

Startup Guide

Keysight Y1299A-002 RF Power Amplifier Test Reference Solution



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

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Sales and Technical Support

For product information and support, and to obtain the latest software and documentation, go to www.keysight.com/find/pxi-poweramplifier.

Worldwide contact information for repair and service can be found at www.keysight.com/find/assist.

Information on preventing damage to your Keysight equipment can be found at www.keysight.com/find/tips.

Regulatory Compliance

This product has been designed and tested in accordance with accepted industry standards, and has been supplied in a safe condition. To review the Declaration of Conformity, go to <http://regulations.corporate.keysight.com/DoC/search.htm>.

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Safety Notices

The following safety precautions should be observed before using this product and any associated instrumentation.

This product is intended for use by qualified personnel who recognize shock hazards and are familiar with the safety precautions required to avoid possible injury. Read and follow all installation, operation, and maintenance information carefully before using the product.

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.

The types of product users are:

- **Responsible body** is the individual or group responsible for the use and maintenance of equipment, for ensuring that the equipment is operated within its specifications and operating limits, and for ensuring operators are adequately trained.
- **Operators** use the product for its intended function. They must be trained in electrical safety procedures and proper use of the instrument. They must be protected from electric shock and contact with hazardous live circuits.
- **Maintenance personnel** perform routine procedures on the product to keep it operating properly (for example, setting the line voltage or replacing consumable materials). Maintenance procedures are

described in the user documentation. The procedures explicitly state if the operator may perform them. Otherwise, they should be performed only by service personnel.

- **Service personnel** are trained to work on live circuits, perform safe installations, and repair products. Only properly trained service personnel may perform installation and service procedures.

WARNING

Operator is responsible to maintain safe operating conditions. To ensure safe operating conditions, modules should not be operated beyond the full temperature range specified in the Environmental and physical specification. Exceeding safe operating conditions can result in shorter lifespans, improper module performance and user safety issues. When the modules are in use and operation within the specified full temperature range is not maintained, module surface temperatures may exceed safe handling conditions which can cause discomfort or burns if touched. In the event of a module exceeding the full temperature range, always allow the module to cool before touching or removing modules from chassis.

Keysight products are designed for use with electrical signals that are rated Measurement Category I and Measurement Category II, as described in the International Electrotechnical Commission (IEC) Standard IEC 60664. Most measurement, control, and data I/O signals are Measurement Category I and must not be directly connected to mains voltage or to voltage sources with high transient over-voltages. Measurement Category II connections require protection for high transient over-voltages often associated with local AC mains connections. Assume all measurement, control, and data I/O connections are for connection to

Category I sources unless otherwise marked or described in the user documentation.

Exercise extreme caution when a shock hazard is present. Lethal voltage may be present on cable connector jacks or test fixtures. The American National Standards Institute (ANSI) states that a shock hazard exists when voltage levels greater than 30V RMS, 42.4V peak, or 60VDC are present. A good safety practice is to expect that hazardous voltage is present in any unknown circuit before measuring.

Operators of this product must be protected from electric shock at all times. The responsible body must ensure that operators are prevented access and/or insulated from every connection point. In some cases, connections must be exposed to potential human contact. Product operators in these circumstances must be trained to protect themselves from the risk of electric shock. If the circuit is capable of operating at or above 1000V, no conductive part of the circuit may be exposed.

Do not connect switching cards directly to unlimited power circuits. They are intended to be used with impedance-limited sources. NEVER connect switching cards directly to AC mains. When connecting sources to switching cards, install protective devices to limit fault current and voltage to the card.

Before operating an instrument, ensure that the line cord is connected to a properly-grounded power receptacle. Inspect the connecting cables, test leads, and jumpers for possible wear, cracks, or breaks before each use.

When installing equipment where access to the main power cord is restricted, such as rack mounting, a separate main input power disconnect device must be provided in close proximity to the equipment and within easy reach of the operator.

For maximum safety, do not touch the product, test cables, or any other instruments while power is applied to the circuit under

test. ALWAYS remove power from the entire test system and discharge any capacitors before: connecting or disconnecting cables or jumpers, installing or removing switching cards, or making internal changes, such as installing or removing jumpers.

Do not touch any object that could provide a current path to the common side of the circuit under test or power line (earth) ground.

Always make measurements with dry hands while standing on a dry, insulated surface capable of withstanding the voltage being measured.

The instrument and accessories must be used in accordance with its specifications and operating instructions, or the safety of the equipment may be impaired.

Do not exceed the maximum signal levels of the instruments and accessories, as defined in the specifications and operating information, and as shown on the instrument or test fixture panels, or switching card.

When fuses are used in a product, replace with the same type and rating for continued protection against fire hazard.

Chassis connections must only be used as shield connections for measuring circuits, NOT as safety earth ground connections.

If you are using a test fixture, keep the lid closed while power is applied to the device under test. Safe operation requires the use of a lid interlock.

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.

Instrumentation and accessories shall not be connected to humans.

Before performing any maintenance, disconnect the line cord and all test cables.

To maintain protection from electric shock and fire, replacement components in mains circuits – including the power transformer, test leads, and input jacks – must be purchased from Keysight. Standard fuses with applicable national safety approvals may be used if the rating and type are the same. Other components that are not safety-related may be purchased from other suppliers as long as they are equivalent to the original component (note that selected parts should be purchased only through Keysight to maintain accuracy and functionality of the product). If you are unsure about the applicability of a replacement component, call an Keysight office for information.

WARNING

No operator serviceable parts inside. Refer servicing to qualified personnel. To prevent electrical shock do not remove covers. For continued protection against fire hazard, replace fuse with same type and rating.

PRODUCT MARKINGS:



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



Australian Communication and Media Authority mark to indicate regulatory compliance as a registered supplier.



This symbol indicates product compliance with the Canadian Interference-Causing Equipment Standard (ICES-001). It also identifies the product is an Industrial Scientific and Medical Group 1 Class A product (CISPR 11, Clause 4).



South Korean Class A EMC Declaration. This equipment is Class A suitable for professional use and is for use in electromagnetic environments outside of the home. A급 기기 (업무용 방송통신기자재) 이 기기는 업무용 (A급) 전자파적합기기로서 판매자 또는 사용자는 이 점을 주의하시기 바라며, 가정외의 지역에서 사용하는 것을 목적으로 합니다.



