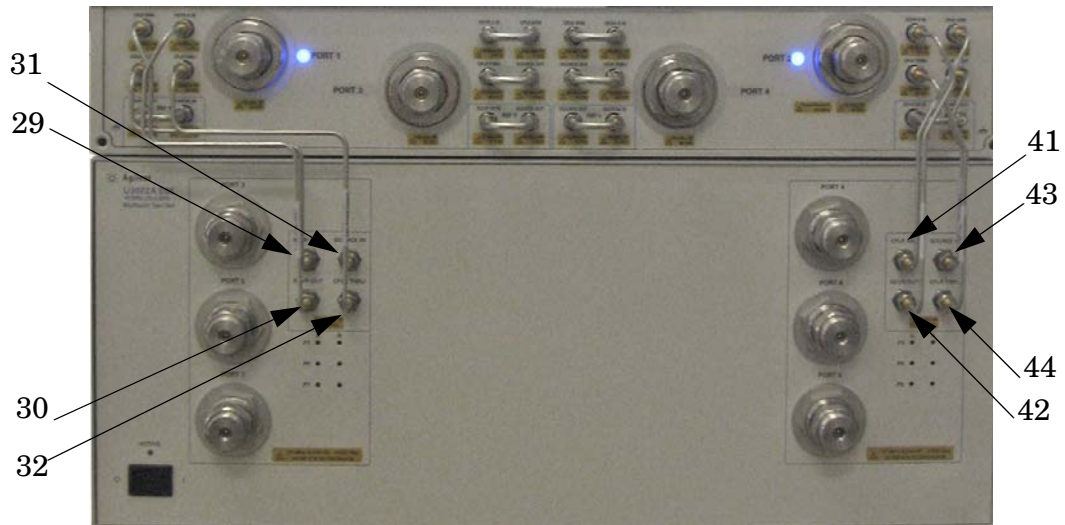
3. Connect the PNA-X Test Set I/O cable (8120-6818) to the U3022AM06 Test Set Interface on the rear panel.

Figure 32   N5242A Test Set I/O Cable Connection

Controlling the Test Set with E8362C, N5230C or N5242A

This section will describe how to setup and operate the U3022AM06 Multiport Test Set with the E8362C, N5242A or N5230C.

NOTE	The internal firmware of the Agilent E8362C and N5230C has not been modified for this test set option. Power levels may differ from those indicated on the PNA when the Test Set is connected.

The U3022AM06 Multiport Test Set is considered a "slave" instrument. A E8362C, 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. See Figure 33.

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

Figure 33   N5230C and N5242A Options
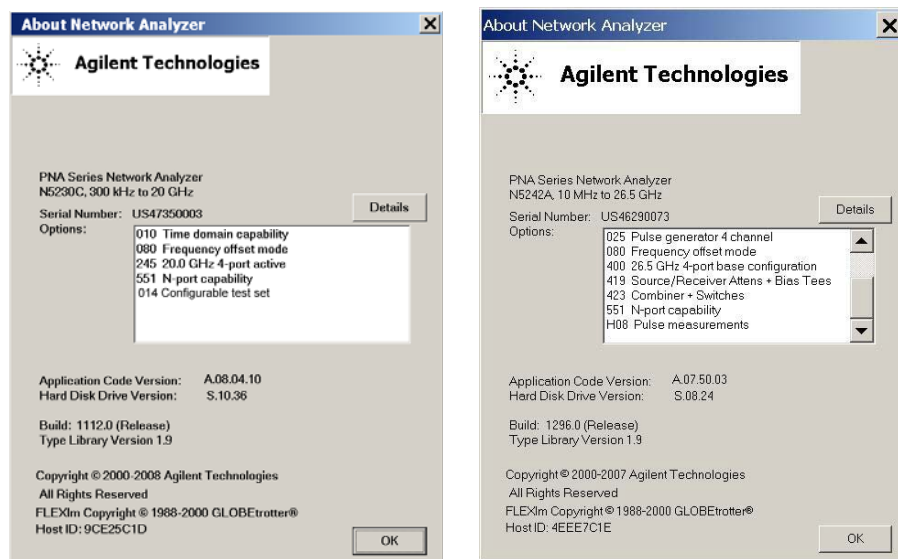
- The following test set file must be installed into network analyzer file directory:
  c:\Program Files\Agilent\Network Analyzer\testsets

- 2-Port PNA or PNA-L requires test set: u3022am06_p2.tsx

- 4-Port PNA-L requires test set: u3022am06_p4.tsx
  4-Port PNA-X requires test set: u3022am06_pnax_p4.tsx *or*
  2-Port PNA-X requires test set: u3022a_m06_pnax_p2.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
You may also refer to "Installing New Firmware" on page 23 in this manual.

Multiport Mode for E8362C, N5230C and N5242A with Option 551

The PNA multiport mode selects the test set file that will enable the PNA to control the Test Set. The PNA multiport mode allows you to complete a N-Port calibration using the Cal Wizard application in the PNA. Refer to the PNA System Help menu for more information. Refer to for the N5230C Options.

How to Access Multiport Mode

The Option 551 must be installed for Multiport capability.

1. To access the multiport application select **Utility > System > Configure > Multiport Capability**.

Figure 34   Selecting Multiport Mode
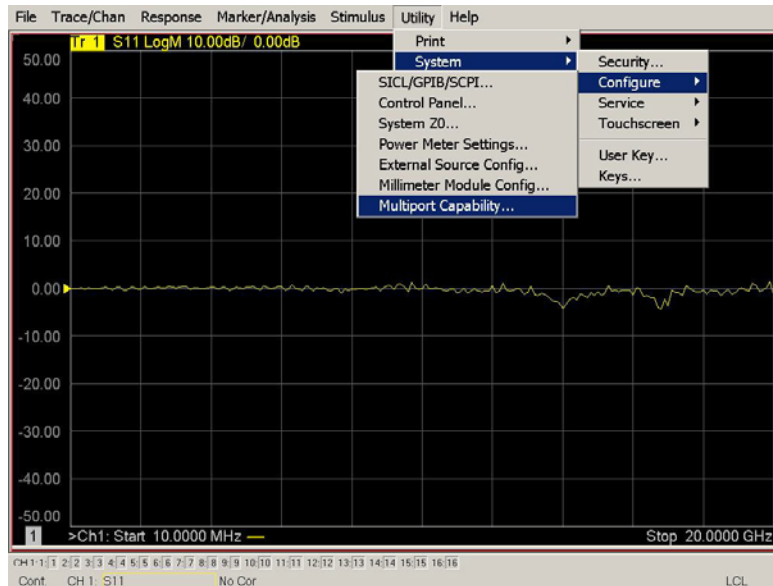
2. Select **U3022AM06** (8 or 10-Port System) from the test set drop-down menu and select **Restart as a Multiport PNA with this test set**. Select **OK**. The PNA will restart the network application with the U3022AM06 Multiport Test Set interface features. See .

If the U3042M06 is not available in the testset list, it will be necessary for you to copy the required test set file to the PNA 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.

External Test Set Control Feature

NOTE   If you are using a 2-Port PNA, Ports 9 and 10 are not available. The following
                  graphics illustrate a 10-Port configuration.

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1. To verify that the network application has the U3022AM06 interface features, select
   Trace/Chan > **Channel** > **Hardware Setup** > **External Test Set** > **Other**. The U3022AM06
   will be displayed as **External Test Set Control-U3022AM06**. See Figure 35, Figure 37 on
   page 47 and Figure 38 on page 48.

Figure 35   External Test Set Control
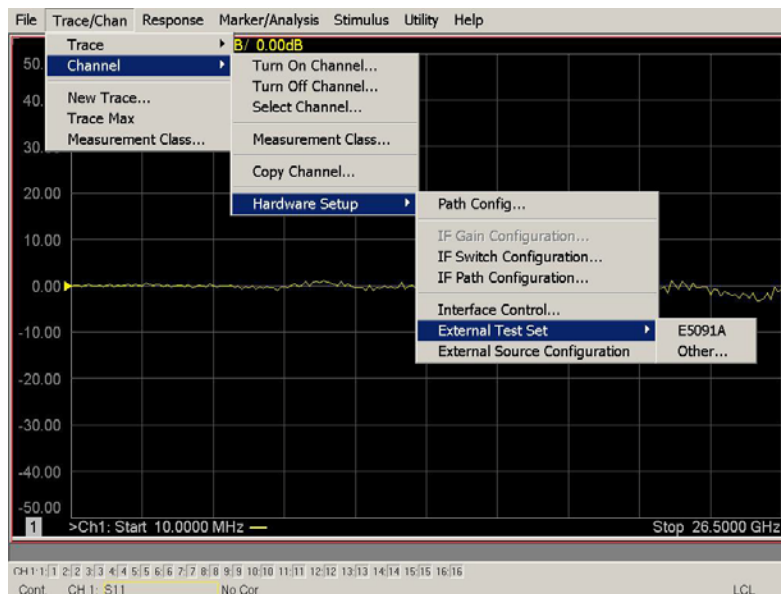
   This menu will allow the physical Ports 1 thru 10 to be identified as any port for your
   convenience. For example; Port 5 can be named Port 2.

2. The **External Test Set Control-U3022AM06** also allows control of the DUT control lines,
   refer to "DUT Control Lines" on page 59. To change the state from LOW to HIGH, select
   the graphical user interface (GUI) for the specific control (LINE 1 thru 8) and then
   select **OK**. Each line can be controlled separately, see Figure 17 on page 26.

3. Select the **Port Control** down arrow for Ports 9 thru 10, see Figure 18 on page 27.

Trace Measure S-Parameter

1. S-Parameter selection can be accomplished using **Response** > **Measure**. Use the drop-down menus to select 1 of 100 S-Parameters for the 10-Port system, see Figure 36. 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 36   Trace Measure
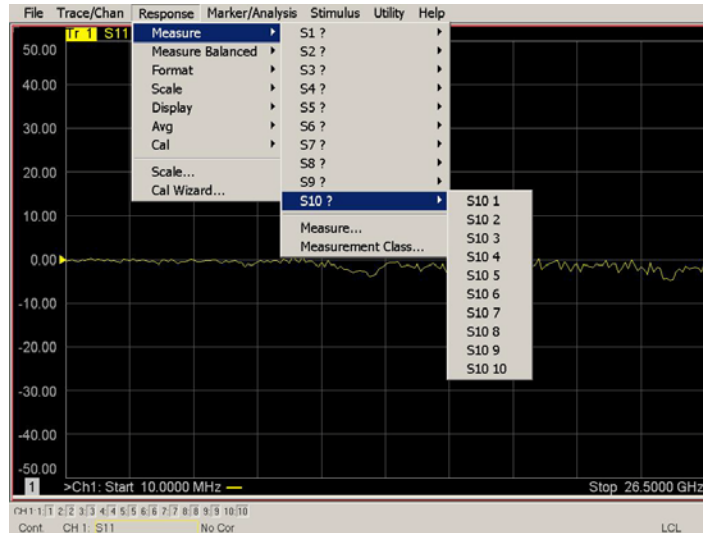
New Trace Measure S-Parameter

1. **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 Trace dialog box allows the selection of the 100 S-Parameter's. Refer to Figure 37 and Figure 38.

