Keysight Technologies
M9405A

KEYSIGHT
TECHNOLOGIES

User's and
Service Guide

Safety Notices

CAUTION

A **CAUTION** notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, 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.

WARNING

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

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M9405A

Introduction

The scope of this User's and Service Guide is to detail the processes of receiving and installing the M9405A module, installing the required software, and verifying basic module operations. If you have any inquiries after reviewing this information, contact your local Keysight Technologies Inc. representative or refer to "Keysight Support, Services, and Assistance" on page 19.

Description

Congratulations on your purchase from Keysight Technologies, Inc.

The M9405A is a 1-slot, 1U PXIe Amplifier. The M9405A operates over a frequency range of 300 kHz to 26.5 or 50 GHz.

To get the most out of your purchase, it is recommended that this User's and Service Guide be read carefully and completely.

Table 1   Model and Options

Module	Option	Description
M9405A	H01	Standard PXIe Amplifier
	F26	Frequency 300 kHz to 26.5 GHz
	F50	Frequency 300 kHz to 50 GHz

Verifying the Shipment

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

Inspect the shipping container for damage. Report any damage to the shipping agent immediately, such damage is not covered by the warranty (warranty information can be found at the beginning of this manual). Keep the damaged shipping materials (if any) for inspection by the carrier and a Keysight Technologies representative. Refer to "Keysight Support, Services, and Assistance" on page 19.

Carefully remove the contents from the shipping container and verify that your order is complete. Confirm that the options you ordered are included with the shipment. Refer to the serial number label on the side panel and the packing literature included with the shipment.

Technical Specification and Characteristics

Definitions

Specifications describe the warranted performance of calibrated instruments. Data represented in this document are specifications unless otherwise noted under the following conditions.

- Full temperature range = Individual module temperature of ≤ 75 °C as reported by the module, and environment temperature of 0 to 55 °C.

- Controlled temperature range = Individual module temperature of ≤ 55 °C as reported by the module, and environment temperature of 20 to 30 °C.

Temperatures referred to in this document are defined as follows:

- Calibrated instruments have been stored for a minimum of 2 hours within the full temperature range

- 45 minute warm-up time

- Calibration cycle maintained

- When used with Keysight M9300A frequency reference and Keysight interconnect cables

Characteristics describe product performance that is useful in the application of the product, but that is not covered by the product warranty. Characteristics are often referred to as Typical or Nominal values and are italicized.

- *Typical* describes characteristic performance, which 80% of instruments will meet when operated within the controlled temperature range.

- *Nominal* describes representative performance that is useful in the application of the product when operated within the controlled temperature range.

Electrostatic Discharge Protection

Electrostatic discharge (ESD) can damage or destroy electronic components. The module is shipped in materials which prevent damage from static, and should only be removed from the packaging in an anti-static area ensuring that the correct anti-static precautions are taken.

Two types of ESD protection are listed below. Purchase acceptable ESD accessories from your local supplier.

- Conductive table-mat and wrist-strap combination
- Conductive floor-mat and heal-strap combination

Both types, when used together, provide a significant level of ESD protection. To ensure user safety, static-safe accessories must provide at least 1 Meg Ohm of isolation from ground.

WARNING **These techniques for a static-safe work station should not be used when working on circuitry with a voltage potential greater than 500 volts.**

General Characteristics

Table 2   Nominal Performance

Frequency Range	300 kHz to 50 GHz	
Input Power at Compression (dBm) (0.1 dB and 1 dB compression)	1 GHz 10 GHz 26.5 GHz 50 GHz	0.1 dB 1 dB −22 −18 −22 −13 −22 −14 −20 −13
Maximum Input Power	−10 dBm	
Impedance	50 Ohms	
Power Drawn from Chassis	≤ 14 W	
	Option F26	Option F50