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 the instrument is sensitive to electrostatic discharge (ESD). ESD can damage the highly sensitive components in your instrument. ESD damage is most likely to occur as the module is being installed or when cables are connected or disconnected. Protect the circuits from ESD damage by wearing a grounding strap that provides a high resistance path to ground. Alternatively, ground yourself to discharge any built-up static

charge by touching the outer shell of any grounded instrument chassis before touching the port connectors.



This symbol on an instrument means caution, risk of danger. You should refer to the operating instructions located in the user documentation in all cases where the symbol is marked on the instrument.



This symbol 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.

CLEANING PRECAUTIONS:

WARNING

To prevent electrical shock, disconnect the Keysight Technologies instrument from mains 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.

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Introduction

The scope of this document is to present the processes of receiving, installing, and verifying operation of the RF PA Test, Reference Solution.

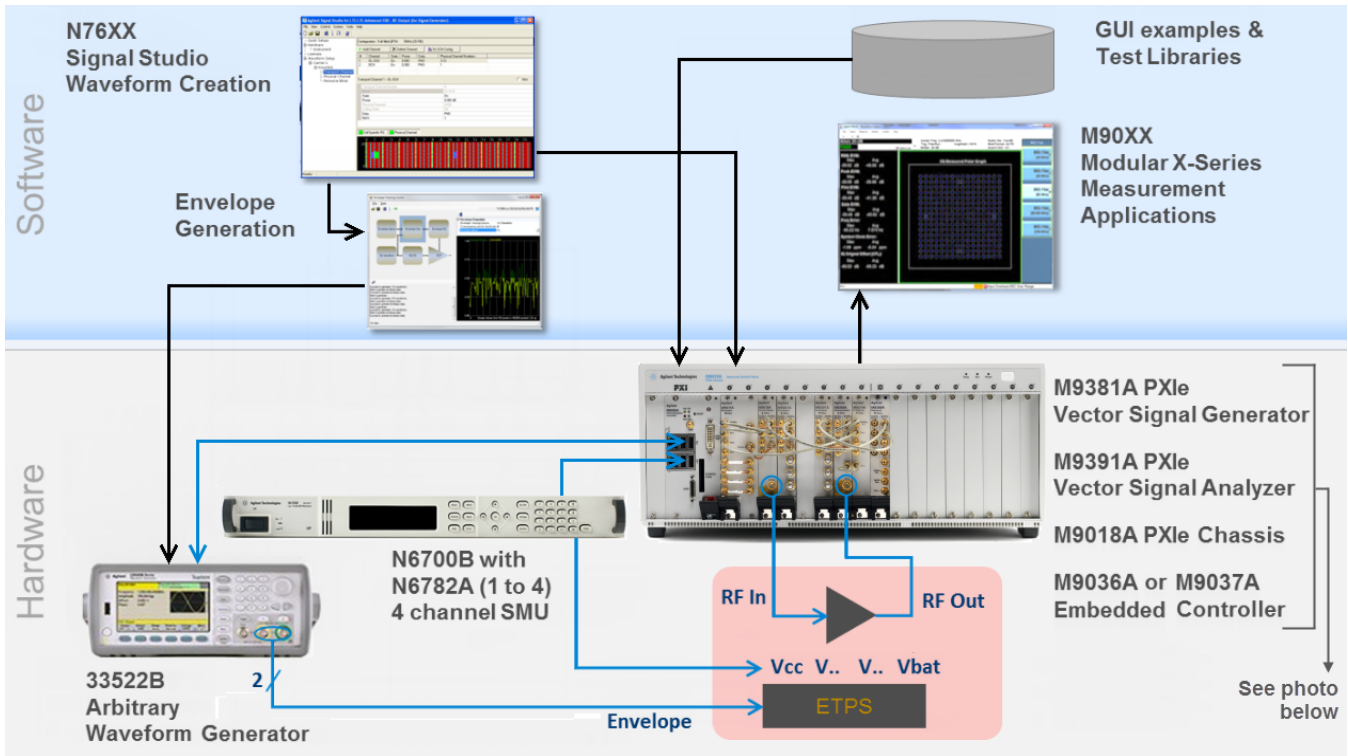
1. Unpack and inspect your shipment. Verify the contents of each box matches the respective content list.
2. Install and cable the modules.
3. Install the software.
4. Redeem your software licenses.
5. Verify operation of the M9381A VSG and M9391A VSA.
6. Make a measurement with your M9381A VSG and M9391A VSA.
7. (Optional) Verify PA test configuration (includes connecting peripheral instruments for your PA test solution, such as Waveform generator, SMU, etc.).
8. Installation is complete. Proceed to use the Demo Tool and product drivers to develop your control programs.

About the RF PA Reference Solution

The RF PA Test Reference Solution is a complete hybrid/third-party test solution for power amplifier production test. Standards for both cellular and WLAN are supported.

The reference solution includes a GUI, measurement software and hardware. The block diagram that follows shows the relationship of the solution components. The synchronized signal with envelope is generated by the Keysight M9381A Vector Signal Generator (VSG) and the Keysight 33522A Waveform Generator (AWG), passed to the DUT, and analyzed by the M9391A Vector Signal Analyzer (VSA). High measurement throughput is achieved with the fastlane technology and embedded measurements associated with the PXIe VSG and VSA.

Block Diagram



Chassis and Modules

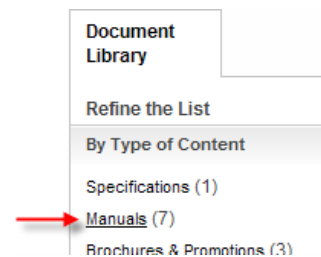


Related Documentation

The documentation associated with this solution is available at the respective product pages on keysight.com (go to **Document Library > Manuals**).

M9381A Vector Signal Generator (see www.keysight.com/find/M9381A)

- M9381A VSG and M9391A VSA Startup Guide
- M9381A VSG and M9391A VSA Programming Guide
- M9381A Soft Front Panel help system
- M9381A device driver API references (IVI-C/IVI-COM and LabVIEW G)
- M9381A Data Sheet
- M9381A Specifications Guide



M9391A Vector Signal Analyzer (see www.keysight.com/find/M9391A)

- M9391A Soft Front Panel help system
- M9391A device driver API references (IVI-C/IVI-COM and LabVIEW G)
- M9391A Data Sheet
- M9391A Specifications Guide

NOTE Depending upon your particular order, you may find the following product documentation useful.

