

Keysight Add Configurable Test Set and Source Attenuators Upgrade Kit

To Upgrade PNA N5231A, N5232A, or N5239A
Option 200 to Option 216

Upgrade Kit Order Numbers: N5231AU-216,
N5232AU-216, or N5239AU-216

Keysight Kit Number: N5232-60101

NOTICE: This document contains references to Agilent Technologies. Agilent's former Test and Measurement business has become Keysight Technologies. For more information, go to www.keysight.com.



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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.
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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 note until the indicated conditions are fully understood and met.
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Description of the Upgrade

This upgrade adds the following items to your N5231A Option 200, N5232A Option 200, or N5239A Option 200 network analyzer:

- 60 dB source step attenuators with brackets and wire harnesses
- front panel jumpers
- cable guards for front panel jumpers
- front panel overlay replacement
- new cables

After installation of this upgrade, your analyzer will be an N5231A Option 216, N5232A Option 216, or N5239A Option 216.

Getting Assistance from Keysight

By internet or phone, get assistance with all your test and measurement needs.

Contacting Keysight

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

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

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

NOTE In any correspondence or telephone conversation, refer to the Keysight product by its model number and full serial number. With this information, the Keysight representative can determine whether your product is still within its warranty period.

If You Have Problems With the Upgrade Kit Contents

Keysight stands behind the quality of the upgrade kit contents. If you have problems with any item in the kit, email Keysight Component Test Division (CTD) Support at support_ctd-soco@keysight.com, or telephone the CTD Hotline at (707) 577-6802 and leave a voice mail message. Please include details of the problem.

Getting Prepared

CAUTION The PNA contains extremely sensitive components that can be ruined if mishandled. Follow instructions carefully when making cable connections, especially wire harness connections.

The person performing the work accepts responsibility for the full cost of the repair or replacement of damaged components.

To successfully install this upgrade kit, you will need the following:

- A license key - refer to “[License Key Redemption](#)” below.
- A PDF copy or a paper copy of the PNA Service Guide - refer to “[Downloading the Online PNA Service Guide](#)” below.
- An ESD-safe work area - refer to “[Protecting Your Workspace from Electrostatic Discharge](#)” below.
- Correct tools - refer to “[Tools Required for the Installation](#)” on page 6.
- Enough time - refer to “[About Installing the Upgrade](#)” on page 6.
- Test equipment for the post-upgrade adjustments and full instrument calibration. To view the equipment list, click the Chapter 3 bookmark “[Tests and Adjustments](#)” in the PDF Service Guide¹.

License Key Redemption

NOTE The enclosed Option Entitlement Certificate is a receipt, verifying that you have purchased a licensed option for the PNA of your choice. You must now use a Keysight Web page to request a license key for the instrument that will receive the option.

To enable the option product, you must request a license key from: <http://www.keysight.com/find/softwarelicense>. To complete the request, you will need to gather the following information:

- From the certificate
 - Order number
 - Certificate number
- From your instrument
 - Model number
 - Serial number
 - Host ID

The instrument information is available on the network analyzer – on the analyzer’s **Help** menu, click **About Network Analyzer**.

If you provide an email address, Keysight will promptly email your license key. Otherwise, you will receive your license key via postal mail.

1. See “[Downloading the Online PNA Service Guide](#)” on page 5.

Downloading the Online PNA Service Guide

To view the online Service Guide for your PNA model number, use the following steps:

1. Go to www.keysight.com.
2. In the Search box, enter the model number of the analyzer (Ex: N5232A) and click **Search**.
3. Click **Technical Support > Manuals**.
4. Click **Service Manual**.
5. Click the service guide title to download the PDF file.
6. When the PDF of the Service Guide is displayed, scroll through the Contents section bookmarks to locate the information needed.

Protecting Your Workspace from Electrostatic Discharge

For information, click on the Chapter 1 bookmark, “Electrostatic Discharge Protection” in the PDF Service Guide¹.

ESD Equipment Required for the Installation

Description	Keysight Part Number
ESD grounding wrist strap	9300-1367
5-ft grounding cord for wrist strap	9300-0980
2 x 4 ft conductive table mat and 15-ft grounding wire	9300-0797
ESD heel strap (for use with conductive floors)	9300-1308

1. See [“Downloading the Online PNA Service Guide”](#) on page 5.

Tools Required for the Installation

Description	Qty	Part Number
T-10 TORX driver - set to 9 in-lbs (1.02 N.m)	1	N/A
T-20 TORX driver - set to 21 in-lbs (2.38 N.m)	1	N/A
5/16-in (8 mm) nutsetter or open end torque wrench - set to 10 in-lbs (1.13 N.m)	1	N/A

CAUTION Use a 5/16-in torque wrench set to 10 in-lbs on all cable connections except the front panel and rear panel bulkhead connectors. Torque these connections to 21 in-lb.