Return Loss (dB)
   RF Input (S11)
   RF Output (S22)
	≤ -10	≤ -5

Gain (dB) (S21)	≥ 27	≥ 24
NF (dB) (The conversion loss of the link is the primary contributor to the NF results. Amplification is recommended to reduce NF).	7	9
RF Connectors	3.5 mm	2.4 mm

Figure 1   Nominal Performance
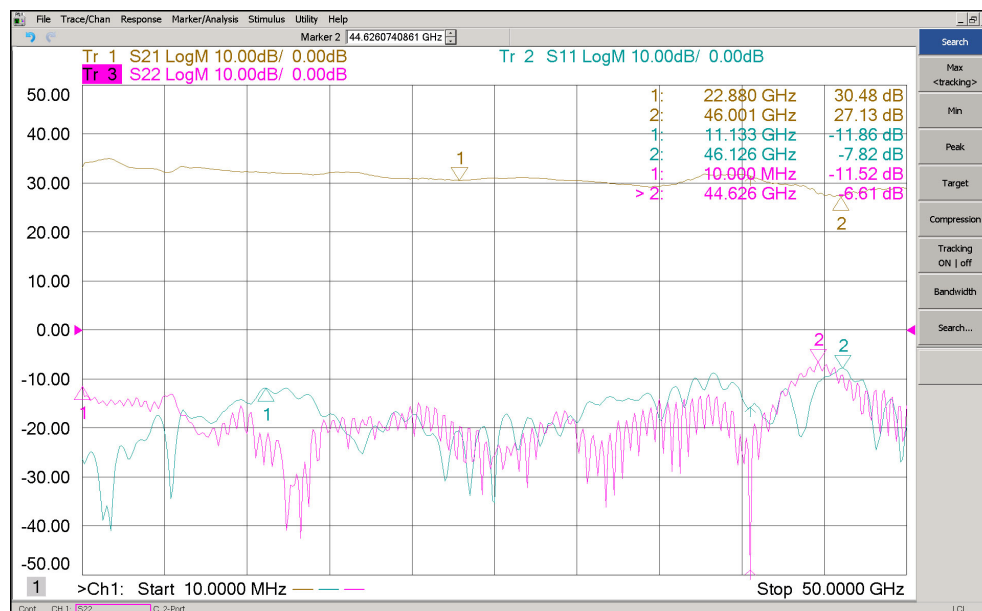
Front Panel Features

Figure 2   M9405A Front Panel

Status LED

- Green, the status LED indicates the chassis is powered on and communicating with the module when the soft front panel is opened (SFP).

Access Ports 3.5 or 2.4 mm (female)

- RF Input/Output 300 kHz to 26.5 or 50 GHz.

PXI Latch

- Secures the modules to the mainframe.

Install the Software

Table 3   System and Hardware Requirements

Topic	Requirements	
System Requirements		
Operating System	Window XP, Service Pack 3	Windows Vista®, SP1 and SP2 (32-bit and 64-bit), Windows 7 (32 bit and 64 bit)
Processor speed	600 MHz or higher required 800 MHz recommended	1 GHz 32-bit (x86), 1 GHz 64-bit (x64), no support for Itanium64
Available memory	256 MB minimum (1 GB or greater recommended)	1 GB minimum
Available disk space[1]	1.5 GB available hard disk space, includes: l 1 GB available for Microsoft.NET Framework 3.5 SP1[2] l 100 MB for Keysight IO Libraries Suite	
Video	Super VGA (800x600) 25 colors or more	Support for DirectX 9 graphics with 128 MB graphics memory recommended (Super VGA graphics is supported)
Browser	Microsoft Internet Explorer 6.0 or greater	Microsoft Internet Explorer 7.0 or greater
Hardware Requirements		
Chassis	PXIe system/ host controller A PXI or PXI Express embedded controller or remote controller (external PC connected to the chassis via a PCI-to-PXI interface) is required.	
PXIe System/ host Controller	A PXI or PXI Express embedded controller or remote controller (external PC connected to the chassis via a PCI-to-PXI interface) is required.	
Embedded Controller	Keysight M9036A or an embedded controller that meets the following requirements: - PXIe system controller (PXI-1 embedded controllers are not compatible) - Utilize a 2x8, 4x4, or 1x4 PXIe system slot link configuration. - Run one of the operating systems listed in System Requirements (above).	
Remote Controller	(for Keysight M9018A chassis use only) Keysight M9021A Cable Interface x8 with one of the following PC interface options: - Keysight M9045B PCIe ExpressCard Adaptor x1, with cable (for a laptop PC) - Keysight M9048A PCIe Desktop Adaptor x8, with cable (for desktop PCs) Or an equivalent remote controller using a PC running one of the operating systems listed in System Requirements (above).	