M9018A PXIe Chassis (see www.keysight.com/find/M9018A)

- M9018A PXIe Chassis Startup Guide

M9036A or M9037A PXIe Embedded Controller

- M9036A PXIe Embedded Controller Startup Guide (optional) – see www.keysight.com/find/M9036A
- M9037A PXIe Embedded Controller Startup Guide (optional) – see www.keysight.com/find/M9037A

M9021A PCIe Cable Interface – *optional* (see www.keysight.com/find/M9021A)

- keysight M9021A PCIe Cable Interface Module Installation Guide

Keysight Power Amplifier Test Demo Program

These items are available after placing the "Power Amp Demo Program" folder on your desktop (from the CD):

Introduction

- Keysight PXI Power Amplifier Test Demo Program User Guide
- Keysight PXI Power Amplifier Test Demo Program Developer Guide
- Video presenting an overview of using the Power Amplifier Test Demo Program
- Video using the Power Amplifier Test Demo Program for envelop tracking measurements

Recommended Instruments and Software for Power Amplifier Test with Envelop Tracking

- 33522B Arbitrary Waveform Generator (see www.keysight.com/find/33522B)
- N6700B Power System Mainframe with N6782A Source/Measurement Unit (see www.keysight.com/find/N6700B and www.keysight.com/find/N6782A)
- U2004A Power Sensor (see www.keysight.com/find/U2004A)
- Keysight 89600 VSA Software (see www.keysight.com/find/89600)
- N7624B Signal Studio for LTE/LTE-Advanced FDD (see www.keysight.com/find/N7624B)
For other Keysight Signal Studio applications, see www.keysight.com/find/signalstudio.
- M9080A LTE FDD Measurement Application (see www.keysight.com/find/M9080A)
For other Keysight measurement applications for modular instruments, see www.keysight.com/find/M90XA.

Items You Will Need

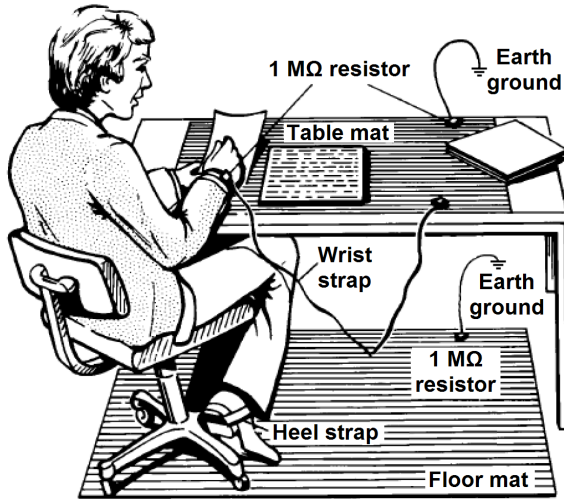
To complete the startup process and begin using the solution, you will need the following items:

- Pozidriv P1 or slotted screwdriver to secure the modules into the chassis
- Adjustable torque wrench (at minimum, accommodate an 8 Lb-In [0.904 Nm] torque on SMA connectors).
- If your solution contains an embedded controller, such as the M9036A or M9037A:
 - Monitor with M9036A - Use the DVI-to-VGA adaptor (an accessory to the M9036A) if necessary.
 - Monitor with M9037A - Use the Display Port to VGA adaptor (an accessory to the M9037A) if necessary.
 - USB compatible keyboard
 - USB compatible mouse
- If you are installing the software from CDs onto an embedded controller, you may wish to use a USB CD/DVD drive. As an alternative, copy the installer files to a computer, transfer the installer files to a USB flash drive, and install the software from the USB flash drive.
- A high-quality SMA (male) to SMA (male) cable at least 10 inches (25.4 cm) long. This cable is used in [Step 6: Make a Measurement \(page 30\)](#). If you are using a signal generator other than the Keysight M9381A PXIe Vector Signal Generator the cable end at the signal generator RF Output may be different.

Step 1: Unpack and Inspect the RF PA Test Solution Components

CAUTION The RF PA Reference Solution components are shipped in materials which prevent damage from static. The modules should only be removed from the packaging in an anti-static area ensuring that correct anti-static precautions are taken. Store all modules in anti-static envelopes when not in use.

ESD



Electrostatic discharge (ESD) can damage or destroy electronic components. Use a static-safe work station to perform all work on electronic assemblies. The figure (left) shows a static-safe work station using two types of ESD protection: conductive table-mat and wrist-strap combination, and conductive floor-mat and heel-strap combination. Both types, when used together, provide a significant level of ESD protection. Of the two, only the table-mat and wrist-strap combination provides adequate ESD protection when used alone. To ensure user safety, the static-safe accessories must provide at least 1 MΩ of isolation from ground.

WARNING DO NOT use these techniques for a static-safe work station when working on circuitry with a voltage potential greater than 500 volts.

Inspect for Damage

After unpacking a solution, inspect all components for any shipping damage. Report any damage to the shipping agent immediately, as such damage is not covered by the warranty (see warranty information at beginning of this document).

NOTE See www.keysight.com/find/tips for information on preventing damage to your keysight equipment.

Return an Instrument for Service

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

NOTE All component modules for an M9381A M9391A instrument are factory tested, aligned, calibrated and shipped as a "bundle". It is important that you maintain the bundle when installing modules or returning an instrument for repair. See [explanation \(page 28\)](#).

1. Review the warranty information shipped with your product.

2. Contact Keysight to obtain a Return Material Authorization (RMA) and return address. For assistance finding contact information, go to www.keysight.com/find/assist.
3. 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.
 - Description of failure or service required.
5. On the shipping label, write ATTENTION REPAIR DEPARTMENT and the RMA number.

NOTE In your correspondence, refer to the modules by serial number and the instrument by model number.

NOTE For components other than the M9381A, M9391A, and M9300A, see the product's documentation.

Verify Shipment Contents

Your solution shipped in multiple boxes. Refer to the box content list attached to each box.

Step 2: Install the PXI Modules

Proceed through this section in the following order:

1. Review “Before Installing PXI Modules” to understand installation guidelines and precautions.
2. Prepare the PXI chassis for the installation process.
3. Install the controller (embedded or external).
4. Install the modules.
5. Cable the instruments.
6. Install slot blockers and filler panels in the empty PXI chassis slots.
7. Power up the chassis.

Before installing the PXI Modules

Precautions

CAUTION PXI hardware does not support "hot-swap" (changing modules while power is applied to the chassis) capabilities. Before installing or removing a module to/from the chassis, power off the chassis to prevent damage to the module.