Figure 37   New Trace Measure
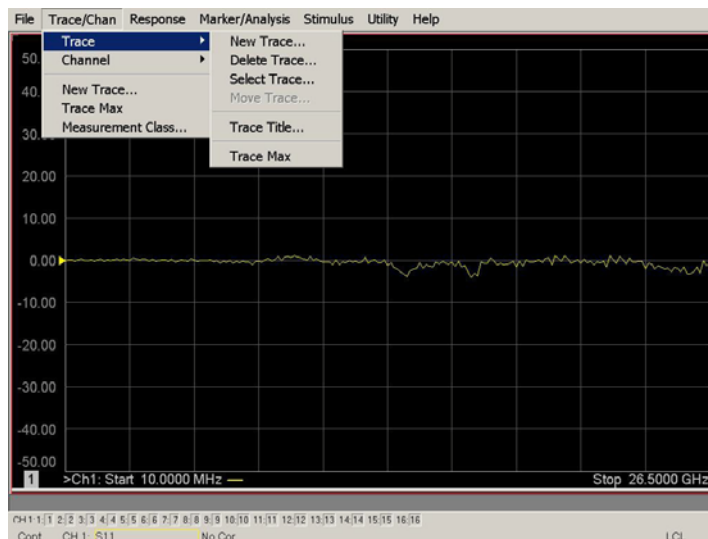
Figure 38   10-Port New Trace Measure (S11 - S55)

Use the scroll bar
to select other
s-parameter
measurements
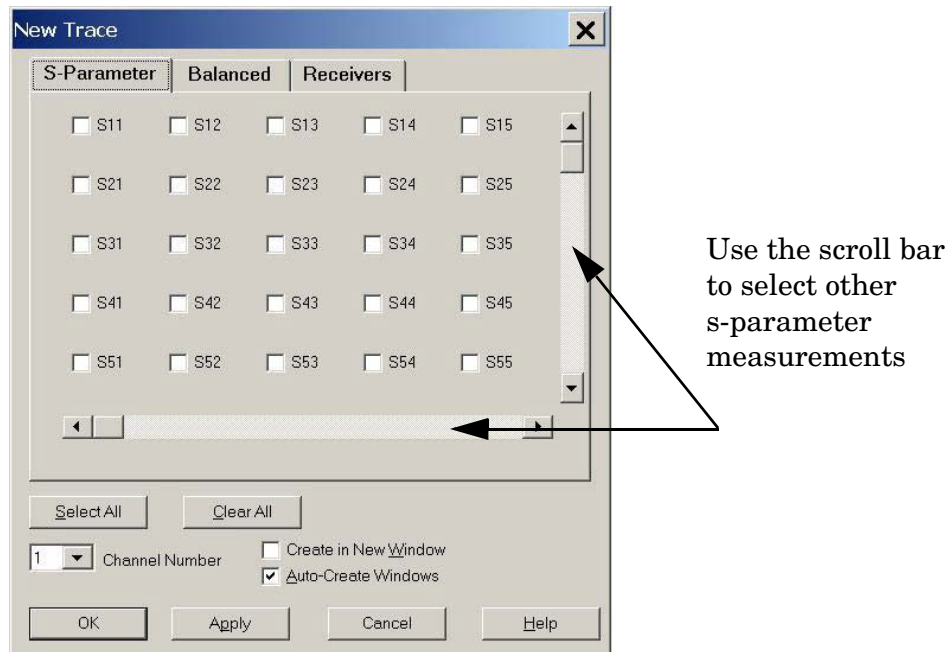
Figure 39   10-Port New Trace Measure (S88 - S1010)
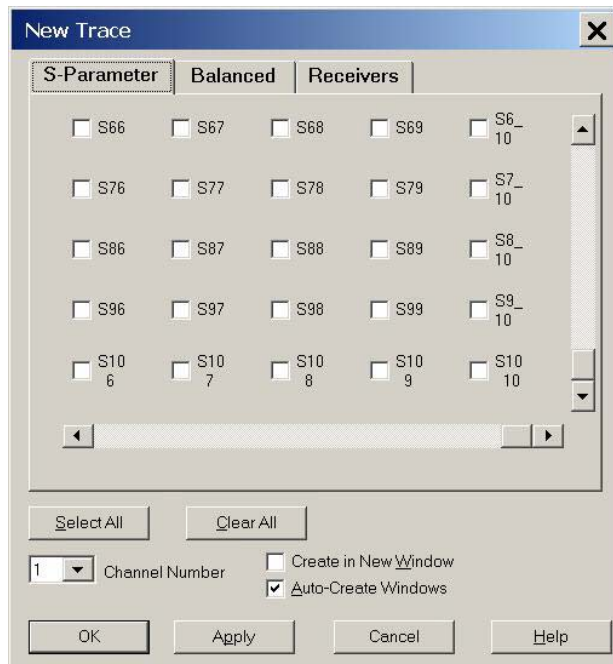
Balanced Tab: Balanced Measurements can be configured by selecting the **Balance** tab in the New Measurement dialog box. Refer to Figure 22.

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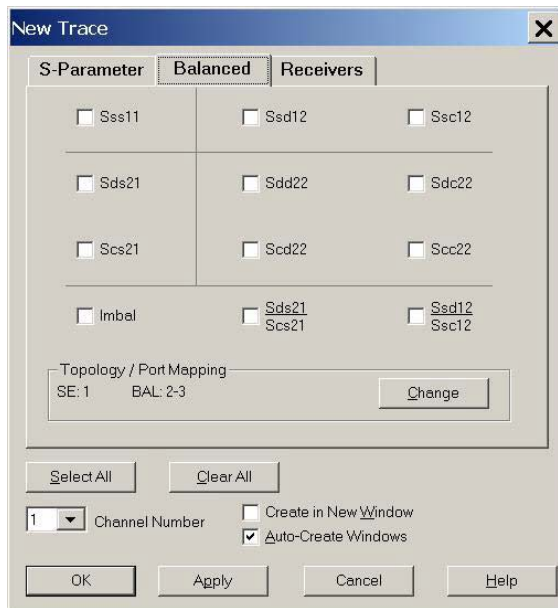
Receiver Tab: The S-Parameter measurements can be ratioed with selectable Denominators for each port and receiver. Refer to the standard PNA-X documentation for more information.

Figure 41   Receiver Measurements
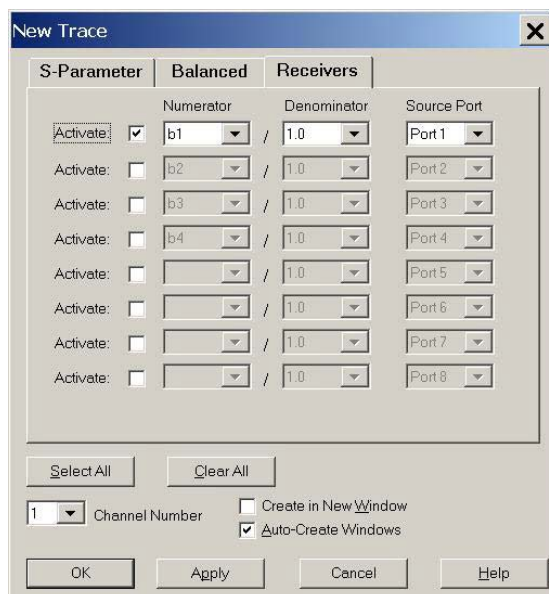
N-Port Calibration with E8362C, N5230C or N5242A

It is recommended that you perform an ECal characterization to minimize the connections required for multiple port calibration, refer to Figure 42. The N4691B Option M0F is recommended with cable (85131F) if you are calibrating at the PNA 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 PNA. 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*

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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, see Figure 42. Refer to the Help menu for further information on characterizing.

2. On the network analyzer select **Response > Cal Wizard**, see Figure 42.

   a. If using a mechanical cal kit, select **SmartCal**.

   b. If using an ECal module, select **ECal**.

Figure 42   ECal Characterization and Calibration Wizard
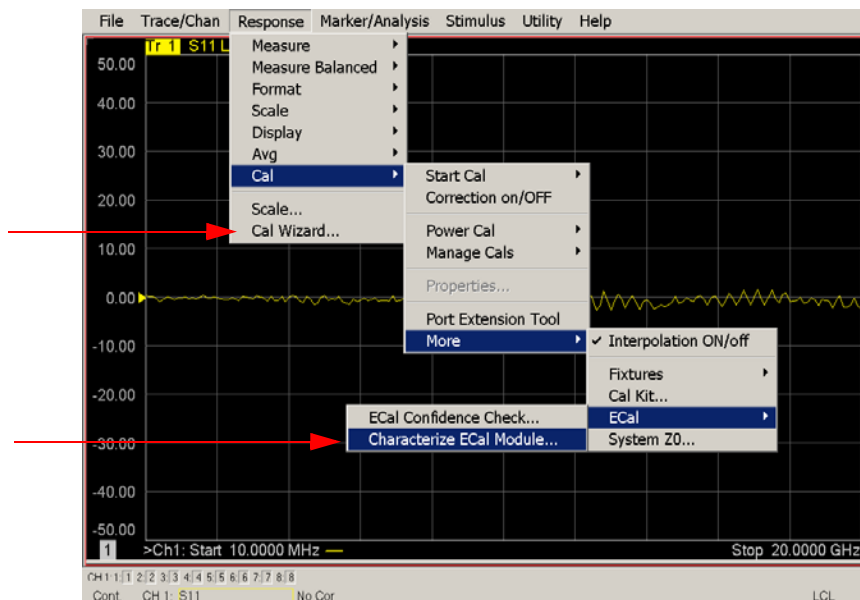
3. In the Select Calibration Ports and ECal Module dialog box, select **Select All,** or select the ports you are calibrating and select **Next**. If an ECal characterization has been done, select **View/Select ECal Module** and select the previously saved user file from step 1. Refer to Figure 43.

Figure 43   8 or 10-Port Calibration
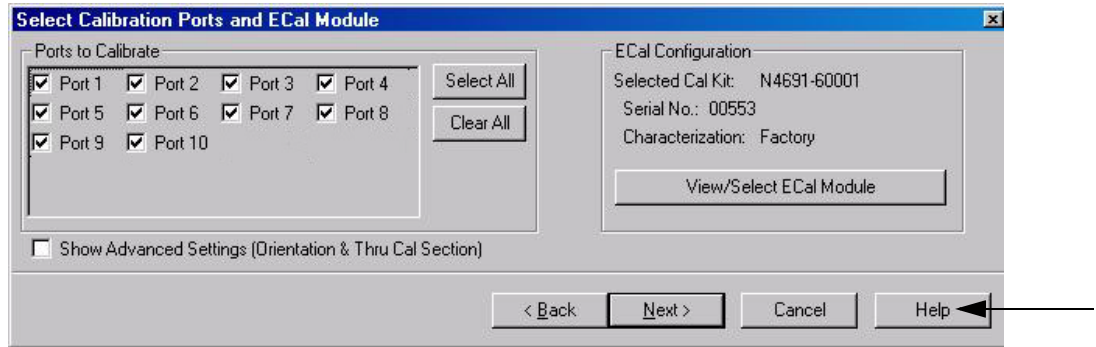
4. Connect the ECal or the mechanical cal kit to the ports you are calibrating following the Cal Wizard prompts and select **Measure** after each connection.

5. At the Calibration Completed prompt, select **Save As User Calset** and type the name desired. Select **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 PNA is in standard (non-multiport) mode.

E8362C, N5230C or N5242A Interface Control

NOTE	The interface control will not function properly when using the mutliport mode. The multiport mode will reset the switch path commands of the interface control. It is recommended that the PNA 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 U3022AM06 Multiport Test Set. Applications and feature information can be found in the PNA's System **Help** 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 System 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 PNA Series Network Analyzer System **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 Settings

This section will describe how to setup and operate the U3022AM06 Multiport Test Set with the PNA. To access the **Interface Control** application select **Trace/Chan** > **Channel** > **Hardware Setup** > **Interface Control** in the drop-down menu list.