About Installing the Upgrade

Products affected	N5231A, N5232A, and N5239A Option 200
Installation to be performed by	Keysight service center or personnel qualified by Keysight
Estimated installation time	2 hours
Estimated adjustment time	0.5 hour
Estimated full instrument calibration time	4.5 hours

Items Included in the Upgrade Kit¹

Check the contents of your kit against the following list. If any part is missing or damaged, contact Keysight Technologies. Refer to [“Getting Assistance from Keysight” on page 3](#).

Table 1 Contents of Upgrade Kit N5232-60101

Ref Desig.	Description	Qty	Part Number
--	Installation note (this document)	1	N5232-90101
A29, A30	Test port 1 source 60 dB step attenuator Test port 2 source 60 dB step attenuator	2	33321-60082
--	Bracket (for A29 port 1 step attenuator)	1	N5235-00013
--	Bracket (for A30 port 2 step attenuator)	1	N5235-00012
--	Machine screw, M3 x 8, pan head (to attach brackets to step attenuators; to attach attenuator assemblies to deck)	10	0515-0372
--	Cable clamp	14	1400-1334
--	Front panel overlay	1	N5232-80005
--	Front panel jumper cable guard	2	N5242-00029
--	Dust caps for test ports	2	1401-0214
W11	RF cable, A21 MASSY to A29 60 dB step attenuator	1	N5232-20026
W12	RF cable, A21 MASSY to A30 test port 2 source attenuator	1	N5232-20019
W13	RF cable, A29 60 dB step attenuator to PORT 1 SOURCE OUT	1	N5232-20027
W14	RF cable, A30 test port 2 source attenuator to PORT 2 SOURCE OUT	1	N5232-20020
W15	RF cable, A25 test port 1 bridge coupler (thru) to PORT 1 CPLR THRU	1	N5232-20028
W16	RF cable, A26 test port 2 bridge coupler (thru) to PORT 2 CPLR THRU	1	N5232-20021
W17	RF cable, A25 test port 1 bridge coupler (arm) to PORT 1 CPLR ARM	1	N5232-20029
W18	RF cable, A21 MASSY to REF 1 SOURCE OUT	1	N5232-20032
W19	RF cable, A21 MASSY to REF 2 SOURCE OUT	1	N5232-20025
W20	RF cable, A26 test port 2 bridge coupler (arm) to PORT 2 CPLR ARM	1	N5232-20022
W21	RF cable, A24 mixer brick to PORT 1 RCVR A IN	1	N5232-20030
W22	RF cable, A24 mixer brick to REF 1 RCVR R1 IN	1	N5232-20031
W23	RF cable, A24 mixer brick to REF 2 RCVR R2 IN	1	N5232-20024
W24	RF cable, A24 mixer brick to PORT 2 RCVR B IN	1	N5232-20023
W30	RF cable, front panel jumper	6	N5222-20091

1. In addition to the upgrade kit, the shipment includes an Option Entitlement Certificate. Refer to [“License Key Redemption” on page 4](#) for important information about this certificate.

Table 1 **Contents of Upgrade Kit N5232-60101**

Ref Desig.	Description	Qty	Part Number
--	Wire harness, A19 test set motherboard J8 to A29 60 dB step attenuator	1	8121-0982
--	Wire harness, A19 test set motherboard J6 to A30 test port 2 source attenuator	1	

NOTE Extra quantities of items such as protective plastic caps, screws, cable ties, and cable clamps may be included in this upgrade kit. It is normal for some of these items to remain unused after the upgrade is completed.

Installation Procedure for the Upgrade

The network analyzer must be in proper working condition prior to installing this option. Any necessary repairs must be made before proceeding with this installation.

WARNING **This installation requires the removal of the analyzer's protective outer covers. The analyzer must be powered down and disconnected from the mains supply before performing this procedure.**

Overview of the Installation Procedure

- Step 1. Obtain a Keyword and Verify the Information.
- Step 2. Remove the Outer Cover.
- Step 4. Remove the Front Panel Assembly.
- Step 5. Remove Some Existing Cables.
- Step 6. Assemble the A29 and A30 Source Attenuator Assemblies.
- Step 7. Install the A29 and A30 Source Attenuator Assemblies.
- Step 8. Install the Cables.
- Step 9. Secure the Hex Nuts on the Front Panel Bulkhead Connectors.
- Step 10. Remove the Old Lower Front Panel Overlay.
- Step 11. Reinstall Front Panel Assembly.
- Step 12. Install the New Lower Front Panel Overlay.
- Step 13. Install Front Panel Jumpers.
- Step 15. Reinstall the Outer Cover.
- Step 16. Enable Option 216.
- Step 17. Perform Post-Upgrade Adjustments and Calibration.
- Step 18. Prepare the PNA for the User.

Step 1. Obtain a Keyword and Verify the Information

Follow the instructions on the Option Entitlement Certificate supplied to obtain a license key for installation of this upgrade. Refer to [“License Key Redemption” on page 4](#).

Verify that the model number, serial number, and option number information on the license key match those of the instrument on which this upgrade will be installed.