NOTE All component modules for an M9381A or M9391A instrument are factory tested, aligned, calibrated and shipped as a "bundle". It is important that you maintain the bundle when installing modules or returning an instrument for repair. See [explanation](#) on (page 28).

Recommended best practices to ensure proper and safe module operating conditions

- Ensure proper chassis air flow is maintained
- Select a chassis that provides thermal protection if fans become inoperable or forced air cooling is obstructed
- Use slot blockers (Keysight model [Y1212A](#), 5 per kit) and EMC filler panels in empty module slots to ensure proper operating temperatures. Keysight chassis [Keysight M9018A chassis](#) and slot blockers optimize module temperature performance and reliability of test.
- Set chassis fans to high or auto. Do not disable fans.
- Position chassis to allow plenty of space around chassis air intake and fan exhaust.
- At environment temperatures above 45 °C, set chassis fan speed to high.

M9018A Chassis Air Flow

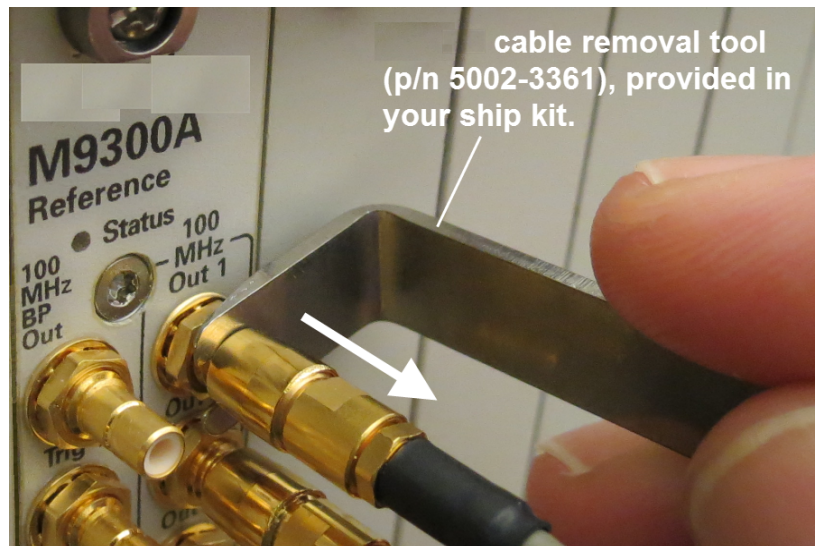


The M9018A has multiple air intakes. They are located at the lower sides, lower front and bottom of the chassis.

Cable and Connector Care

When you need to disconnect push-on cables from the module front panel connectors, use the Keysight Cable Removal Tool provided in your Keysight PXI instrument's ship kit.

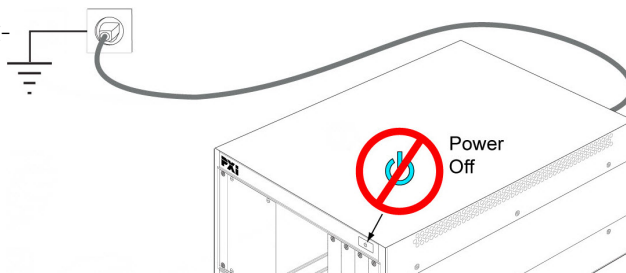
To avoid damage to the cables or connectors, pull the cable straight away from the connector. **Do not use the tool as a pry bar.**



Step 2: Install the PXI Modules

Prepare the Chassis

1. Make sure that the line cord is plugged into a grounded outlet to establish earth ground.
2. Make sure the chassis power switch is **Off**.
3. If the chassis has multiple fan speed settings, ensure that the fan switch is set to **AUTO** and the inhibit switch is set to **DEF**.



4. Position the chassis to provide ample space between the chassis fan intake and exhaust vents. Blockage by walls or obstructions affects the air flow needed for cooling.
5. Before inserting a module into the chassis, back the mounting screws out to ensure that there is no interference between the screws and the mounting rails.
6. Make sure the PXI chassis fans are operable and free of dust and other contaminants that may restrict airflow.

For additional information about setting up the M9018A chassis, refer to the [M9018A documentation](#) and the getting started video at <http://www.youtube.com/watch?v=Idl02MF-nWU>.

Install the Controller

Use the appropriate instructions below for installing the **embedded controller** (Keysight models M9036A or M9037A) or **remote controller** (Keysight M9021A Cable Interface with M9045B adaptor for laptop PC or M9048A adaptor for desktop PC).

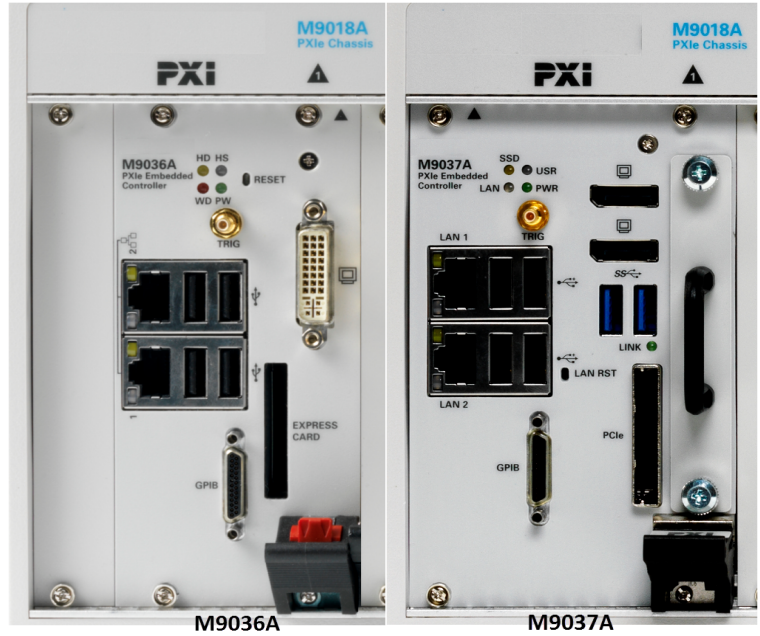
CAUTION Do not power up the controller until instructed to do so later in this document.


Embedded Controller

If your solution contains a Keysight M9036A or M9037A Embedded Controller, follow the procedure below.