NOTE   The PNA Series Network Analyzer comes with the Interface Control application. Please review this application before connecting the U3022AM06 Test Set to the PNA. Information regarding this application can be found in the PNA's System **Help** menu > **InterfaceControl**. The application is shown below.
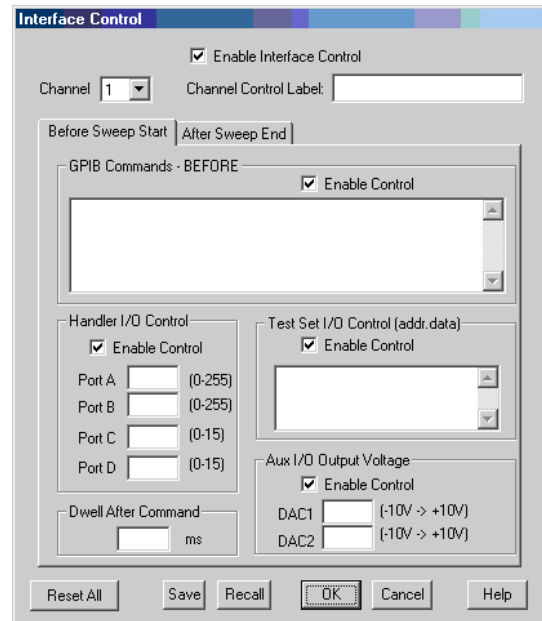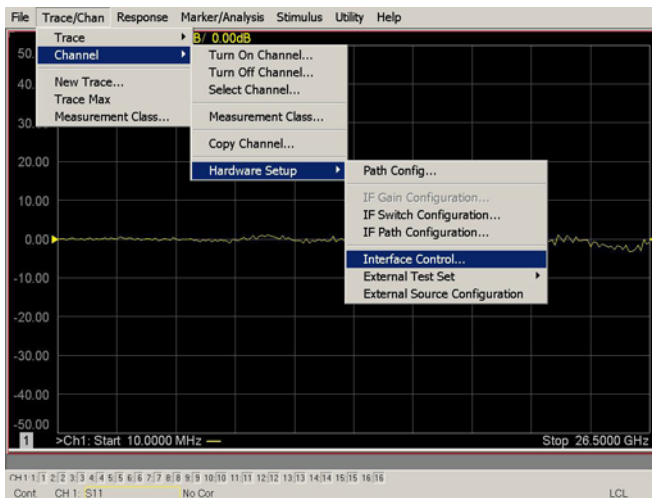
NOTE   While using Interface Control, the PNA must be in GPIB System Controller mode. Once this is complete you must restart the PNA application to go back to Talker/Listener.

Address and Data using Control Interface with E8362C, 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 PNA screen and the Channel Trigger State is set to Hold. You must fix the condition that caused the error, then change the Channel TriggeState 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.

Channel:

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 Label:

Specifies the label to be displayed on the PNA 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 PNA 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 64.

- 112 = DUT Control
- 0 = Ports 1, 3, 5 and 7
- 16 = Ports 2, 4, 6 and 8

Data:

Positive integer is used to select switch position or state of DUT control interface line. Refer to Table 15 on page 65 through Table 18 on page 66.

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

For example:

0.0
16.1
32.2

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 only by the available memory of the PNA. See "Test Set I/O Interface Commands" on page 64.

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.

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 PNA 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	U3022AM06 Test Set I/O Commands can be found in "Test Set I/O Interface Commands" on page 64. The Address and Data commands can be entered into the Test Set I/O control.

N5230C or N5242A 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 Series Network Analyzer System 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 Series Network Analyzer System 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 select **Utility > System > Configure > SICL/GPIB/SCPI**.

Figure 44   Utility Configure
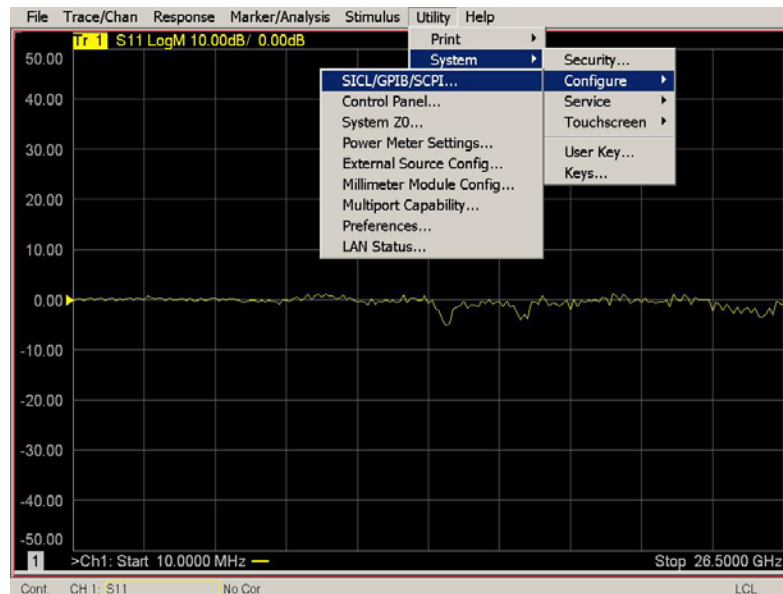
2. Select **GPIB Command Processor Console** and select **OK**.

Figure 45   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 64.

DUT Control Lines

The 15 pin female D-Sub connector on the rear 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 13 and Figure 49 on page 63.

Setting the DUT Control Interface

This section describes how to control the DUT control lines. Refer to "Controlling the Test Set with E8362C, N5230C or N5242A" on page 44 or "Controlling the Test Set with N5230A or E8362B" on page 22. For more information regarding the control lines, see Table 11 on page 59 and Table 12 on page 60.

Table 11   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 46   DUT Control Line Pin Assignment
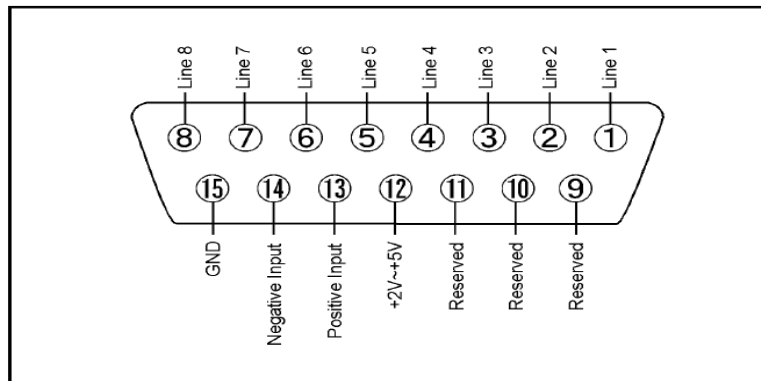
Table 12   DUT Control Line Pin Assignment

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 U3022AM06.

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 47 illustrates an example of the connection between the DUT and the U3022AM06 *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 47   Control Line Connector
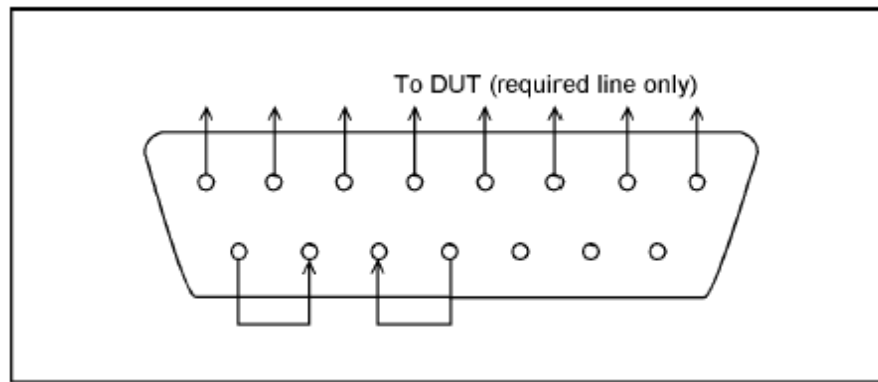
Using an External Power Supply

Figure 47 illustrates an example of the connection between the DUT and the U3022AM06 *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 U3022AM06 using an External Power Supply.

1. Turning On the U3022AM06.

2. Connect the DUT.

3. Turn On the external power supply.

Turning Off the U3022AM06 using an External Power Supply.

1. Turning Off the Power Supply.

2. Turning Off the U3022AM06.

3. Disconnect the DUT.

Figure 48   U3022AM06 to the DUT and External DC Power Supply
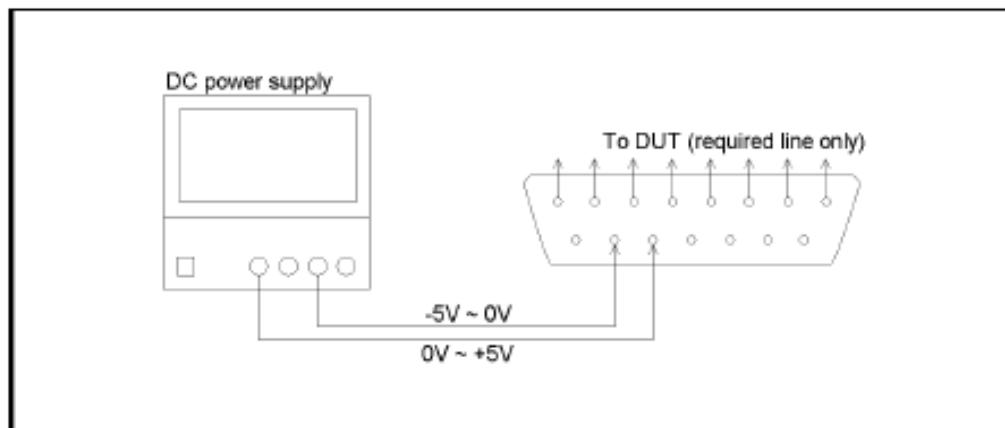
Table 13   DUT Control Specifications

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 49   Block Diagram of DUT Control
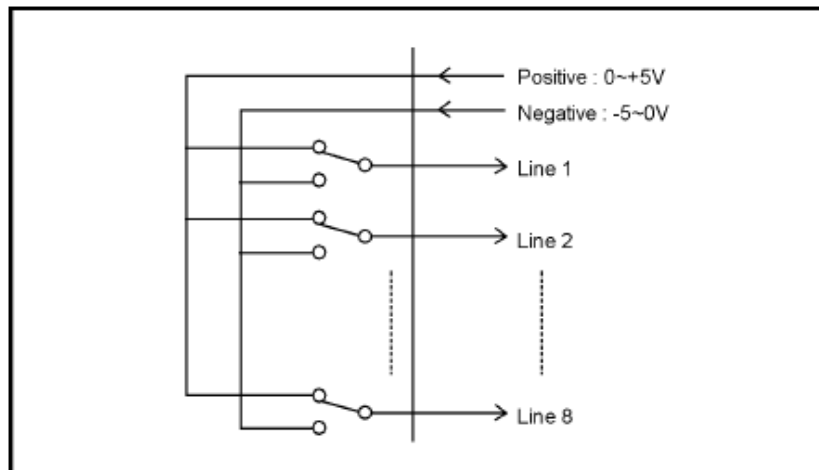
Test Set I/O Interface Commands

Switch Address and Data

Table 15 through Table 18 contain the information to set the internal switch paths of the U3022AM06 Test Set. Additional information regarding the operation and descriptions for the internal switches can be found in "Theory of Operation" on page 82.

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 decimal values together to determine the data command value, which is the second number in the test set I/O or GPIB command. Refer Table 14.

Table 15 and Table 16 on page 65 illustrates Port 1, 3, 5 and 7 as the configured source and receiver paths. Refer to Table 14 to calculate other path combinations.

Example:

If Port 3 is to be the source and Port 4 is to be the receiver.

then;

Source Port 3 = address 0, decimal 2 and Receiver Port 4 = address 64, decimal 32. See Table 14. Refer to "How to Access Interface Control Settings with N5230A" on page 33 and in "How to Access GPIB Command Processor" on page 37.