If the model number, serial number, or option number do not match those on your license key, you will not be able to install the option. If this is the case, contact Keysight for assistance before beginning the installation of this upgrade. Refer to [“Contacting Keysight” on page 3](#).

Once the license key has been received and the information verified, you can proceed with the installation at step 2.

Step 2. Remove the Outer Cover

For instructions, click the Chapter 7 bookmark “Removing the Covers” in the PDF Service Guide¹.

Step 3. Remove the Inner Cover

For instructions, click the Chapter 7 bookmark “Removing the Covers” in the PDF Service Guide¹.

Step 4. Remove the Front Panel Assembly

For instructions, click the Chapter 7 bookmark “Removing and Replacing the Front Panel Assembly” in the PDF Service Guide¹.

Step 5. Remove Some Existing Cables

NOTE Leave the gray flexible cables, the wire harnesses, and the ribbon cables connected where possible. **Any that are removed should be labeled for reconnection later.**

NOTE Be careful not to damage the center pins of the semirigid cables. Some flexing of the cables may be necessary but do not over-bend them.

NOTE When removing a cable, also remove the plastic cable clamp, if present. It is normal for some of the cable clamp’s adhesive to remain.

1. Place the analyzer bottom-side up on a flat surface.

Remove the following cables. To see an image showing the location of these cables, click the Chapter 6 bookmark “Bottom RF Cables, Standard 2-Port Configuration, Option 200” in the PDF Service Guide¹.

These RF cables may be discarded - they will not be reinstalled.

- W3 (N5232-20013) A21 MASSY to A25 test port 1 bridge coupler (thru)

1. See [“Downloading the Online PNA Service Guide” on page 5](#).

- W5 (N5232-20016) A25 test port 1 bridge coupler (arm) to A24 mixer brick
- W6 (N5232-20014) A21 MASSY to A24 mixer brick
- W4 (N5232-20011) A21 MASSY to A26 test port 2 bridge coupler (thru)
- W8 (N5232-20015) A26 test port 2 bridge coupler (arm) to A24 mixer brick
- W7 (N5232-20012) A21 MASSY to A24 mixer brick

These cables must be saved - they will be reinstalled.

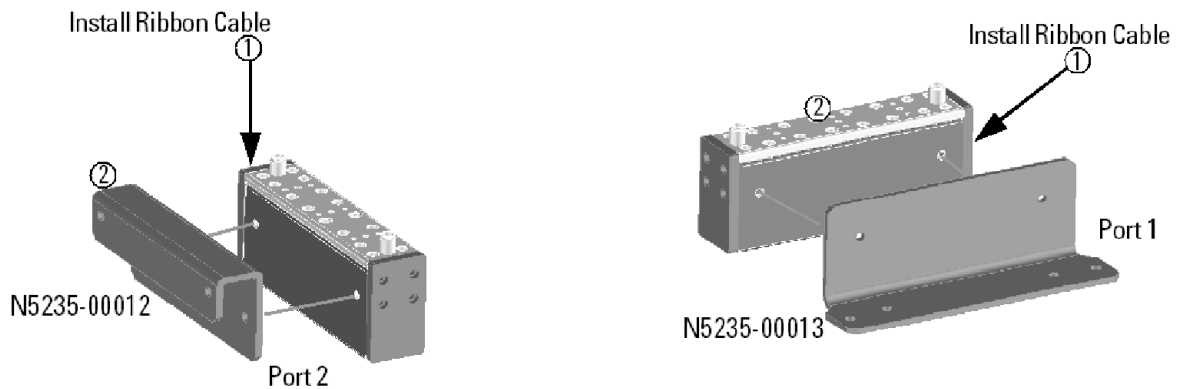
- W2 (N5232-20082) A21 MASSY to test set deck cable bracket
- W1 (top-side cable) (N5235-20040) A4 13.5 GHz Source Synthesizer board to test set deck cable bracket
- W10 (N5232-20081) A24 mixer brick to test set deck cable bracket

Step 6. Assemble the A29 and A30 Source Attenuator Assemblies

Refer to [Figure 1](#) for this step of the procedure. New parts are listed in [Table 1 on page 7](#).

1. Gather two source attenuators (33321-60082) and install a ribbon cable (8121-0982) on each.
2. Install bracket N5235-00013 on the port 1 source attenuator, and bracket N5235-00012 on the port 2 source attenuator using two screws (0515-0372) with each bracket. Use a T-10 TORX driver set to 9 in-lbs to tighten all screws.