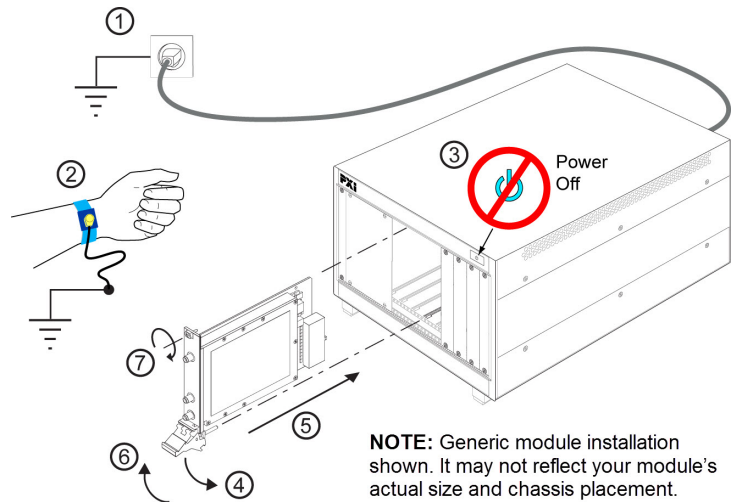
(For additional detail, refer to instructions in the [M9036A Startup Guide](#) or the [M9037A Startup Guide](#).)

1. Remove the M9036A or M9037A module from its ESD protective bag. Observe **ESD precautions** (see page 12).



2. Install the embedded controller in Slot 1 (see  icon above the slot) in the chassis.

- a. While holding the module by the injector/ejector handle and making sure the injector/ejector handle is pushed down in the unlatched (downward) position, slide the controller module into chassis, using the slot guides (top and bottom).
- b. Sliding the module into position, when you begin to feel resistance, pull up on the injector/ejector handle to fully inject the module into the chassis backplane connectors.



- c. Tighten the module retaining screws (top and bottom) and torque them to 5 Lb-In (0.57 N-m).

3. If you have an M9036A controller, install a blank Y1213A filler panel in the empty slot to the left of the controller.
4. Connect peripherals (mouse, keyboard, and monitor).

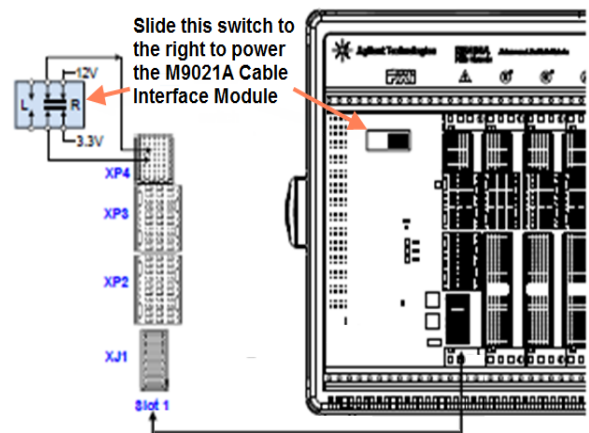
Step 2: Install the PXI Modules

Remote Controller

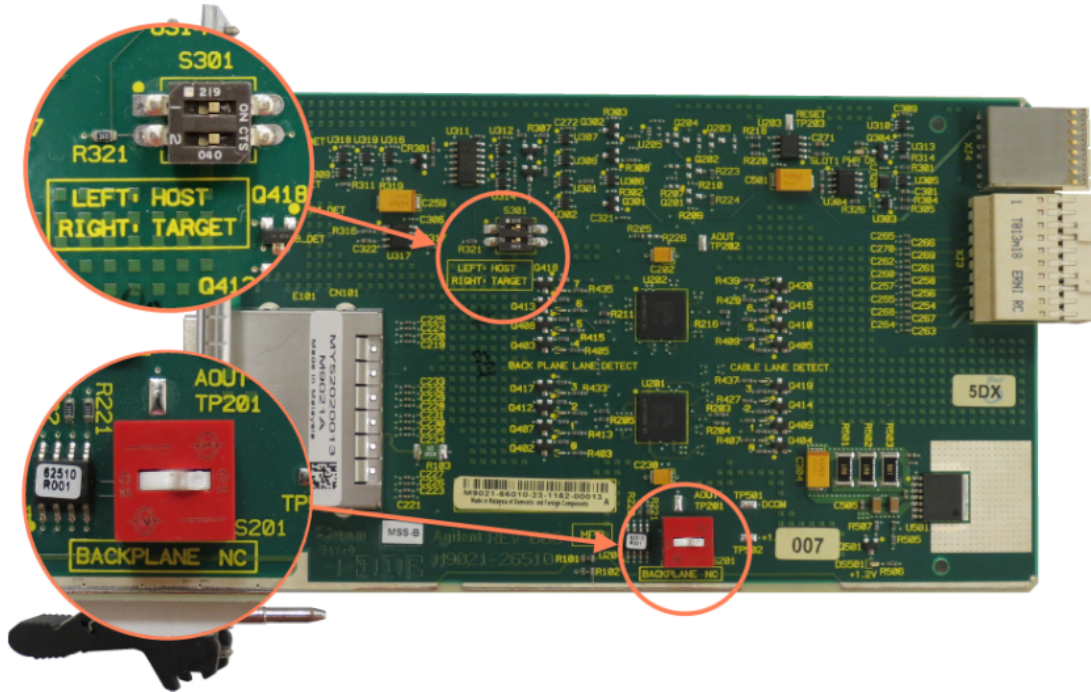
If your solution contains a Keysight M9021A Cable Interface Module, follow the procedure below. For additional information about installing the M9021A, refer to the [M9021A Installation Guide](#) or the getting started video at <http://www.youtube.com/watch?v=ldl02MF-nWU>.