Table 14   N5230A and N5242A Port Value Select

Address		Source Path[1]				Receiver Path[2]			
	Data	0	1	2	3	0	16	32	48
0	Ports	1	3	5	7	1	3	5	7
16	Ports	2	4	6	8	2	4	6	8

1. All source switches are 10 and 20.
2. All receiver switches are 11 and 21.

Table 15   PNA Port 1 and Test Set Ports 3, 5, 7

Address	Decimal Data	Description						
0	D0 - D3	Controls SW100; Source to PNA Port 1 or Test Set Port 3, 5 and 7.						
0	D4 - D7	Controls SW101; Receiver to PNA Port 1 or Test Set Port 3, 5 and 7.						
Test Set I/O Data Bit		D0	D1	D2	D3	D4	D5	D6	D7
Data Bit Decimal Equivalent		1	2	4	8	16	32	64	128

Table 16   Address and Data for Port 1, 3, 5 and 7

Address	Data	Description	Port LED's
0	0	Selects the Port 1 as the Source and Receiver port. Port 3, 5 and 7 terminated with a 50 Ω switch load.	All Off
0	1	Selects the PNA Port 1 as the Receiver and Port 3 as the Source. Ports 5 and 7 terminated with a 50 Ω switch load.	Port 3 S ON
0	16	Selects the Port 1 as the Source Port. Port 3 as the Receiver. Ports 5 and 7 terminated with a 50 Ω switch load.	Port 3 R ON
0	17	Selects the Port 3 as the Source and Receiver port. Port 1, 5 and 7 terminated with a 50 Ω switch load.	Port 3 R ON Port 3 S ON
0	32	Port 1 as the Source and Port 5 as the Receiver Port. Port 3 and 7 terminated with a 50 Ω switch load.	Port 5 R ON
0	2	Port 1 as the Receiver and Port 5 as the Source. Port 3 and 7 terminated with a 50 Ω switch load.	Port 5 S ON
0	34	Port 5 as the Receiver and Source. Port 1, 3 and 7 terminated with a 50 Ω switch load.	Port 5 R ON Port 5 S ON
0	3	Port 7 as the Source and Port 1 as the Receiver. Port 3 and 5 terminated with a 50 Ω switch load.	Port 7 S ON
0	48	Port 1 as the Source and Port 7 as the Receiver. Port 3 and 5 terminated with a 50 Ω switch load.	Port 7 R ON
0	51	Port 7 as the Receiver and Source. Port 1, 3 and 5 terminated with a 50 Ω switch load.	Port 7 R ON Port 7 S ON

Table 17   PNA Port 2 and Test Set Ports 4, 6 and 8

Address	Decimal Data	Description							
16	D0 - D3	Controls SW200; Source to PNA Port 2 or Test Set Port 4 6 and 8.							
16	D4 - D7	Controls SW201; Receiver to PNA Port 2 or Test Set Port 4, 6 and 8.							
Test Set I/O Data Bits		D0	D1	D2	D3	D4	D5	D6	D7
Data Bit Decimal Equivalent		1	2	4	8	16	32	64	128

Table 18   Address and Data for Port 2, 4, 6 and 8

Address	Data	Description	Port LED's
16	0	Selects the Port 2 as the Source and Receiver port. Port 4, 6 and 8 terminated with a 50 Ω switch load.	All Off
16	1	Selects the PNA Port 2 as the Receiver and Port 4 as the Source. Ports 6 and 8 terminated with a 50 Ω switch load.	Port 4 S ON
16	16	Selects the Port 2 as the Source Port. Port 5 as the Receiver. Ports 6 and 8 terminated with a 50 Ω switch load.	Port 4 R ON
16	17	Selects the Port 4 as the Source and Receiver port. Port 2, 6 and 8 terminated with a 50 Ω switch load.	Port 4 R ON Port 4 S ON
16	32	Port 2 as the Source and Port 6 as the Receiver Port. Port 4 and 8 terminated with a 50 Ω switch load.	Port 6 R ON
16	2	Port 2 as the Receiver and Port 6 as the Source. Port 4 and 8 terminated with a 50 Ω switch load.	Port 6 S ON
16	34	Port 6 as the Receiver and Source. Port 2, 4 and 8 terminated with a 50 Ω switch load.	Port 6 R ON Port 6 S ON
16	3	Port 8 as the Source and Port 2 as the Receiver. Port 4 and 6 terminated with a 50 Ω switch load.	Port 8 S ON
16	48	Port 2 as the Source and Port 8 as the Receiver. Port 4 and 6 terminated with a 50 Ω switch load.	Port 8 R ON
16	51	Port 8 as the Receiver and Source. Port 2, 4 and 6 terminated with a 50 Ω switch load.	Port 8 R ON Port 8 S ON

Operational Check

This section provides operational check to confirm the U3022AM06 and PNA operational performance. The operation verification limits provided ensure that your U3022AM06 and PNA are operating properly.

Ports 9 and 10 (in a 10-Port system) are not connected to the test set therefor, do not require testing.

- PNA-X Ports 3 and 4 are relabeled as Port 9 and Port 10.
- PNA-L Ports 2 and 3 are relabeled as Port 9 and Port 10.
- PNA-L Port 4 is relabeled as Port 2.

Verification Limits

Specifications for the U3022AM06 Multiport Test Set are typical. System performance for the PNA and Test Set are only characteristic and intended as non warranted information. Only a functional certificate is provided for the U3022AM06.

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

NOTE   Typical specifications are based on 1 to 2 units performance. Refer to Table 19 and .

Table 19   E8362B/C and N5230A/C Operation Verification Limit for Reflection Tracking[1]

Frequency	Port 1-8
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 Mixer Cal.

Table 20   N5242A Operation Verification Limit for Reflection Tracking[1]

Frequency	Standard Port 1-8
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 Mixer Cal.

NOTE   If you suspect that your 8 or 10-Port configuration is not operating properly, ensure that all front RF jumper interconnect cables are correctly attached.

Equipment Required

The Agilent U3022AM06 requires that the user be familiar with the equipment

and components listed in Table 21.

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

Table 21   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
N5230A/C 4-Port Network Analyzer (Option 245 and 551) *or* N5242A Option 400 and 551	1
Set of interconnect cables (PNA and Test Set), see "N5230A/C RF Interface Cable Connections" on page 18.	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 PNA if you are performing a PNA Operator's Check. The PNA will indicate false failures if the test set is connected. Ports 9 and 10 are not connected to the test set therefor, only Ports 1 thru 8 are tested.

Preparing the E8362B or N5230A

1. Connect the Test Set to the N5230A 4-Port PNA using the interconnect cables as shown in Figure 12 and Table 8 on page 18. For N5230A and E8363B 2-Port, refer to Figure 13 on page 21 and Table 9 on page 20. Insure that the Test Set I/0 cable is connected as shown in Figure 32 on page 43.

2. Turn On the Test Set.

3. On the PNA, select **Calibration** > **Cal Sets**. Delete or Rename any Cal Sets titled "999.1" thru "999.8", although it is unlikely that you will find Cal Sets with these names.

4. Verify that the PNA is in 10-Port mode. Refer to the bottom of Figure 53 on page 72, or select **Trace** > **New Trace**.

    a. If only four S-Parameters are listed, select **System** > **Configure** > **Multiport Capability**. On the Multiport Restart dialog, select **Restart as multiport PNA with this test set**. Select **U3022AM06** (10-Port).

5. Press **[System]** > **[Preset].**

6. Verify that the **[Stop Frequency]** is set to the maximum of the PNA and test set.

7. Verify that the **[Start Frequency]** is set to **[10 MHz]**. If not, select **Channel** > **Start/Stop** and enter **[10 MHz].**

8. Verify that the **[Power]** is to set to **[–8 dBm]**. If not, select **[Power]** > **Power Level** and enter **[–8 dBm].**

9. Select **Sweep** > **IF Bandwidth** > **100 Hz**.

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

11. Connect the ECal module to the PNA-L USB port on the front or rear panel. This procedure assumes you are using a ECal. If you are not, see "E8362B or N5230A 1-Port Calibration and Verification Procedure", step 2 on page 70.

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

E8362B or N5230A 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 more information select **Help**.

2. Perform a 1-Port Calibration on Port 1. On the PNA, select **Calibration** > **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 dialog box, select **Clear All** and select **Port 1** > **Next**.

Figure 50   Calibration Ports and ECal Module
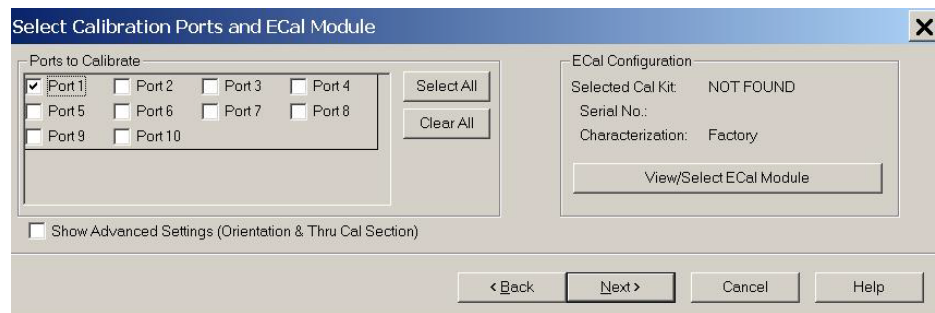
4. Continue to follow the prompts until "Calibration Completed" appears.

5. At the Calibration Completed prompt, select **Save As User Calset** and type the name **999.1**. Overwrite the Calset if it already exists. Select **Save.** Refer to Figure 51 on page 71.

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 51. Use the numeric keypad on the PNA front panel to enter "999.1."

Figure 51   Calibration Complete
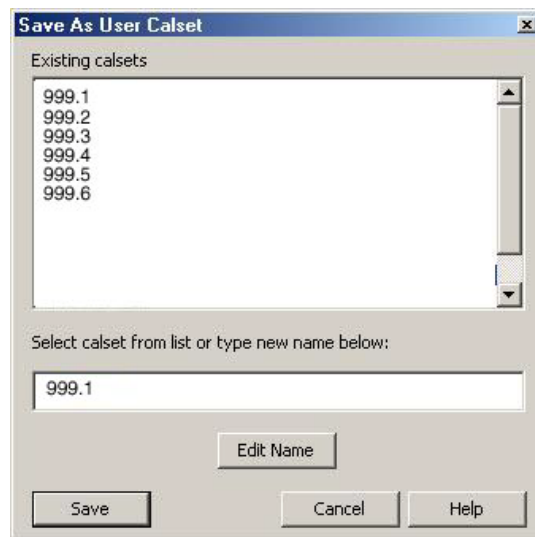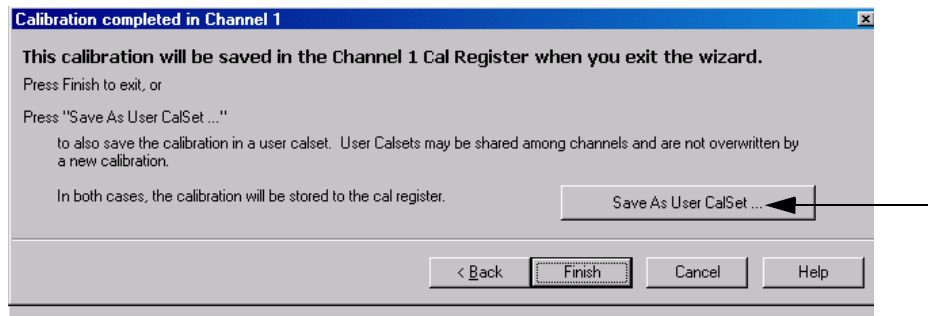
6. Repeat step 1 thru step 5 (1-Port Calibration Procedure) for Ports 2 thru 12. When finished, there should be sixteen Cal Sets saved with the titles "999.1" thru "999.8" (8-Port).

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

7. Select **Trace** > **Delete Trace**. There should be no traces on the PNA screen.

8. Select **Calibration** > **Cal Set Viewer** to launch the Cal Set Viewer toolbar. See Figure 52.

Figure 52   Calibration, Cal Set Viewer
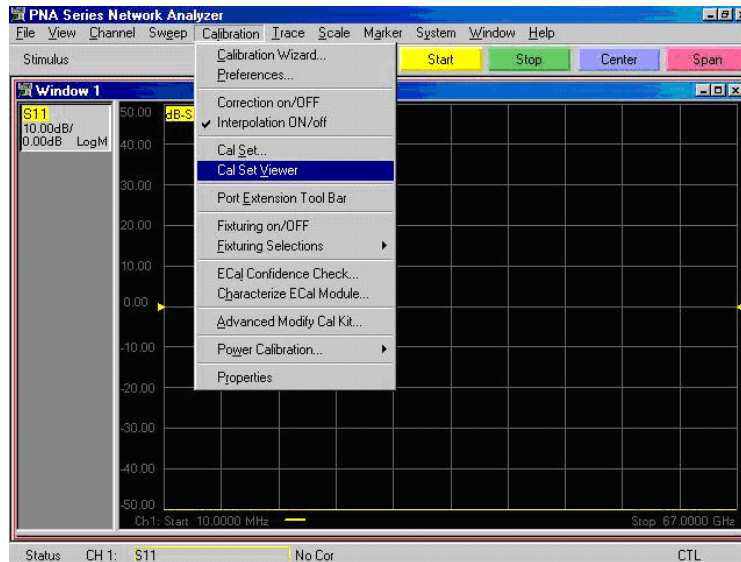
9. From the Cal Sets drop-down menu, select **999.1** and select **Enable**. Select the **Reflection Tracking(1,1)** term in the center drop-down menu and ensure that the **Enable** and **Error Terms** are selected as shown in Figure 53.