Figure 1 Source Attenuator Assembly



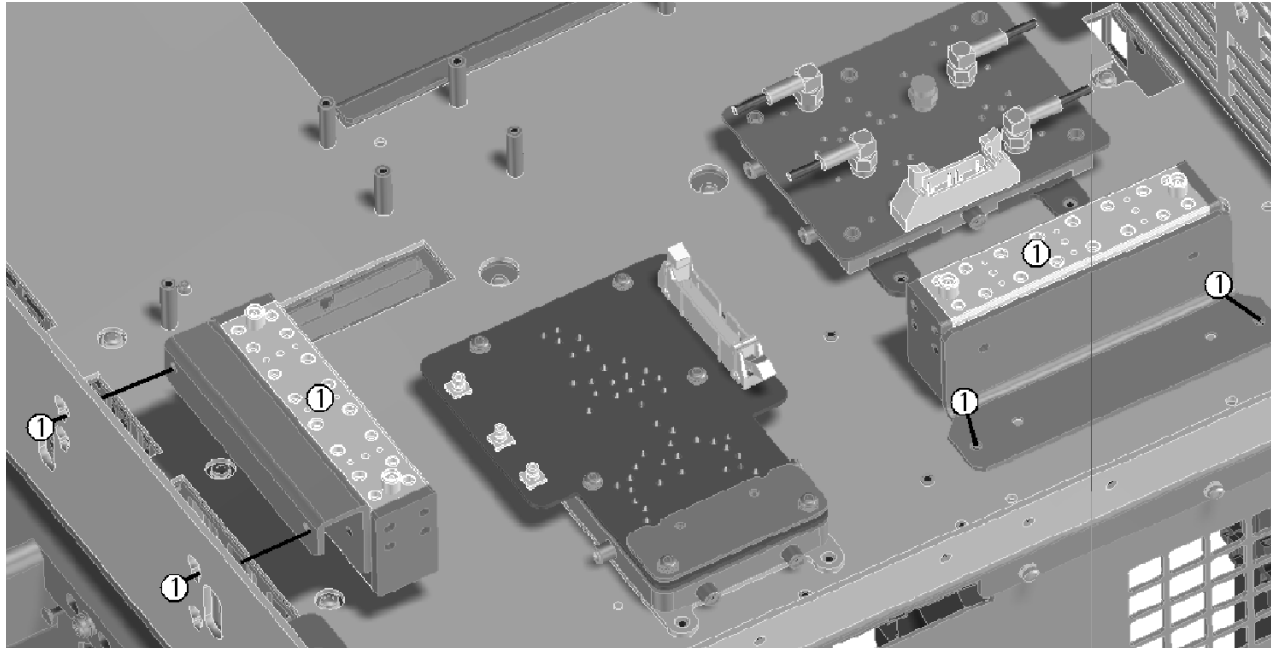
N5232_101_03

Step 7. Install the A29 and A30 Source Attenuator Assemblies

Refer to [Figure 2](#) for this step of the procedure. New parts are listed in [Table 1 on page 7](#).

1. Install both source attenuator assemblies to the deck as shown, using two screws (0515-0372) with each assembly. Use a T-10 TORX driver set to 9 in-lbs to tighten all screws.

Figure 2 Source Attenuators Installation



N5232_101_04

Step 8. Install the Cables

CAUTION Follow instructions carefully when making cable connections, especially wire harness connections. Incorrect connections can destroy components, resulting in additional customer costs.

CAUTION Be careful not to damage the center pins of the semirigid cables. Some flexing of the cables may be necessary but do not over-bend them.

CAUTION Use a 5/16-in torque wrench set to 10 in-lbs on all cable connections except the front and rear panel bulkhead connectors. On these, use a 9 mm nutsetter or open end torque wrench set to 21 in-lb.