NOTE The following procedure addresses using the M9021A as a cabled PCIe interface between the M9018A chassis and an external host computer. **However**, if you intend to use an M9021A module to control a subordinate downstream chassis or RAID solution:

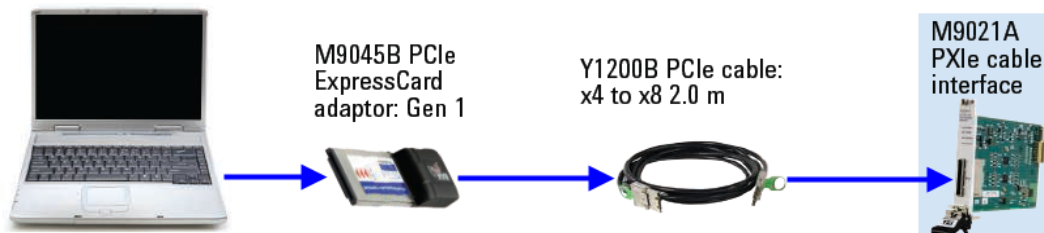
- Install the M9021A in an x8 hybrid slot in the PXIe chassis (M9018A chassis slots 2, 6, 11, or 15).
 - Reverse the switch settings from those noted in this procedure: On the M9021A module, set both S301 switches to “Host” and set the S201 rocker switch to the left-hand position. On the M9018A chassis back-plane, set the controller slot power-supply switch to the left.
1. Locate slot 1 in the chassis. It has the icon (▲) above it.
 2. Set the M9018A chassis controller slot power supply switch to the right-hand position. This provides power to slot 1 for the benefit of the M9021A card.
 3. Remove the M9021A module from its protect bag. Observe [ESD precautions](#) (see page 12).



4. On the M9021A module, set both S301 switches to the “Host” (right-hand) position and set the S201 rocker switch to the left-hand position. Refer to the following figure for M9021A switch locations and positions.

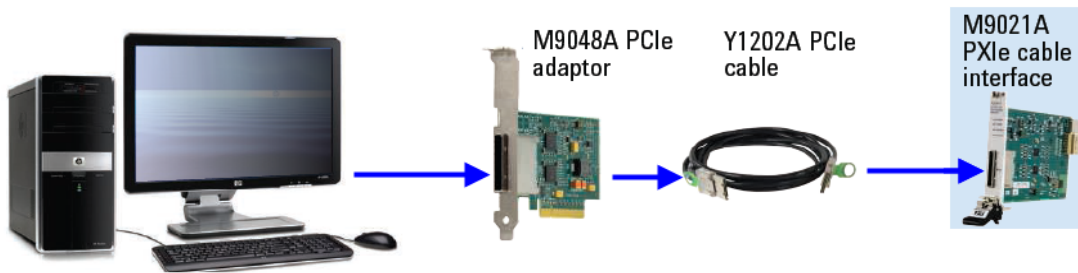


5. Install the M9021A Cable Interface Module into the chassis:
 - a. While holding the module by the injector/ejector handle and making sure the injector/ejector handle is pushed down in the unlatched (downward) position, slide the M9021A module into chassis, using the slot guides (top and bottom).
 - b. Sliding the module into position, when you begin to feel resistance, pull up on the injector/ejector handle to fully inject the module into the chassis backplane connectors.
 - c. Tighten the module retaining screws (top and bottom) and torque them to 5 Lb-In (0.57 N-m).
6. Connect the M9021A to your laptop or desktop PC.
 - a. If you are using a **laptop** as a controller, connect to your M9021A using the following components:



Step 2: Install the PXI Modules

- b. If you are using a **desktop** PC as a controller, connect to the M9021A using the following components:

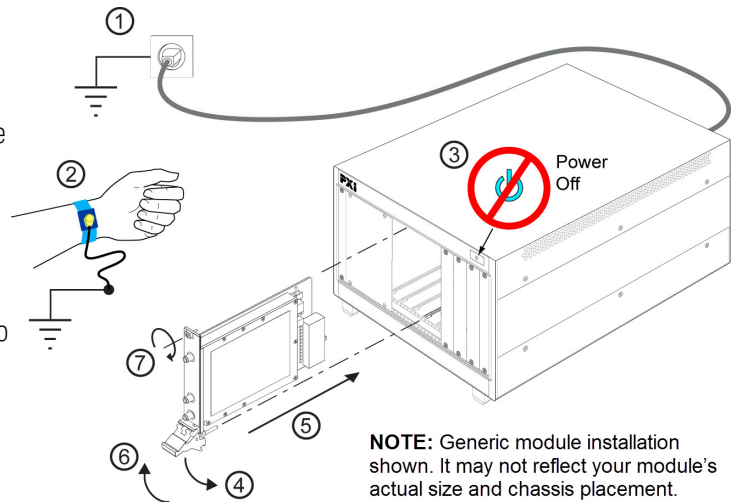


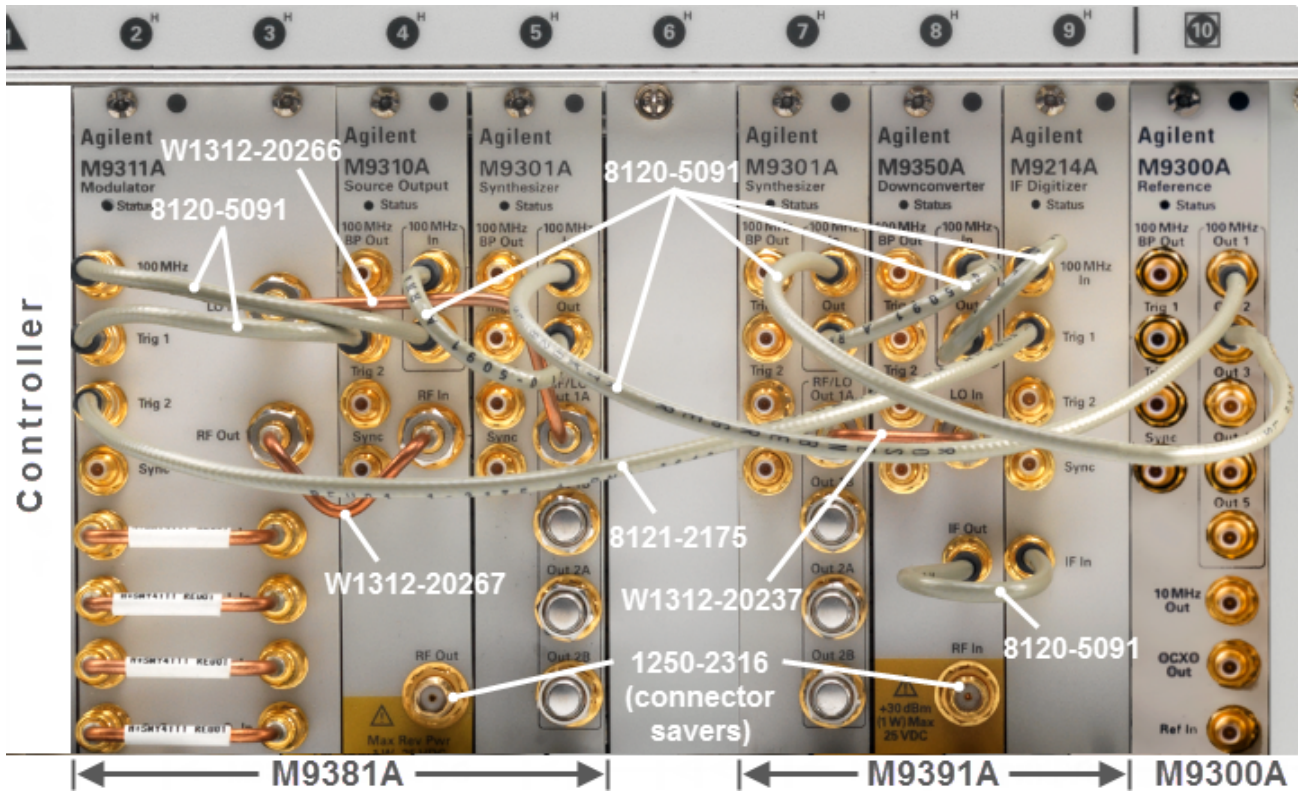
Install the M9381A and M9391A Instrument Modules