NOTE   You may also create a table on the PNA and enter the limit line stimulus and response values. Select **Limit Test ON** and **Limit Line ON,** and select **Show Table**. See Figure 53 on page 72.

Figure 53   Limit Line Setup Example: Trace (Port 1-8) with N5230A/C
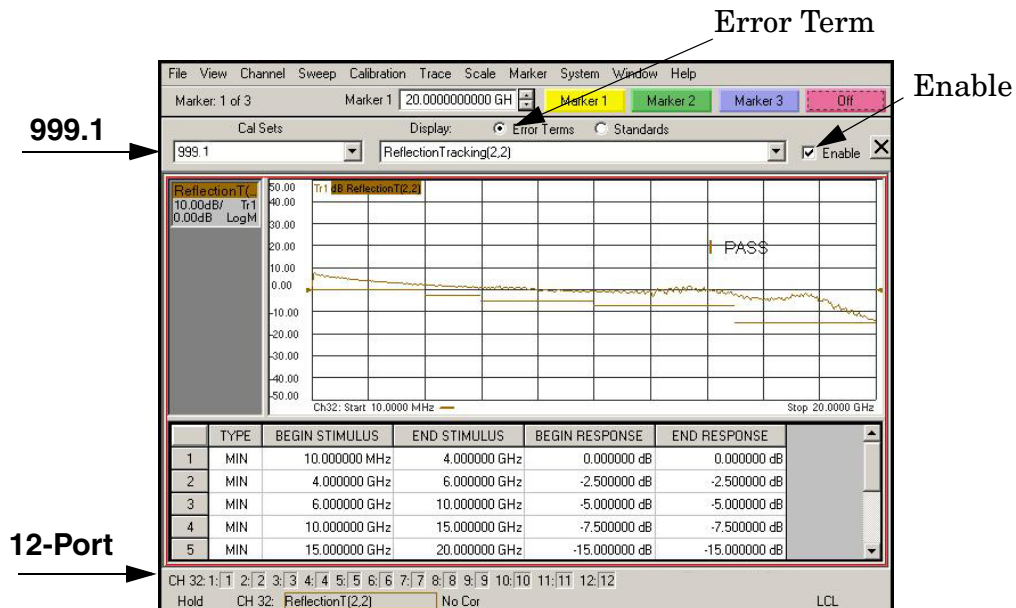
10.Compare the Reflection Tracking (1,1) trace to the appropriate limits in Table 19 on page 67. This can be done using Limit Lines, select **Trace** > **Limit Test** or **Marker**. The trace should be above the limit. PASS will be displayed on the screen if the limit lines are used. Refer to Figure 54 as an example of a reflection tracking trace.

11.Repeat step 9 and step 10 for Cal Sets "999.1" thru "999.8" (10-Port).

Figure 54   **Standard Reflection Tracking Trace (Port 1-8) with N5230A/C or E8362B/C**
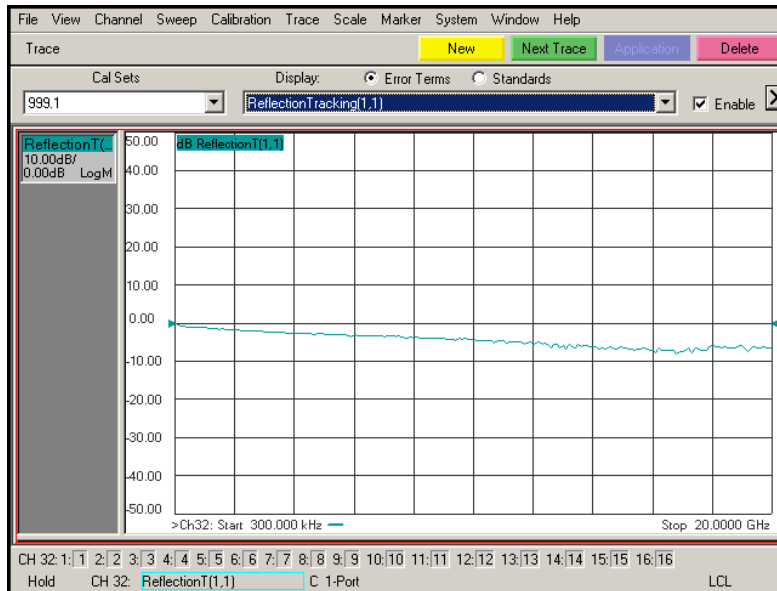
Preparing the N5230C or N5242A

1. Connect the Test Set to the N5242A NA-X using the interconnect cables as shown in Figure 31 on page 43 and Table 10 on page 42. If you are using a N5230C, refer to Figure 12 on page 19 and Table 8 on page 18.

2. Turn On the Test Set.

3. On the PNA, select **Response** > **CAL** > **Manage CALS** > **CAL Set**. Delete or Rename any Cal Sets titled "999.1" thru "999.8", although it is unlikely that you will find Cal Sets with these names.

4. Verify that the PNA is in 10-Port. See the bottom of the measurement window.

    a. If only four S-Parameters are listed, select **Utility** > **System** > **Configure** > **Multiport Capability**. On the Multiport Restart dialog, select **Restart as multiport PNA with this test set**. Select **U3022AM06** (10-Port).

5. Press **[Preset]**.

6. Verify that the **[Stop Frequency]** is set to **[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**. See Figure 55.

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

11. Connect the ECal module to the PNA 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 PNA to warm up for a minimum of 30 minutes.

Figure 55   Setting the IF Bandwidth
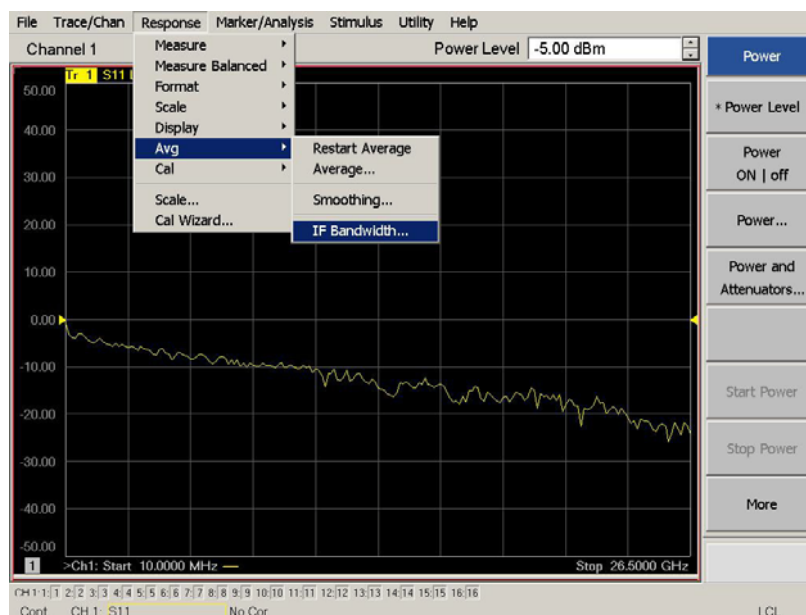
N5230C or N5242A 1-Port Calibration and Verification Procedure

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 select **Help**, see Figure 25 on page 31.

2. Perform a 1-Port Calibration on Port 1. On the PNA, select **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 dialog box, select **Clear All** > **Port 1,** then select **Next**. Refer to Figure 50 on page 70.

4. Continue to follow the prompts until "Calibration Completed" 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 select **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 51. Use the numeric keypad on the PNA front panel to enter "999.1."

Figure 56   Calibration Complete
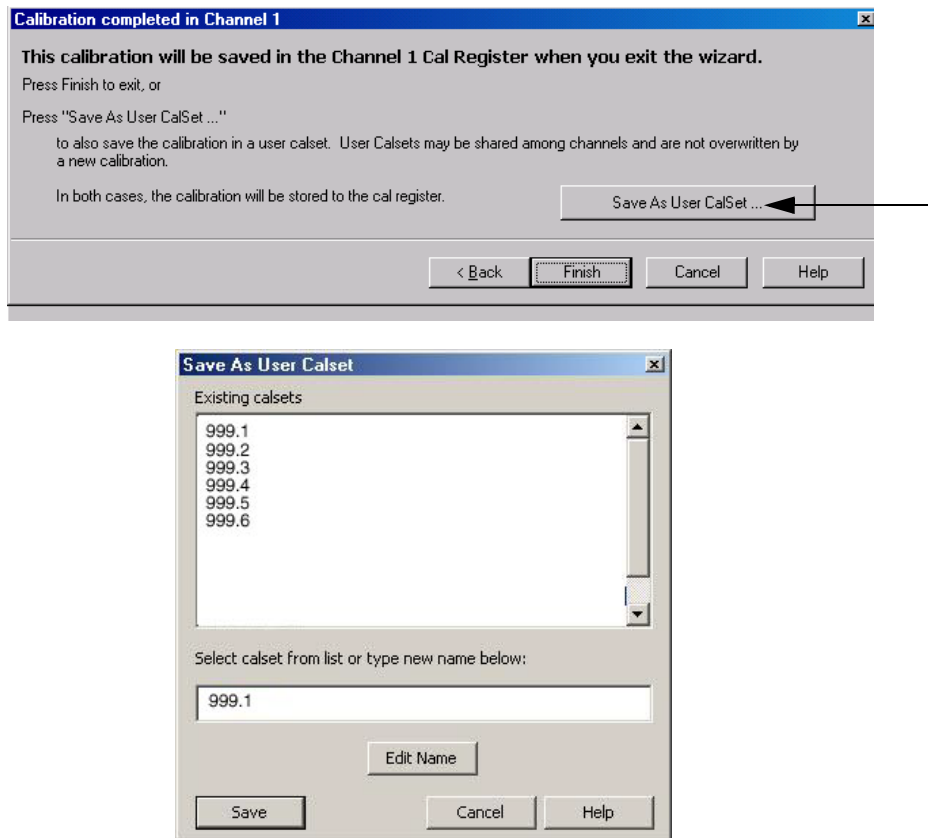
6. Repeat step 1 thru step 5 (1-Port Calibration Procedure) for Ports 2 thru 8. When finished, there should be eight Cal Sets saved with the titles "999.1" thru "999.8". Do not use Ports 9 and 10 (relabeled Ports 3 and 4) if you are using a 4-Port PNA.

    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 system Help menu.

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

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

Figure 57   Calibration, Cal Set Viewer
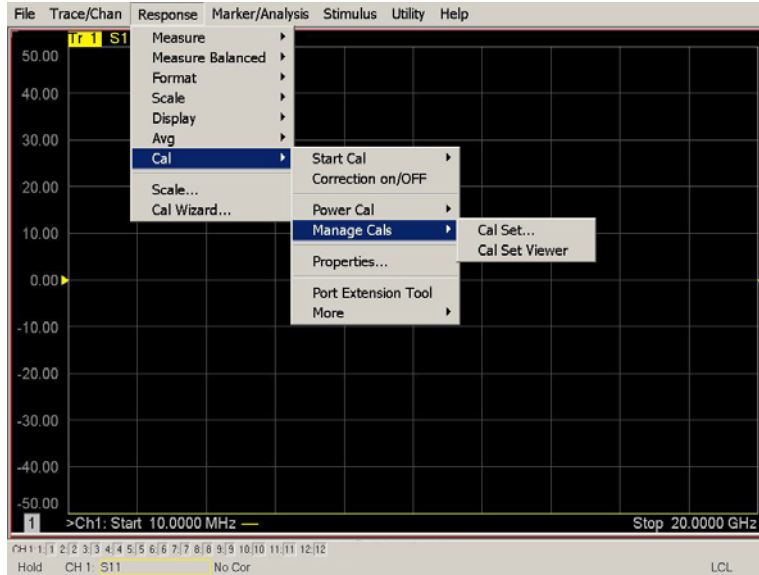
9. From the Cal Sets drop-down menu, select **999.1** and check **Enable**. Select the
    Reflection Tracking(1,1) term in the center drop-down menu and ensure that the
    Enable and **Error Terms** are selected.