Install the Semirigid Cables

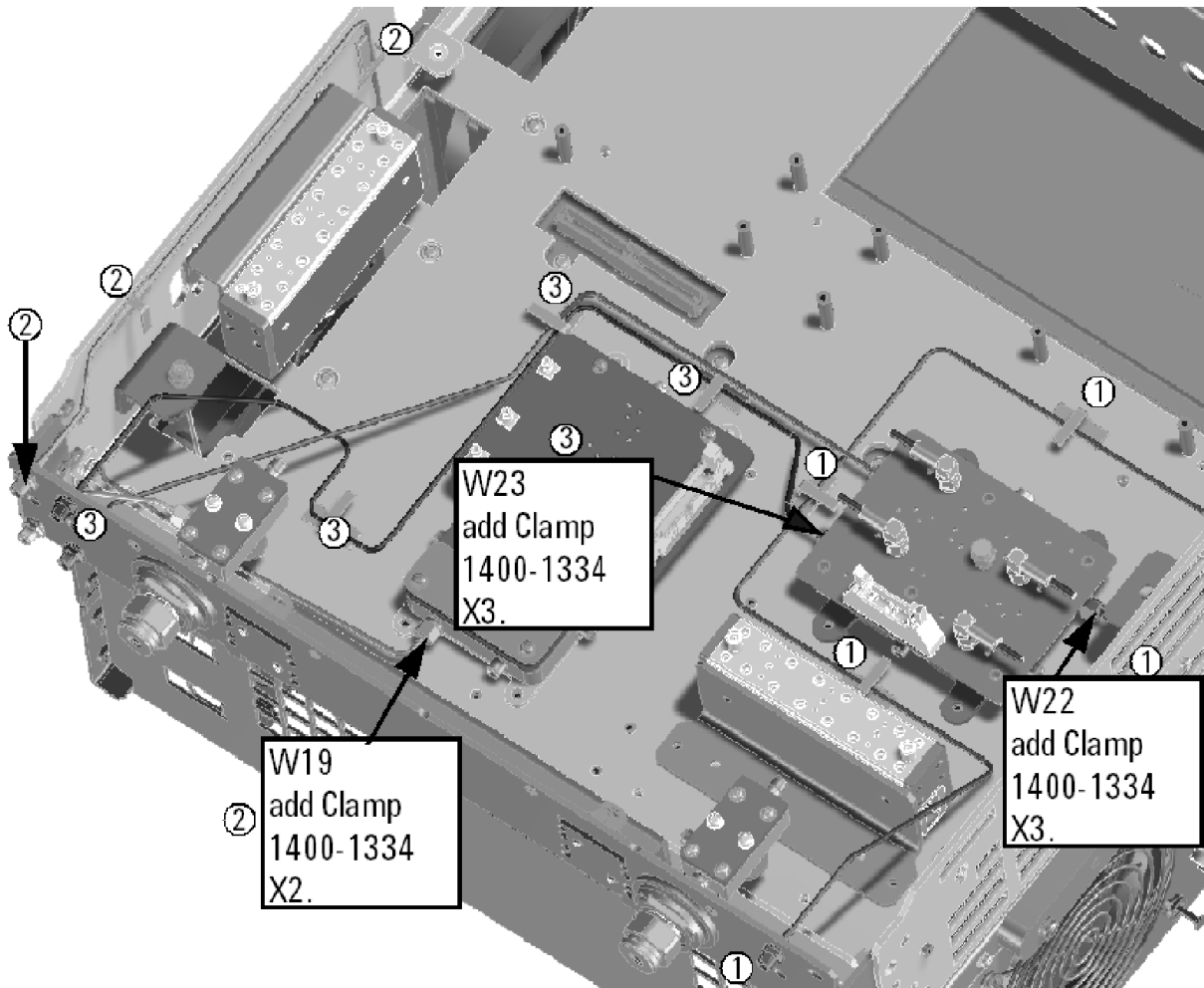
To see an image showing the location of these cables, click the Chapter 6 bookmarks “Bottom RF Cables, 2-Port Configuration, Option 216” in the PDF Service Guide¹. New parts are listed in [Table 1 on page 7](#).

Install the following new cables in the order listed.

- W22 (N5232-20031) A24 mixer brick to REF 1 RCVR R1 IN

* As shown in **Figure 3**, install three cable clamps (part number 1400-1334) to secure W22 (part number N5232-20031).

Figure 3 Location of Cable Clamps to Secure W19, W22, and W23



N5232_101_01

- W19 (N5232-20025) A21 MASSY to REF 2 SOURCE OUT

* As shown in **Figure 3**, install two cable clamps (part number 1400-1334) to secure W19 (part number N5232-20025).

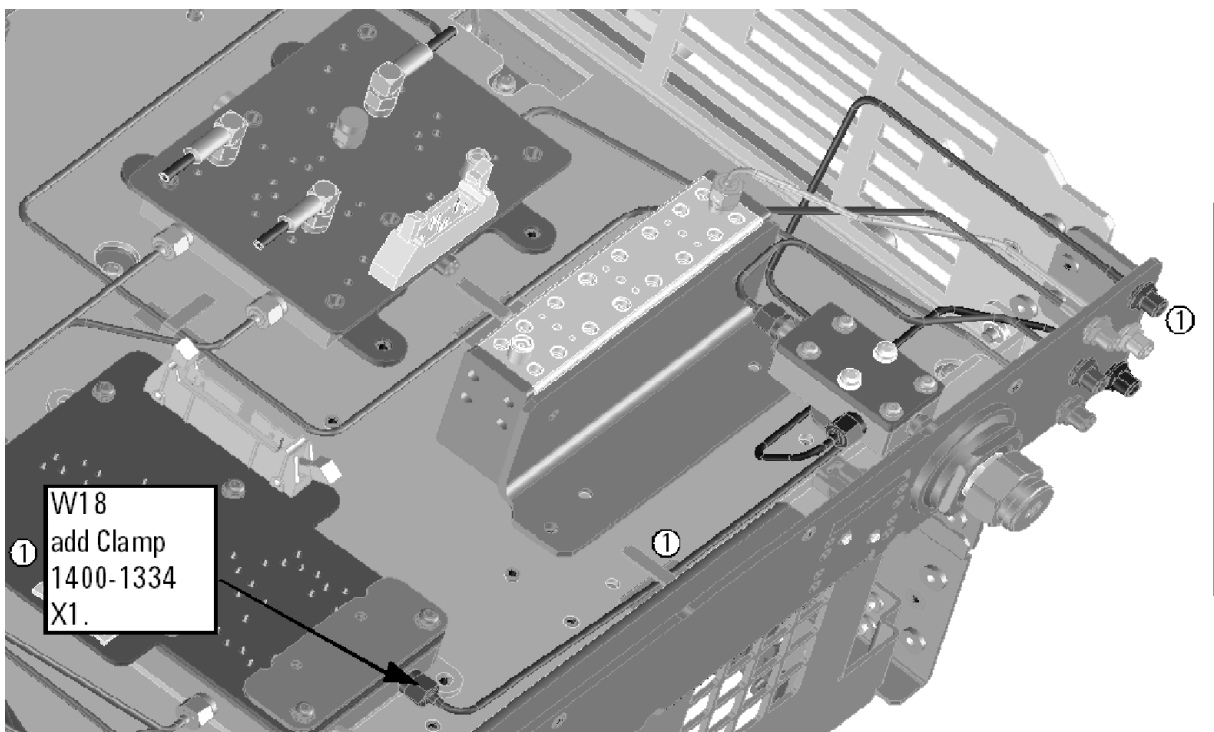
- W23 (N5232-20024) A24 mixer brick to REF 2 RCVR R2 IN