1. This is the required disk space for installation. Typically, less disk space is required for operation than is required for installation.
2. NET Framework Runtime Components are installed by default with Windows Vista. Therefore, you may not need this amount of disk space.

Power up the Controller

CAUTION   If you are using a remote controller and you have installed the interface cable, you must power up the chassis *before* you power up the PC. As well, you must power down the PC *before* you power down the chassis.

If you are using an embedded controller, complete the following steps:

1. Install the embedded controller module into the compatible chassis. The Keysight M9036A PXIe Embedded Controller and Keysight M9018A PXIe Chassis are recommended. Please refer to the embedded controller and chassis documentation for further details.

2. Connect peripherals (mouse, keyboard and monitor).

3. Turn On the chassis.

Install the Software

NOTE   Administrator privileges will be needed for software and hardware installation. This includes first-time installation of a module in a different chassis slot.

The software installation includes the following:

NOTE   Version 16.2 (or newer) of the Keysight IO Libraries Suite is required.

· The Keysight IO Libraries Suite CD (E2094-60003), includes the Keysight Connection Expert. It is also available on the Internet at: http://www.keysight.com/find/iosuite

· Instrument software, which includes the soft front panel (SFP), device driver (IVI-COM) and documentation for the M9405A. This software CD is included with your shipment (M9499-10002).

Use the following procedure to install the software:

1. From the Keysight IO Libraries Suite CD (E2094-60003) browser, launch the installer.

2. Follow the installer prompts to install the IO Libraries Suite.

3. From the Product Software and Information CD (M9499-10002) browser, launch the installer.

4. Follow the installer prompts to install all software and documentation for the module.

5. After installation has completed, power down the host PC.

Install the M9405A

NOTE	The M9405A can be used in a chassis with a PXIe or PXI-H chassis peripheral slot.

7ᴴ	The M9405A can also be installed in any hybrid PXI slot marked with a peripheral slot compatibility image (the letter "H" and a solid circle containing the slot number).

CAUTION	PXI hardware does not support "hot-swap" capabilities (changing modules while power is applied to the chassis).

> Before installing a module into the chassis, the chassis must be powered off to prevent damage to the module.

1. Ensure that the PXI chassis power switch is in the off (Standby) position.

2. If the chassis has multiple fan speed settings, ensure that the fans are set to automatic. Do not set the fan speed to low or turn it off.

3. Position the chassis so that there is ample space between the chassis fan intake and exhaust vents. Blockage by walls or obstructions affects the air flow needed for cooling. (Refer to the chassis documentation for more information about cooling).

4. Holding the module by the injector/ejector handle, slide it into the card edges on the guide slot (top and bottom) as shown in Figure 3.

   a. Slide the module to the rear of the chassis and ensure that the injector/ejector handle is pushed down in the unlatched (downward) position.

   b. Slide the module completely into the chassis. When you begin to feel resistance, push up on the injector/ejector handle to fully insert the module into the chassis.