NOTE   You may also create a table on the PNA and enter the limit line stimulus and
                response values. Select **Limit Test ON** and **Limit Line ON** > select **Show Table.**
                See Figure 58.

Figure 58   Setting the Test Limits
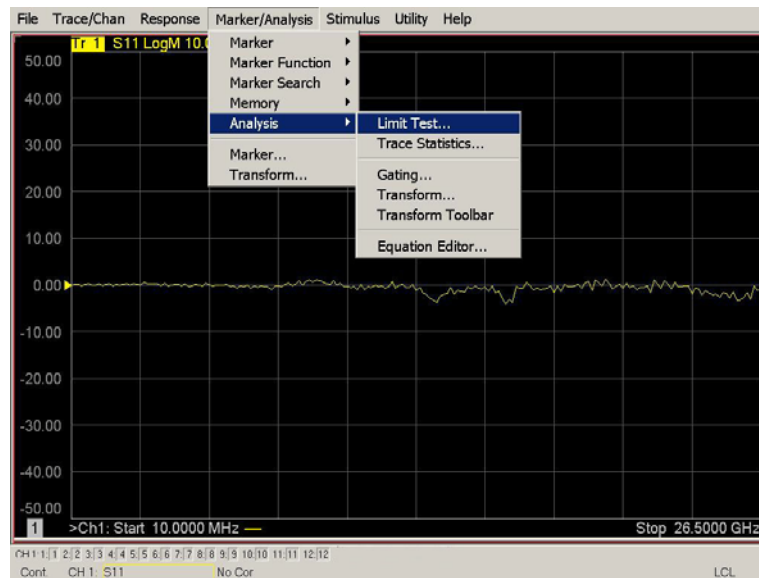
10. Compare the Reflection Tracking (1,1) trace to the appropriate limits in Table 20 on page 68. This can be done using Limit Lines (select **Marker/Analysis** > **Analysis** > **Limit Test**). The trace should be above the limit. PASS will be displayed on the screen if the limit lines are used. Refer to Figure 59 and Figure 60 on page 78.

11. Repeat step 9 and step 10 for Cal Sets "999.1" thru "999.8" (10-Port).

NOTE   Response from 10 MHz to 500 MHz is normal due to the PNA-X Couplers in comparison to the U3022AM06 bridges. The bridges have more gain in the coupled RF path.

Figure 59   Standard Reflection Tracking Trace (Port 1-2) with N5242A
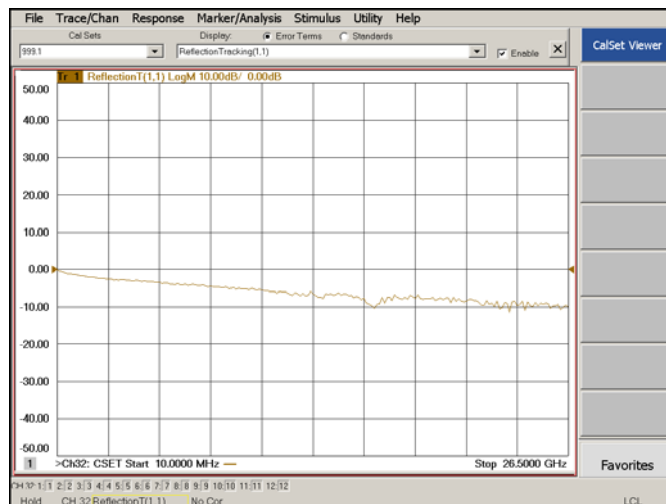
Figure 60   Standard Reflection Tracking Trace (Port 3-8) with N5242A
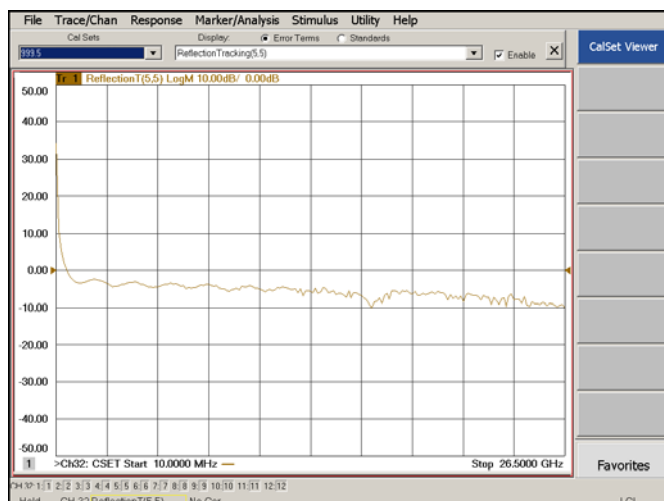
NOTE   Response from 10 MHz to 500 MHz is normal due to the PNA-X couplers in comparison to the U3022AM06 bridges. The bridges have more gain in the coupled RF path.

Troubleshooting Operational Check Failures

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

1. Insure that the test set is turned on and connected properly to the PNA.

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 PNA 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 PNA jumpers.

    b. Connect an RF cable on the PNA, Port-1 to Port-2. Port 2 on the N5242A, or Port 4 on the N5230A.

    c. Set the PNA to measure Trace S12 and S21. Verify that there are no power holes. If S12 has a power hole check the Port-2 Source interconnect cables and test set connectors for damage. If S21 has a power hole check the Port-1 Source interconnect cables and test set connectors for damage.

3. Verify the Receiver Interconnect RF cables (RCVR OUT 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 PNA jumpers.

    c. Set the PNA to measure Trace S12 and S21. Verify that there are no power holes. If S12 has a power hole check Port-1 Receiver Interconnect cables and test set connectors for damage. If S21 has a power hole check Port-2 Receiver Interconnect cables and test set connectors for damage.

4. If the problem still exists, connect the standard jumpers to the PNA (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 PNA 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 Sales and Service Offices" on page 102.

    d. Connect Port-1 to RCVR OUT and Port-2 to CPLR ARM connectors on the test set. If a power hole still exists refer to "Contacting Agilent Sales and Service Offices".

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
RF Cable, Semi-rigid	Z5623-20418
RF Cable, Semi-rigid	Z5623-20419
Port1 Source to Source	U3022-20116
Port 1 Coupler Thru to Coupler Thru	U3022-20117
Port 1 Coupler Arm to Coupler Arm	U3022-20118
Port 1 Receiver to Receiver	U3022-20119
Port 2 Source to Source	U3022-20120
Port 2 Coupler Thru to Coupler Thru	U3022-20121
Port 2 Coupler Arm to Coupler Arm	U3022-20122
Port 2 Receiver to Receiver	U3022-20123
Port 2 Receiver to Receiver	U3022-20123
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 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

Description	Agilent Part Number
User's Guide (Option M06)	U3022-90006
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 (programmed)	N5261-60005
Test Set Control Board (programmed)	N5261-60006
Switch, Multiport, SP4T, DC-26.5 GHz	87104-60001
Fan (rear panel)	87050-60027
DUT Control Board	E5091-66503
PNA-L or PNA-X Locking Feet	5023-0132
PNA-L Test Set Locking Feet	5063-9253
Coupler Bridge	5087-7716
Screw	0515-2317
PWR Supply (AC/DC SWG 650W 9-Output	0950-4729
Fuse (8 A 250 V non-time delay 0.0146OHM	2110-0342
Fuse (5 A 250 V non-time delay Socket	2110-0709
Test set I/O Cable	8120-6818

Theory of Operation

The following is a description of the operation of the U3022AM06. Reference the U3022AM06 block diagram Figure 61 on page 84. This section assumes the user has a general understanding of couplers, switches, and network analyzers.

RF Coupler/Bridges

U3022AM06 uses six coupler/bridges (5087-7716) on the front panel for RF Test Ports 3 - 8. The coupler/bridges provide the signal separation of the source and receiver paths, using resistor networks. 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 internal CPLR THRU and CPLR ARM ports are female 3.5 mm connectors. The coupling factor is approximately –16 dB for the Coupled Arm (minimum –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. Do not use excessive RF power or DC voltage, or damage may occur to the internal resistors.

RF Switches

Four RF Switches (87104-60001) provide switching for RF Test Ports to the PNA access ports for SOURCE OUT, CPLR THRU, RCVR OUT and RCVR IN. Refer to the block diagram, Figure 61 on page 84, for RF path information. Both mechanical switches typically have < 1 dB insertion loss at 26.5 GHz (not including RF cables connections) and are specified up to 5,000,000 cycles. The internal 50 Ohm loads, within the switch, can be damaged by excessive RF power or DC voltage. The switch expectancy of the switch is approximately 5,000,000 cycles.

S10 - Source to Ports (1, 3, 5 and 7)

Switch 10 provides control of the PNA Source path to Port 1, 3, 5 and 7. 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 3, 5 and 7 are terminated.

S20 - Source to Ports (4, 6 and 8)

Switch 20 provides control of the PNA Source path to PNA-L Port 4 or PNA-X Port 2 and the test set Ports 4, 6 and 8. In the state shown in the block diagram, switch 20 routes the RF Source back to the PNA Port and unused test set ports (4, 6 and 8) are terminated.

S11 - Receiver to Ports (1, 3, 5 and 7)

Switch 11 provides control of the Receiver path to Port 1, 3, 5 and 7. 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 (3, 5 and 7) Coupler Arm paths are terminated.

S21 - Receiver to Ports (4 or 2, to 4, 6 and 8)

Switch 21 provides control of the Receiver path to PNA-L Port 4 (relabeled to Port-2) or PNA-X Port 2 and test set Ports 4, 6 and 8. In the state shown in the block diagram, switch 21 routes the Coupler Arm from the PNA Port 2 to the B Receiver and all unused Test Set ports (2, 4, 6 and 8) 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 U3022AM06 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 ribbon cables connected to plugs P10, P11, P20 and P21.

Front Panel LED Boards

Two 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 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 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 AC line voltage (100 to 240 V @ 50/60 Hz) is provided from the line module on the rear panel.

System Block Diagram

Figure 61   U3022AM06 Standard Configuration
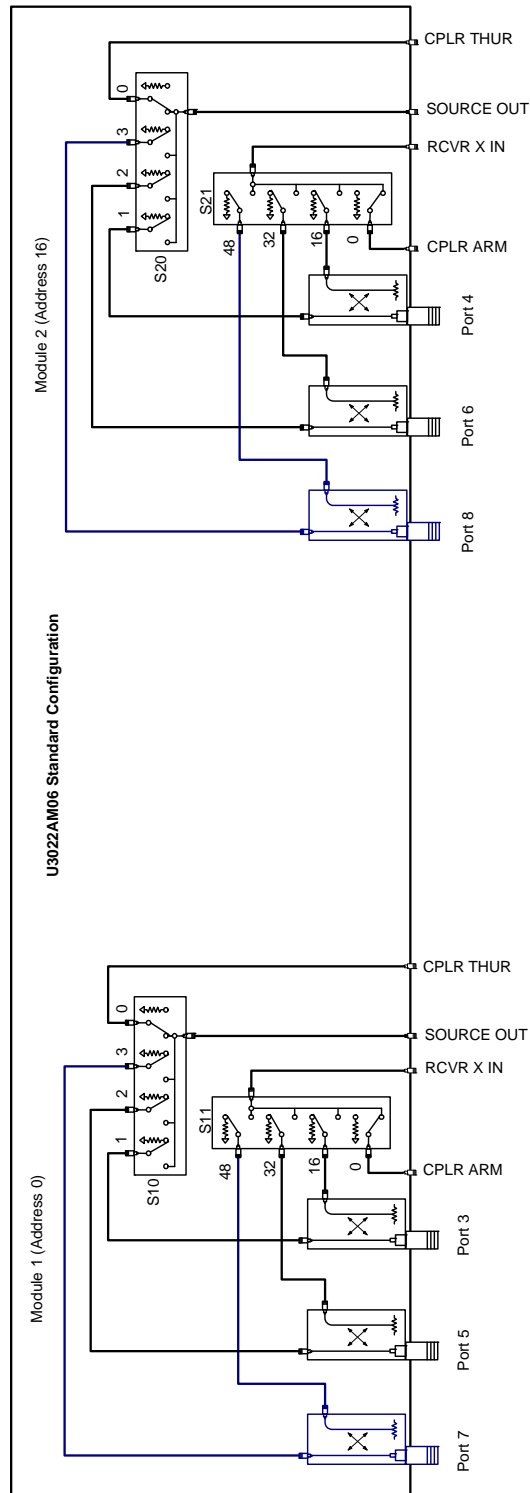
Troubleshooting

If the U3022AM06 is not operating properly, use the following procedures to isolate and repair the failure.