* As shown in **Figure 3**, install three cable clamps (part number 1400-1334) to secure W23 (part number N5232-20024).

1. See ["Downloading the Online PNA Service Guide"](#) on page 5.

- W24 (N5232-20023) A24 mixer brick to PORT 2 RCVR B IN
 - W20 (N5232-20022) A26 test port 2 bridge coupler (arm) to PORT 2 CPLR ARM
 - W1 (reuse) (top-side cable) (N5235-20040) A4 13.5 GHz Source Synthesizer board to test set deck cable bracket
 - W16 (N5232-20021) A26 test port 2 bridge coupler (thru) to PORT 2 CPLR THRU
 - W14 (N5232-20020) A30 test port 2 source attenuator to PORT 2 SOURCE OUT
 - W2 (reuse) (N5232-20082) A21 MASSY to test set deck cable bracket
 - W12 (N5232-20019) A21 MASSY to A30 test port 2 source attenuator
 - W18 (N5232-20032) A21 MASSY to REF 1 SOURCE OUT
- * As shown in [Figure 4](#), install one cable clamp (part number 1400-1334) to secure W18 (part number N5232-20032).

Figure 4 Location of Cable Clamps to Secure W18



N5232_101_02

- W21 (N5232-20030) A24 mixer brick to PORT 1 RCVR A IN
- W17 (N5232-20029) A25 test port 1 bridge coupler (arm) to PORT 1 CPLR ARM
- W15 (N5232-20028) A25 test port 1 bridge coupler (thru) to PORT 1 CPLR THRU
- W13 (N5232-20027) A29 60 dB step attenuator to PORT 1 SOURCE OUT
- W11 (N5232-20026) A21 MASSY to A29 60 dB step attenuator
- W10 (reuse) (N5232-20081) A24 mixer brick to test set deck cable bracket

Install the Wire Harnesses

To see an image showing the location of these wire harnesses, click the Chapter 6 bookmarks “Bottom Ribbon Cables and Wire Harnesses, 2-Port, Option 216” in the PDF Service Guide¹. New parts are listed in [Table 1 on page 7](#).

If not already done, connect these wire harnesses:

- 8121-0982 A19 test set motherboard J8 to A29 60 dB step attenuator
- 8121-0982 A19 test set motherboard J6 to A30 test port 2 source attenuator

Step 9. Secure the Hex Nuts on the Front Panel Bulkhead Connectors

Some of the new cables that were installed in the previous step connect to the front panel bulkhead. These cables were shipped with hex nuts. If not already done, secure the cable connectors to the front panel bulkhead with the hex nuts, torquing to 21 in-lbs.

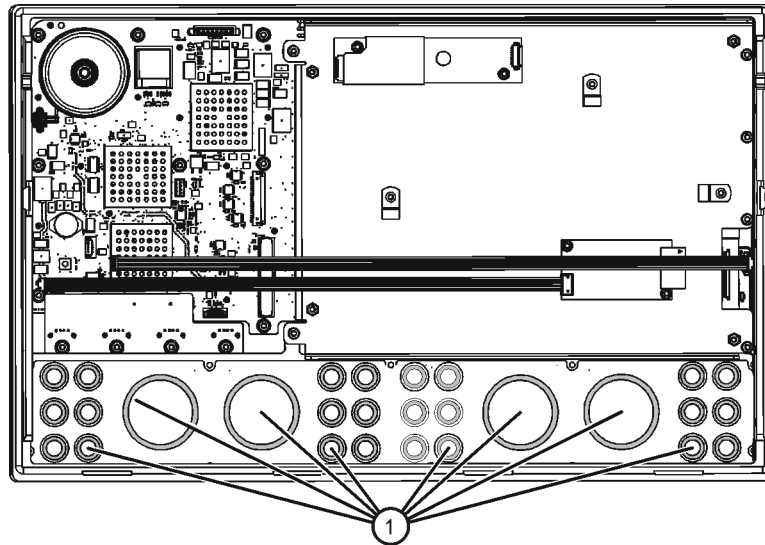
Step 10. Remove the Old Lower Front Panel Overlay

Refer to [Figure 5](#) for this step of the procedure. Although a 4-port PNA is shown in the graphic, the concept is the same for the 2-port PNA. New parts are listed in [Table 1 on page 7](#).