Figure 3   Installing the Module
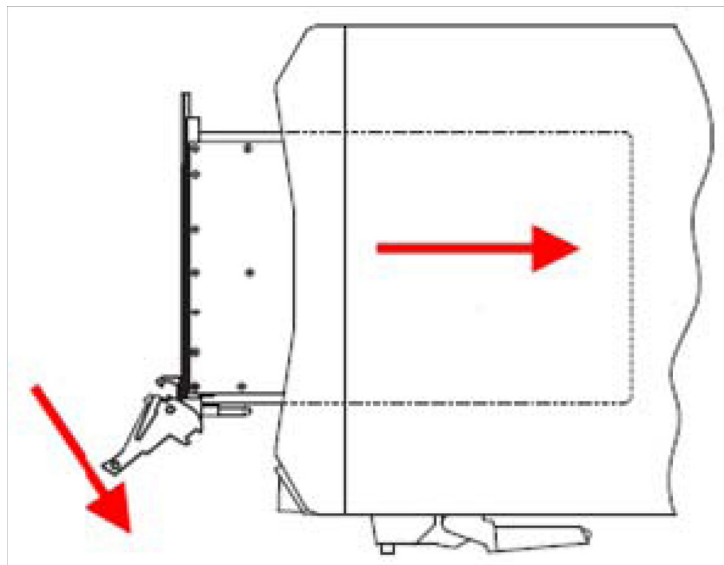
5. Secure the front panel to the chassis using the front panel mounting screws. Performance may suffer if the screws are not tightened properly.

6. Verify that the PXI chassis fans are operable and free of dust and other contaminants that may restrict air flow.

7. Install all chassis covers and filler panels. Missing filler panels may disrupt necessary air circulation in the chassis.

8. Power up the PXI chassis.

M9405A Operational Check Procedure

The operational check measures the signal paths from the RF Input of the M9405A module. The following procedure verifies that the connectors and circuitry are operating correctly.

> **CAUTION**   Do not exceed the maximum input power level of +20 dBm.

Equipment Required

To demonstrate that the module works properly requires external equipment with operating frequency range of 10 MHz to 26.5 or 50 GHz. This includes a network analyzer, or optionally, a signal source and power meter or spectrum analyzer.

Table 4   Hardware Test Configuration

Hardware	Description
Option I	Network Analyzer
Option II	Signal Source and Power Meter
Option III	Signal Source and Spectrum Analyzer

Equipment Test Configuration Option I (Network Analyzer)

1. Adjust the Network Analyzer Stimulus Power for the M9405A to –30 dBm.

2. Set the Frequency Sweep from 10 MHz to 26.5 or 50 GHz depending on Options F26 or F50.

3. Perform a 2-Port Network Analyzer calibration (normalization response is adequate).

4. Connect the Stimulus Source (Network Analyzer Port 1) to the M9405A RF Input Port.

5. Connect Port 2 of the Network Analyzer to the M9405A RF Output Port.

> **NOTE**   Depending on your instrument's power handling capability it may be necessary to use a 20 dB attenuator to protect the instrument.

6. Measure the Return Loss (S11 & S22) and Gain (S21). Compare it to the typical performance in .

Equipment Test Configuration Option II (Signal Source & Power Meter)

1. Adjust the Signal Source Stimulus Power for the M9405A to –30 dBm.

2. Set the Signal Source to a CW Frequency of 50 MHz.

3. Perform a Power Meter calibration.

4. Connect the Stimulus Source to M9405A RF Input Port.

5. Connect the Power Meter Sensor to M9405A RF Output Port.

> **NOTE** Depending on your instrument's power handling capability it may be necessary to use a 20 dB attenuator to protect the instrument.

6. Measure the Power and compare the Gain (Pmeasured - Pstimulus).

7. Set the Signal Source to a CW Frequency of 10 GHz.

8. Repeat step 5 thru step 6.

9. Set the Signal Source to a CW Frequency of 26.5 GHz.

10. Repeat step 5 thru step 6.

11. Set the Signal Source to a CW Frequency of 50 GHz.

12. Compare the Gain to Table 1 on page 2.

Equipment Test Configuration Option III (Signal Source & Spectrum Analyzer)

1. Adjust the Signal Source Stimulus Power for the M9405A to –30 dBm.

2. Set the CW Frequency Sweep to 50 MHz.

3. Set the Center Frequency to 50 MHz on the Spectrum Analyzer respectively.

4. Connect the Stimulus Source to M9405A RF Input Port.

5. Connect the Spectrum Analyzer to M9405A RF Output Port.

> **NOTE** Depending on your instrument's power handling capability it may be necessary to use a 20 dB attenuator to protect the instrument.