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.

When sending the U3022A test set in for repair, please also send your PNA and cables. This will speed your repair turn around time, and verify proper operation of the complete system. Refer to "Contacting Agilent Sales and Service Offices" on page 102.

Refer to the following procedures for type of problem encountered. It is recommended that a qualified service technician perform the following procedures.

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

Fan is not Operating

Suspect a power supply problem or failed fan, and perform the following troubleshooting.

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.**

1. Verify the front panel power switch (3101-4058) is operational.

2. Verify that the AC line voltage is correct (100 to 240 V @ 50/60 Hz) and that the power cord is not damaged.

   a. If the power cord is damaged, replace it.

   b. If the AC line voltage is incorrect, use another receptacle.

3. Verify that the fuse (2110-0709) in line module is not blown. There is a spare fuse in the line module. Refer to Figure 7 on page 15. If the fuse is working, continue to step 4.

4. Remove the top cover. Verify that the supply LED indicators, on the test set control board (N5261-60006) are illuminated. The +9 and +10 V supplies will not be on. If the LED's are illuminated, replace the fan (87050-60027). Refer to Figure 63 on page 94.

5. If the LED's are off, verify the voltages (+24, +5, +3, -15, -12, +15 and +12 Volt) on the Test Set Controller board. If the voltages are not correct, verify that J11 - J14 cables are connected correctly on both the power supply and controller board. Refer to Figure 63 on page 94.

6. If the J11 - J14 cables are connected properly, measure the voltages on the power supply screw terminals. See the power supply voltages in Figure 62.

Figure 62   Power Supply
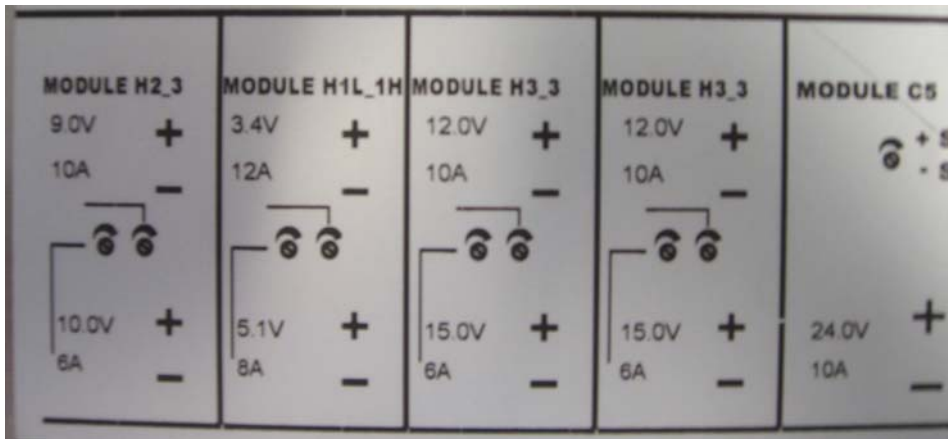
7. If power supply voltages are not present, verify and/or replace the two 8 amp fuses
   (2110-0342) in the line fuse assembly. Refer to Figure 64 on page 95.

   a. If the fuses are correct, replace power supply (0950-4729).

Front Panel LEDs (R, S or Active) are not Illuminated

If the U3022AM06 fan and power supplies are operating the following procedures can be used to verify the failure. Suspect the Test Set Controller Board (N5261-60006) or Front Panel LED Assembly (N5261-60005).

1. Verify the Test Set I/0 cable (8120-6818) is installed correctly. See Figure 32 on page 43.

2. Using multiport mode (Option 551), verify the PNA firmware is correct, and the testset file is loaded into the PNA, refer to "Network Analyzer Requirement" on page 4.

3. Using the I/O command values, confirm the correct address and data values are used. Refer to "Test Set I/O Interface Commands" on page 64.

4. Remove the top cover. Verify that the supply LED indicators, on the test set control board (N5261-60006), are illuminated. The +9 and +10 V supplies will not be on.

5. If the LED's are off, verify the voltages (+24, +5, +3, -15, -12, +15 and +12 Volt) on the Test Set Controller board. If the voltages are not correct, verify that J11 - J14 cables are connected correctly on both the power supply and controller board. Refer to "Fan is not Operating" on page 85.

6. Verify at least one of the status LEDs is on. If not, replace the controller board (N5261-60006).

7. If the controller board status LEDs are on, and the ACTIVE LED is on, suspect the Front Panel LED Boards (N5261-60005) or the ribbon cables (N5261-60001). If only one set of front panel LEDs are not working, connect the ribbon cable from one of the working front panel LED boards to the front panel LED Board assembly that is not working. Replace if necessary.

Test Ports are not Switching

If the test ports are not switching, the following procedures can be used to verify the failure. The procedures assume power supplies, controller board and front panel LEDs are working. Suspect the switch interface board (U3025-60062), ribbon cable connection or coax switch (87104-60001).

1. Inspect the ribbon cable connections from the test port switches to the Switch Interface board (U3025-60062).

2. Send a test set I/O command and verify that the mechanical switches are make a clicking sound. If there is no sound, replace the Switch Interface board (U3025-60062) or the suspected switch (87104-60001).

3. If the switches are operating, send a test set I/O command to verify the path for each port. See "Source and Receiver Path Test" on page 89.

4. Substitute a known good switch, or connect a known good ribbon cable to a suspect switch and retest. Replace if necessary.

Source and Receiver Path Test

This section provides information for testing the RF paths.

Equipment Required

- N5242A PNA-X, N5230A/C PNA-L, or E8362B/C PNA
- Two Flex Cable with SMA connectors (5062-6696 or equivalent)
- Three SMA Adapters (female to female)
- Test Set I/O Cable (8120-6818)

Equipment Setup

1. Connect the Test Set I/O cable (8120-6818) from the PNA to Test Set. Refer to Figure 32 on page 43. Set PNA to "Standalone mode" (Test can not be performed in Multiport mode).

2. Connect the flexible cables (5062-6696 or equivalent) with the SMA adapters to PNA Ports 1 and 2. Connect the cables together using a SMA adapter.

3. Set the frequency range to 300 kHz to 26.5 GHz, or the frequency range of the PNA you are using.

4. Select **measure S21 trace**, and perform a **Response Cal**.

5. Select **[Ref Level]** > **[0 dB]** > **[Scale]** > **[2 dB] (or Autoscale).**

Source Path Trace

The S21 trace slopes down approximately –0 to –3.5 dB (±1 dB) for all CPLR THRU (SMA) to SOURCE IN paths. Refer to the individual port path to be tested. The S21 trace slopes down approximately –1.5 to –7 dB (±1 dB) for test Ports 1 - 8 to SOURCE IN (SMA) paths.

When measuring CPLR THRU or SOURCE IN SMA connectors, use the four SMA connectors to the right of the associated test ports being measured. See Figure 5 on page 13 for the connector locations.

Port 1 Source

- Set Test I/O addr.data 0.0
- Connect PNA Port 1 flex cable to Test Set Port 3 CPLR THRU.
- Connect PNA Port 2 flex cable to Test Set Port 3 SOURCE IN.

Port 2 Source

- Set Test I/O addr.data 16.0
- Connect PNA Port 1 flex cable to Test Set Port 4 CPLR THRU.
- Connect PNA Port 2 flex cable to Test Set Port 4 SOURCE IN.

Port 3 Source

- Set Test I/O addr.data 0.1
- Connect PNA Port 1 flex cable to Test Set Port 3.
- Connect PNA Port 2 flex cable to Test Set SOURCE IN.

Port 4 Source

- Set Test I/O addr.data 16.1
- Connect PNA Port 1 flex cable to Test Set Port 4.
- Connect PNA Port 2 flex cable to Test Set SOURCE IN.

Port 5 Source

- Set Test I/O addr.data 0.2
- Connect PNA Port 1 flex cable to Test Set Port 5.
- Connect PNA Port 2 flex cable to Test Set SOURCE IN.

Port 6 Source

- Set Test I/O addr.data 16.2
- Connect PNA Port 1 flex cable to Test Set Port 6.
- Connect PNA Port 2 flex cable to Test Set SOURCE IN.

Port 7 Source

- Set Test I/O addr.data 0.3
- Connect PNA Port 1 flex cable to Test Set Port 7
- Connect PNA Port 2 flex cable to Test Set SOURCE IN.

Port 8 Source

- Set Test I/O addr.data 16.3
- Connect PNA Port 1 flex cable to Test Set Port 8
- Connect PNA Port 2 flex cable to Test Set SOURCE IN.

Receiver Path Trace

The S21 trace slopes down approximately –0 to –3.5 dB (±1 dB) for all RCVR OUT (SMA) to CPLR ARM paths. Refer to the individual port path to be tested. The S21 trace slopes down approximately –15 to –20 dB (±1 dB) for test Ports 1 - 8 to RCVR OUT (SMA) paths.

When measuring CPLR ARM or RCVR OUT SMA connectors, the connections are to the four SMA connectors to the right of the associated test ports being measured. See Figure 5 on page 13 for the connector locations.

Port 1 RCVR

- Set Test I/O addr.data 0.0
- Connect PNA Port 1 flex cable to Test Set Port 3 CPLR ARM.
- Connect PNA Port 2 flex cable to Test Set Port 3 RCVR OUT.

Port 2 RCVR

- Set Test I/O addr.data 16.0
- Connect PNA Port 1 flex cable to Test Set Port 4 CPLR ARM.
- Connect PNA Port 2 flex cable to Test Set Port 4 RCVR OUT.

Port 3 RCVR

- Set Test I/O addr.data 0.16
- Connect PNA Port 1 flex cable to Test Set Port 3.
- Connect PNA Port 2 flex cable to Test Set Port 3 RCVR OUT.

Port 4 RCVR

- Set Test I/O addr.data 16.16
- Connect PNA Port 1 flex cable to Test Set Port 4.
- Connect PNA Port 2 flex cable to Test Set Port 4 RCVR OUT.

Port 5 RCVR

- Set Test I/O addr.data 0.32
- Connect PNA Port 1 flex cable to Test Set Port 5.
- Connect PNA Port 2 flex cable to Test Set RCVR OUT.

Port 6 RCVR

- Set Test I/O addr.data 16.32
- Connect PNA Port 1 flex cable to Test Set Port 6.
- Connect PNA Port 2 flex cable to Test Set RCVR OUT.

Port 7 RCVR

- Set Test I/O addr.data 0.48
- Connect PNA Port1 flex cable to Test Set Port 7.
- Connect PNA Port 2 flex cable to Test Set RCVR OUT.

Port 8 RCVR

- Set Test I/O addr.data 16.48
- Connect PNA Port 1 flex cable to Test Set Port 8.
- Connect PNA Port 2 flex cable to Test Set RCVR OUT.

RF Performance Fails

If the U3022AM06 operates correctly, but RF performance fails the operational test. The following procedures can be used to isolate the failed component. Suspect the coax switch (87104-60001), RF cables, or coupler bridge (5087-7716).

NOTE   The RF performance of the U3022AM06 depends on the performance of the PNA. Ensure the PNA is meeting specification before continuing.

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1. Verify that the test set and PNA 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. "Troubleshooting Operational Check Failures" on page 79.

3. Review the "Operational Check" on page 67 and verify the results for the port that is failing.

4. Reflection tracking trace shows a power hole, or is below the test limit line, perform the switch path test for the port that is failing. Refer to "Source and Receiver Path Test" on page 89.