1. From the back side of the front panel, use a blunt object in the cutouts in the lower front dress panel to push on the old overlay (item ①) and separate it from the front dress panel.
2. From the front side of the front panel, pull off the overlay completely and discard it.
3. Remove any adhesive remaining on the front panel.

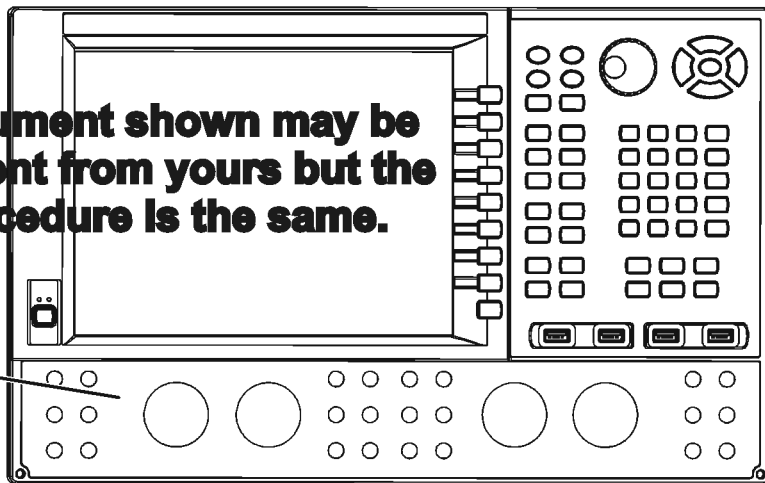
1. See [“Downloading the Online PNA Service Guide” on page 5](#).

Figure 5 Lower Front Panel Overlay Replacement



Old lower front-panel overlay visible through cutouts from rear of front panel.
Push here to release old front-panel overlay.

Instrument shown may be different from yours but the procedure is the same.



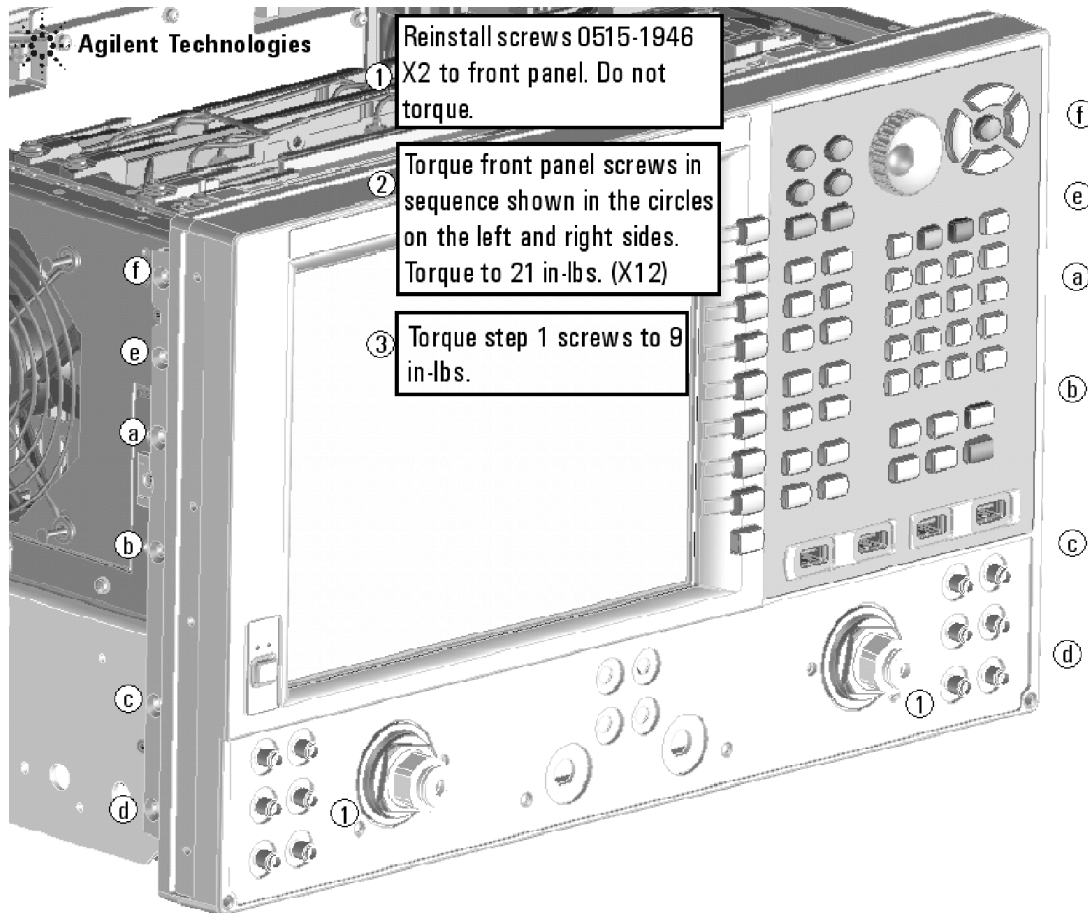
New lower front-panel overlay.
Align loosely to opening before pressing firmly.