6. Measure the Power and compare the Gain (Pmeasured - Pstimulus).

7. Set the Signal Source to a CW Frequency of 10 GHz.

8. Repeat step 5 thru step 6.

9. Set the Signal Source to a CW Frequency of 26.5 MHz.

10. Repeat step 5 thru step 6.

11. Set the Signal Source to a CW Frequency of 50 GHz.

12. Compare the Gain to Table 1 on page 2.

Service

If a Problem is Found

If a problem is found, complete the following procedures:

1. Verify that the relevant hardware is turned on.
2. Verify that the stimulus signal is set to the proper power/frequency and that all cables are properly connected.

Module Core Replacement

Replaceable Parts

Description	Keysight Part Number	Part Number Description
PXIe Amplifier Option F26	M9405-60001	Replacement core assembly
PXIe Amplifier Option F26	M9405-69001	Exchange core assembly
PXIe Amplifier Option F50	M9405-60002	Replacement core assembly
PXIe Amplifier Option F50	M9405-69002	Exchange core assembly

Ordering a Core Replacement Module

1. Contact Keysight on the Internet at: http://www.keysight.com/find/assist
2. Order a core replacement for your module.
3. When the core replacement arrives, the package includes:

   · Entitlement Certificate
   · Replacement module
   · Functional Certificate for the replacement module
   · RMA number
   · Return instructions

Replacing the Defective Module

CAUTION	Before opening a packaged module for troubleshooting, ensure that all electrostatic discharge (ESD) precautions are observed. Refer to "Electrostatic Discharge Protection" on page 4 for details.

1. Power down the chassis.

2. Remove the defective module from the chassis.

3. Write down the serial number shown on the side shield of the defective module. You will assign this serial number to the replacement module using the Keysight M9405A Simple Module (SFP).

4. Remove the replacement module from the box and shipping material.

5. Remove the side shield from the defective module using a Torx #8 driver.

   a. There are five screws to secure the side shield to the module.
      Important: Keep the screws – new ones are not included with the replacement module.

6. Remove the side shield from the replacement module using this same process.

7. Attach the original side shield from the defective module to the replacement module.

8. Install the replacement module into the chassis.

9. Power up the chassis.

10.   If you are using a remote controller, power up the computer. (If you are using an embedded controller, continue to the step 11.)

11.   Program the replacement module with the serial number from the defective module.

   a. If you don't already have the Keysight M9405A Simple Module SFP, download it from http://www.keysight.com/find/M9405A (from this site, select Technical Support > Drivers, Firmware & Software), and install it on your computer or embedded controller.

   b. Launch the Keysight M9405A Simple Module SFP (launch from the Start menu program group "Keysight/SimpleModuleSFP") and follow the embedded instructions for programming the serial number.

12. Attach the side shield from the replacement module to the defective module, and return it to Keysight according to the following procedure:

a. Review the warranty information shipped with your product.

b. Write the following information on a tag and attach it to the malfunctioning equipment:

- Name and address of owner. A P.O. box is not acceptable as a return address.

- Product model number (for example, M9405A).

- Product serial number. The serial number label is located on the side panel of the module. The serial number can also be read from the Soft Front Panel interface, but only after the hardware is installed.

- Description of failure or service required.

- Return Material Authorization (RMA) number.

c. Pack the module in its original ESD bag and packing carton. If the original carton is not available, use bubble wrap or packing peanuts and place the instrument in a sealed container and mark the container "FRAGILE".

d. On the shipping label, write ATTENTION REPAIR DEPARTMENT and the RMA number.