Plan your module positions. Install the left-most module first and then continue installing modules from left to right according to the following photo.

When installing each module:

1. While holding the module by the injector/ejector handle and making sure the injector/ejector handle is pushed down in the unlatched (downward) position, slide the module into chassis, using the slot guides (top and bottom).
2. Sliding the module into position, when you begin to feel resistance, pull up on the injector/ejector handle to fully inject the module into the chassis backplane connectors.
3. Tighten the module retaining screws (top and bottom) and torque them to 5 Lb-In (0.57 N-m).





NOTE In the pictures below, you see two different routings of the 100 MHz Reference signal. The cabling on the left can be used for up to three M9393A instruments in one chassis. If you choose to install four M9393A instruments in one chassis, you may share the 100 MHz signal by using a tee at the 100 MHz In connector of the M9214A. The pictures on the next page show the recommended slot usage for multi-channel chassis and the recommended distribution of the 100 MHz reference.

Step 2: Install the PXI Modules

Items from the M9381A and M9391A ship kits (listed in the recommended installation order)

Part Number	Connection	Cable Description
W1312-20266	M9301A RF/LO Out 1A to M9311A LO In	Cable, semi-rigid, SMA (male) - SMA (male)
W1312-20267	M9311A RF Out to M9310A RF In	Cable, semi-rigid, SMA (male) - SMA (male)
W1312-20237	M9301A RF/LO Out 1A to M9350A LO In	Cable, semi-rigid, SMA (male) - SMA (male)
8120-5091	M9310A 100 MHz Out to M9311A 100 MHz In	Cable, coaxial, SMB (female) - SMB (female)
8120-5091	M9310A Trig 1 to M9311A Trig 1 for Pulse Mod.	Cable, coaxial, SMB (female) - SMB (female)
8120-5091	M9301A 100 MHz Out to M9310A 100 MHz In	Cable, coaxial, SMB (female) - SMB (female)
8120-5091	M9300A 100 MHz Out 1 to M9301A 100 MHz In	Cable, coaxial, SMB (female) - SMB (female)
8120-5091	M9300A 100 MHz Out 2 to M9301A 100 MHz In	Cable, coaxial, SMB (female) - SMB (female) 120 mm
8120-5091	M9301A 100 MHz Out to M9350A 100 MHz In	Cable, coaxial, SMB (female) - SMB (female) 120 mm
8120-5091	M9350A 100 MHz Out to M9214A 100 MHz In	Cable, coaxial, SMB (female) - SMB (female) 120 mm
8120-5091	M9350A IF Out to M9214A IF In	Cable, coaxial, SMB (female) - SMB (female) 120 mm
8121-2175 *	M9311A Trig 2 to M9214A Trig 1	Cable, coaxial, SMB (female) - SMB (female) 300 mm
1250-2316	M9310A RF Out connector saver	Adaptor, coaxial straight SMA (male) - SMA (female)
1250-2316	M9350A RF In connector saver	Adaptor, coaxial straight SMA (male) - SMA (female)
8121-2063	(Optional) Use this cable to direct an external reference into the M9300A Ref In connector.	Cable, coaxial, BNC (male) - SMB (female) 1200 mm

NOTE

* The 8121-2175 cable, although not required for standard M9391A operation, is useful for power amplifier testing. It improves repeatability by enabling you to consistently measure the same portion of the input signal.

Install Slot Blockers and Filler Panels

To assure proper operating temperatures, install slot blockers (Keysight model [Y1212A](#), 5 per kit) and EMC filler panels (Keysight model [Y1213A](#), 5 per kit) in empty module slots.

Power up the Chassis

CAUTION

If you are using a remote controller, you must power up the chassis BEFORE you power up the PC. When you power down your solution, shut down the PC BEFORE you power down the chassis.

Step 3: Install the Software

Requirements

System	Requirements
Operating system	Windows 7 (32- & 64-bit), Windows Embedded Standard 7
Processor speed	1 GHz 32-bit (x86), 1 GHz 64-bit (x64), no support for Itanium64
Available memory	4 GB minimum (8 GB recommended for 64-bit operating systems)
Available disk space 3	1.5 GB available hard disk space (includes 1 GB for Microsoft .NET Framework 3.5 SP1 4, and 100 MB for Keysight IO Libraries Suite)
Video	Support for DirectX 9 graphics with 128 MB graphics memory recommended (Super VGA is supported)
Browser	Microsoft Internet Explorer 7.0 or greater

Hardware	Requirements
Controllers	A PXI or PXI Express embedded controller or remote controller (external PC connected to the chassis by a PCI-to-PXI interface) is required.
Embedded controller	Keysight M9036A or M9037A or an embedded controller that meets the following requirements: <ul style="list-style-type: none"> PXIe system controller (PXI-1 embedded controllers are not compatible) Utilize a 2x8, or 4x4, PXIe system slot link configuration. Run one of the operating systems listed in System Requirements (above).
Remote controller	(Keysight M9018A chassis only) A PC running one of the operating systems listed in System Requirements above and a Keysight M9021A Cable Interface x8 with one of the following PC interface options: <ul style="list-style-type: none"> Keysight M9045B PCIe ExpressCard Adaptor x1, with cable (for a laptop PC) Keysight M9048A PCIe Desktop Adaptor x8, with cable (for desktop PCs)

Due to the Microsoft end of support for Windows XP, is not supported on Windows XP. At the time of release there were no known major problems running on Windows XP. However if you encounter an issue unique to Windows XP, Keysight may not attempt to address the issue.