N5225_105_04

Step 11. Reinstall Front Panel Assembly

Refer to [Figure 6](#) for this step of the procedure.

Figure 6 Front Panel Assembly Installation



Step 12. Install the New Lower Front Panel Overlay

Refer to [Figure 5 on page 16](#) for this step of the procedure. Although a 4-port PNA is shown in the graphic, the concept is the same for the 2-port PNA. New parts are listed in [Table 1 on page 7](#).

1. Remove the protective backing from the new front panel overlay, N5232-80005 (item ②).
2. Starting from either side, *loosely* place the overlay in the recess on the lower front panel, ensuring that it fits tightly against the edges of the recess.
3. Once the overlay is in place, press it firmly onto the frame to secure it.

Step 13. Install Front Panel Jumpers

As shown in [Figure 7](#), install 6 front panel jumper cables (part number N5222-20091). Torque to 10 in-lbs.

Figure 7 Front Panel Jumper Cables Installation



N5232_101_05

Step 14. Reinstall the Inner Cover

For instructions, click the Chapter 7 bookmark “Removing the Covers” in the PDF Service Guide¹.

1. See [“Downloading the Online PNA Service Guide”](#) on page 5.

Step 15. Reinstall the Outer Cover

For instructions, click the Chapter 7 bookmark “Removing the Covers” in the PDF Service Guide¹.

Step 16. Enable Option 216

Procedure Requirements

- The analyzer must be powered up and operating to perform this procedure.
- The Network Analyzer program must be running.
- A keyboard must be connected to the network analyzer.

Option Enable Procedure

1. To start the option enable utility, press UTILITY **System**, then **Service**, then **Option Enable**. An option enable dialog box will appear.
2. Click the arrow in the **Select Desired Option** box. A list of available options will appear.
3. In the **Select Desired Option** list, click **216 - Configurable Test Set**.
4. Using the keyboard, enter the license key in the box provided. The license key is printed on the the license message you received from Keysight. Enter this key *exactly* as it is printed on the message.
5. Click **Enable**.
6. Click **Yes** in answer to the displayed question in the **Restart Analyzer?** box.
7. When the installation is complete, click **Exit**.

Option Verification Procedure

Once the analyzer has restarted and the Network Analyzer program is again running:

1. On the analyzer’s **Help** menu, click **About Network Analyzer**.
2. Verify that “216” is listed after “Options:” in the display. Click **OK**.

NOTE If Option 216 has not been enabled, perform the “**Option Enable Procedure**” again. If the option is still not enabled, contact Keysight Technologies. Refer to “**Getting Assistance from Keysight**” on page 3.

1. See “**Downloading the Online PNA Service Guide**” on page 5.

Step 17. Perform Post-Upgrade Adjustments and Calibration

Adjustments

The following adjustments must be made due to the hardware changes of the analyzer.

- source adjustment
- receiver adjustment

These adjustments are described in the PNA Service Guide and in the PNA on-line HELP. A list of equipment required to perform these adjustments is also found in the service guide.

To view this service guide information, click the Chapter 3 bookmark “Tests and Adjustments” in the PDF Service Guide¹.

After the specified adjustments have been performed, the analyzer should operate and phase lock over its entire frequency range.

Operator’s Check

Perform the Operator’s Check to check the basic functionality of the analyzer. For instructions, click the Chapter 3 bookmark “Tests and Adjustments” in the PDF Service Guide¹.

If you experience difficulty with the basic functioning of the analyzer, contact Keysight. Refer to [“Contacting Keysight” on page 3](#).

Calibration

Although the analyzer functions, its performance relative to its specifications has not been verified. It is recommended that a full instrument calibration be performed using the analyzer’s internal performance test software. To view information on the performance test software, click the Chapter 3 bookmark “Tests and Adjustments” in the PDF Service Guide¹.

Step 18. Prepare the PNA for the User

1. If necessary, reinstall front jumper cables.
2. Install the cable guards, pushing them over the front jumper cables until the cushioning material touches the front panel of the PNA.
3. Install the dust caps on the test ports.
4. Clean the analyzer, as needed, using a damp cloth.

1. See [“Downloading the Online PNA Service Guide” on page 5](#).

This information is subject to change without notice.
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N5232-90101
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