If any correspondence is required, refer to the product by serial number and model number or refer to "Keysight Support, Services, and Assistance" on page 19.

General Safety and Information

Introduction

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

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

Safety Earth Ground

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

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

Statement of Compliance

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

Connector Care and Cleaning Precautions

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

WARNING	**To prevent electrical shock, remove the M9403B from the chassis before cleaning. Use a dry cloth or one slightly dampened with water to clean the external case parts. Do not attempt to clean internally. To clean the connectors, use alcohol in a well-ventilated area. Allow all residual alcohol moisture to evaporate, and the fumes to dissipate prior to energizing the instrument.**

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

Regulatory Information

Listed below are definitions for the markings that may be found on the product.

Instrument Markings

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

This symbol indicates separate collection for electrical and electronic equipment, mandated under EU law. All electric and electronic equipment are required to be separated from normal waste for disposal (Reference WEEE Directive).

The CE mark is a registered trademark of the European Community.

ccr.keysight@keysight.com   The Keysight email address is required by EU directives applicable to our product.

The RCM mark is a registered trademark of the Australian Communications and Media Authority.

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

This symbol indicates that PXI is a U.S. registered trademark of the PXI System Alliance.

South Korean Certification (KC) mark; includes the marking's identifier code which follows the format: MSIP-REM-YYY-ZZZZZZZZZZZZZZ.

EMC Compliance

Complies with the essential requirements of the European EMC Directive as well as current editions of the following standards (dates editions are cited in the Declaration of Conformity):

- IEC/EN 61326-1

- CISPR Pub 11 Group 1, Class A

- AS/NZS CISPR 11

- ICES/NMB-001
  This ISM device complies with Canadian ICES-001.
  Cet appareil ISM est conforme a la norme NMB-001 du Canada.

South Korean Class A EMC Declaration

Information to the user: If this instrument is equipped with a "KC" label, it has been conformity assessed for use in business environments. In a residential environment, this equipment may cause radio interference.

※ This EMC statement applies to the equipment only for use in a business environment.

사 용 자 안 내 문
이 기기는 업무용 환경에서 사용할 목적으로 적합성평가를 받은 기기로서 가정용 환경에서 사용하는 경우 전파간섭의 우려가 있습니다.

※ 사용자 안내문은 "업무용 방송통신기자재"에만 적용한다.

Safety This instrument complies with the essential requirements of the European Low Voltage Directive.

Acoustic Statement (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).

- **Acoustical Noise Emission/ Geraeuschemission**

  LpA ‹70 dB   LpA ‹70 dB
  Operator position   am Arbeitsplatz normaler
  Normal operation mode Per ISO 7779 Betrieb nach DIN 45635 t.19

To find a current Declaration of Conformity for a specific Keysight product, go to: http://regulations.about.keysight.com/DoC/default.htm

Keysight Support, Services, and Assistance

Service and Support Options

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

Return a Module for Service

Should it become necessary to return a module for repair or service, follow the steps below:

1. Review the warranty information shipped with your product.

2. Contact Keysight to obtain a Return Material Authorization (RMA) and return address. If you need assistance finding Keysight contact information go to http://www.keysight.com/find/assist (worldwide contact information for repair and service) or refer to the "Support" information on the product web page.

3. Write the following information on a tag and attach it to the malfunctioning equipment:

   · Name and address of owner. P.O. boxes are not acceptable as return addresses.

   · Product model number (for example, M9405A).

   · Product serial number (for example, MYXXXXXXXX). The serial number label is located on the side panel of the module.

   · Description of failure or service required.

4. Carefully pack the module in its original ESD bag and packing carton. If the original carton is not available, use bubble wrap or packing peanuts and place the instrument in a sealed container and mark the container "FRAGILE".

5. On the shipping label, write ATTENTION REPAIR DEPARTMENT and the RMA number.

> **NOTE** If any correspondence is required, refer to the product by serial number and model number.

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