5. Directivity trace fails (above −10dB), replace the coupler/bridge (5087-7716).

6. Source or load match fails (above −10 dB), replace the coax switch (87104-60001).

7. Isolation is poor between ports, inspect the RF connections. If it continues to fail replace the coax switch (87104-60001). The RF cables require proper torque (10 in-lb) and can be damaged by over tightening.

Control Lines are not Working

If the U3022AM06 operates correctly but the control lines are not functioning, the following procedures can be used to verify the component failure. Suspect the DUT CONTROL BD (E5091-66503).

1. Verify that the control voltage pins on the DUT control are connected correctly. Refer to "DUT Control Lines" on page 59.

2. Verify that the control pot is centered (5V). Refer to Figure 6 on page 14.

3. Verify the ribbon cable connection.

4. Replace the DUT control board (E5091-66503).

5. Replace the test set control board (N5261-60006).

Troubleshooting Diagrams and Tables

Table 22   Controller Board Connections

Controller Board Connection	Connection
LED Ribbon Cables From the LED Board	
J5	Ports 3, 5 and 7
J6	Ports 4, 6 and 8
Wire harness Active LED	
J16	Active LED
DUT Control Ribbon Cable	
J9	DUT Controller Board
Power Supply Wire Harness	
J11- 14	Power Supply

Table 23   Switch Interface Board

Switch Interface Board	Connection
P10	Ports 3, 5 and 7 (Source)
P11	Ports 3, 5 and 7 (Receiver)
P20	Ports 4, 6 and 8 (Source)
P21	Ports 4, 6 and 8 (Receiver)

Figure 63   Top View

Power Supply
LEDs

Active LED
Harness

S11

S10

DUT Control Bd.

Switch Interface Bd.

S21

S20 RF Switch

1 of 6
RF Coupler

Figure 64   Bottom View

Fan

Power Supply

Screw Terminals
for Supplies

Fuse Assy

S21

S11

S20

S10

1 of 6
RF Coupler
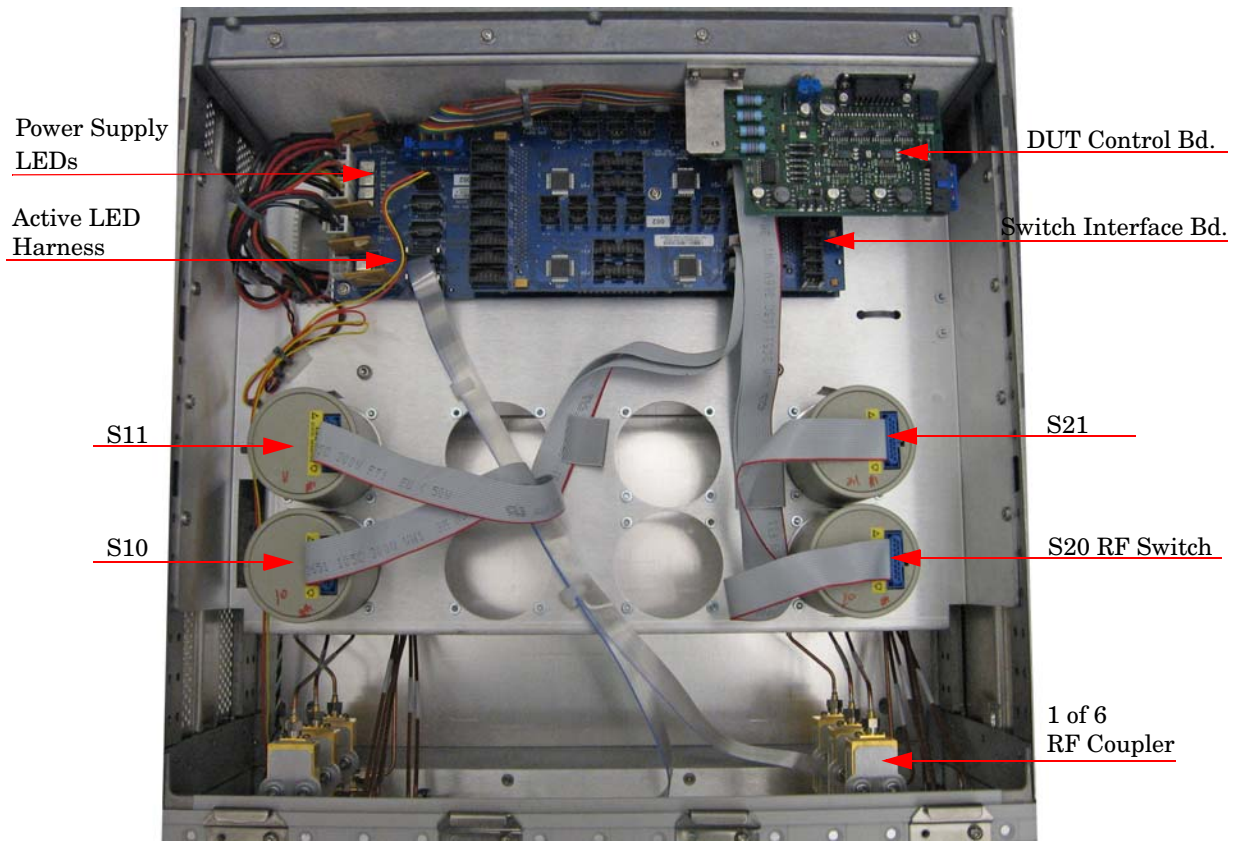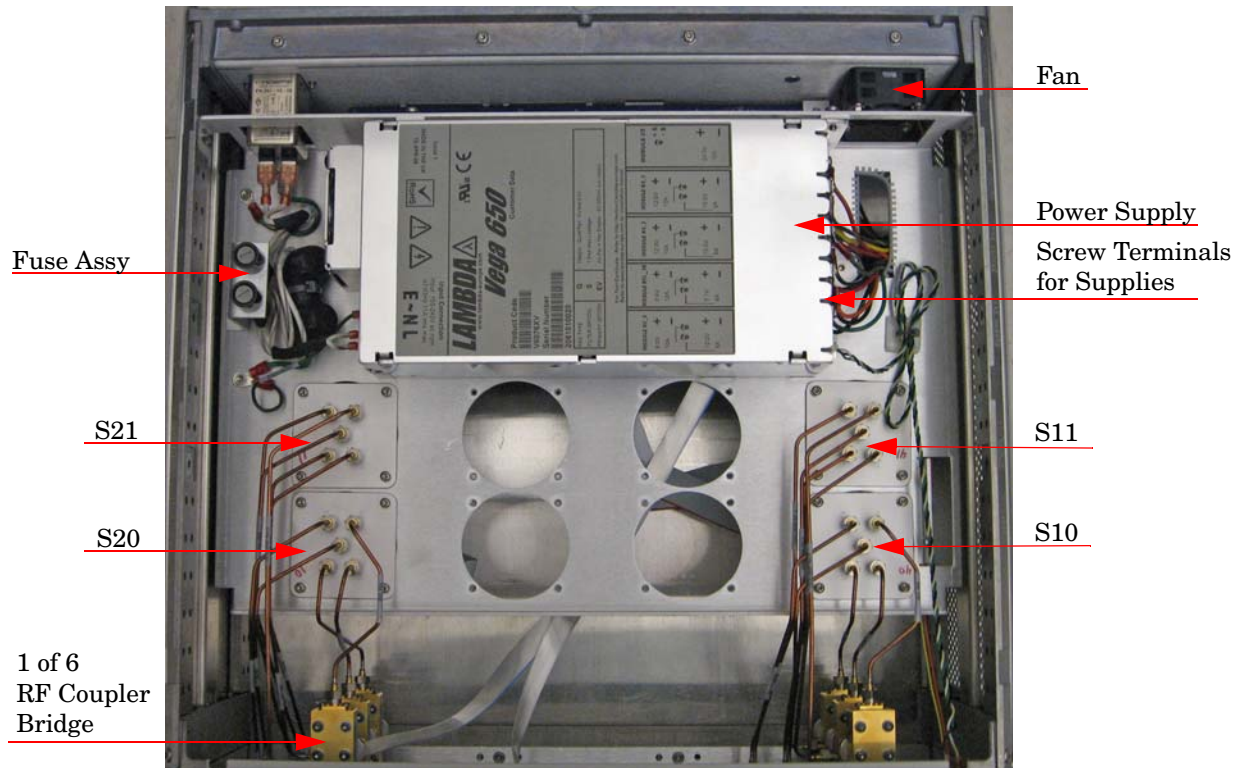Bridge

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 U3022AM06 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.**

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

Shipping Instructions

You must always call the Agilent Technologies Instrument Support Center to initiate service before retuning your instrument to a service office. See "Contacting Agilent Sales and Service Offices" on page 102. Always transport or ship the instrument using the original packaging if possible. If not, comparable packaging must be used. Attach a complete description of the failure symptoms.

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 89/336/EEC, amended by 93/68/EEC

• IEC/EN 61326

This product complies with the radiated electromagnetic field immunity requirement in IEC/EN 61326 using performance criterion B. Degradation of some product specifications can occur in the presence of ambient electromagnetic fields. The product self-recovers and operates as specified when the ambient field is removed.

• 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.

Warnings

WARNING	**The WARNING notice denotes a hazard. It calls attention to a procedure, practice, or the like, which if not correctly performed or adhered to, could result in personal injury. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.**

Warnings applicable to this instrument are:

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	**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.**

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

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 while it is being opened.**

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.**

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).**

Cautions

CAUTION	The CAUTION notice denotes a hazard. It calls attention to an operating procedure, practice, or the like, which if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a CAUTION notice until the indicated conditions are fully understood and met.

Cautions applicable to this instrument are:

CAUTION	Always use the three-prong ac power cord supplied with this instrument. Failure to ensure adequate earth grounding (by not using this cord) can cause instrument damage and the risk of electrical shock.

CAUTION	This instrument has autoranging line voltage input; be sure the supply voltage is within the specified range.

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.

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

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.

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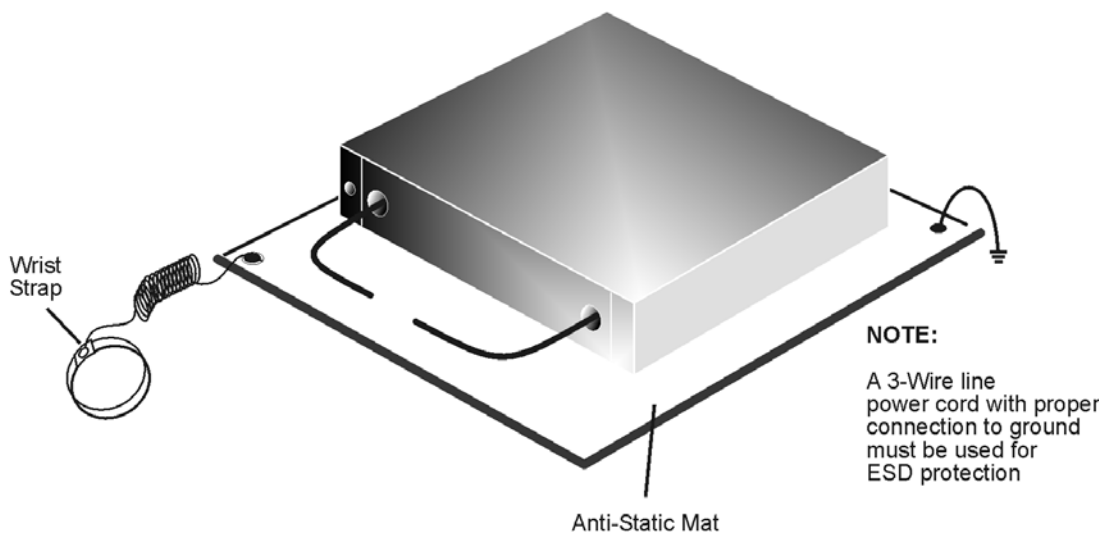
This symbol indicates compliance with the China RoHS regulations for paper/fiberboard packaging.

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 24   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

Contacting Agilent Sales and Service Offices

Assistance with test and measurement needs, and information on finding a local Agilent office are available on the Internet 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.

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