Software Installation

Install the software in the order indicated in the following table into the embedded controller, or PC if your solution contains an M9021A PXIe Cable Interface.

Restart your controller when prompted by the respective software installer.

CAUTION If you are using a remote controller, use this sequence to restart the PC and chassis:

- 1) Shut down the PC.
- 2) Power down the chassis.
- 3) Power up the chassis.
- 4) Power up the PC.

Order	Software	Install from the provided CD, or...
1 *	Keysight IO Libraries Suite version 16.3 Update 1 (version 16.3.16603.3) or newer; includes Keysight Connection Expert	www.keysight.com/find/iosuite

Step 4: Redeem Your Software Licenses

Order	Software	Install from the provided CD, or...
2 *	M9018A 18 Slot PXIe Chassis Drivers	www.keysight.com/find/M9018A
3 **	Keysight 89600 VSA Software (optional, install before M93A software). The minimum version is 16.01.254.0 or newer.	www.keysight.com/find/89600
4	M9381A PXIe Vector Signal Generator version 1.3.300.0 or newer)	www.keysight.com/find/M9381A
6	N7624B Signal Studio for LTE/LTE-Advanced FDD (optional)	www.keysight.com/find/M7624B
7	M9080A LTE FDD Measurement Application (optional)	www.keysight.com/find/M9080A
8	Power Amplifier Demo Tool (Details: see "Installation" on page 33)	www.keysight.com/find/Y1299A
9	Cycle power to ensure the drivers are registered and the software is activated. NOTE: If you are using a remote controller, use this sequence to restart the PC and chassis: 1) Shut down the PC. 2) Power down the chassis. 3) Power up the chassis. 4) Power up the PC.	

* Software that is already installed if you ordered the M9036A or M9037A Embedded Controller.

** If you install or upgrade the Keysight 89600 VSA Software after installing the drivers, you need to run the 89600 VSA Integration utility. Go to **Start > All Programs > Keysight > M9391 > 89600 VSA Integration.**

Step 4: Redeem Your Software Licenses

The basic software required to operate your solution requires no license. This includes:

- Keysight IO Libraries Suite
- Keysight M9381A VSG Software
- Keysight M9391A VSA Software
- Keysight M9018A 18 Slot PXIe Chassis Drivers
- Keysight PXIe Power Amplifier Demo Software

Additional software may be included with your solution that requires licensing. For any additional licensed software products that you include in your solution you receive a Software Entitlement Certificate, for example:

- Keysight Signal Studio Applications Software
- Keysight Waveform 5 or 50 packs (optional)
- Keysight X-Series Measurement Applications for Modular Instruments (optional)

For each of these licensed products, whether installed on your M9036A Embedded Controller, or installed on your PC, you must redeem your license. Follow the instructions on your Software Entitlement Certificate to license and enable your new software.

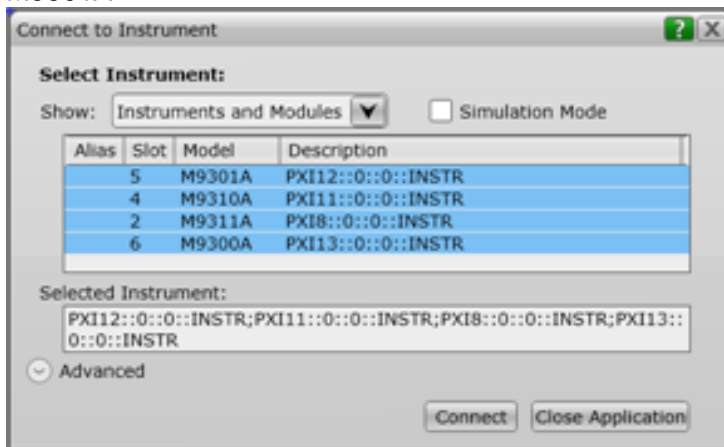
Step 5: Verify Operation of the M9381A Vector Signal Generator and M9391A PXIe Vector Signal Analyzer

In this step you will verify correct operation by conducting a Self Test and observing the Status LEDs. Before running a Self Test assure that all required software is installed, the chassis is powered on, and all cabling is correct. See "Step 2: Install the PXI Modules" on page 14.

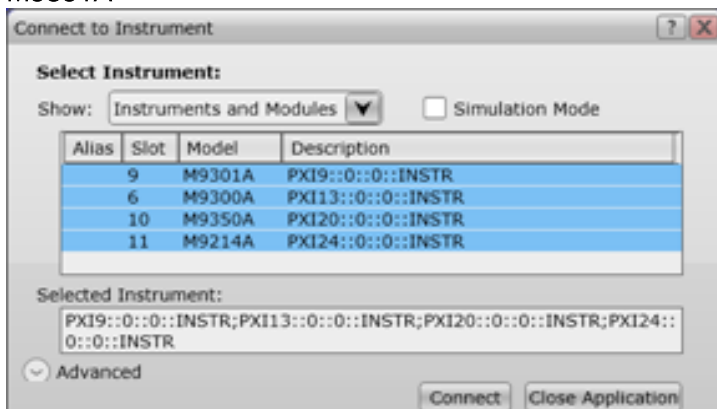
NOTE Use the following procedure to verify operation of a single channel VSG/VSA (M9381A and M9391A) configuration.

1. Turn power on to the M9018A Chassis, if you haven't already.
2. The first step in this process is to conduct a Self Test of the M9381A and the M9391A.
 - a. Open the M9381A SFP by selecting **Start > All Programs > Keysight > M938x > M9381 SFP**.
 - b. Open the M9391A SFP by selecting **Start > All Programs > Keysight > M9391 > M9391 SFP**
 - c. For each SFP, you are presented with the "Connect to Instrument" dialog. Use **Ctrl/Select** to select all of the modules that are components of the M9381A and press **Connect** and the M9391A. Leave the SFPs open. For example:

M9381A



M9391A



Step 5: Verify Operation of the M9381A Vector Signal Generator and M9391A PXIe Vector Signal Analyzer

NOTE Selecting **Connect** initializes the instrument and all associated modules. Prior to initialization, all LEDs are off.

3. Check the front panel Status LEDs of all modules, according to the following table.

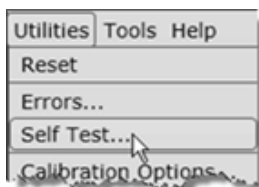
Status LED States

Module	Green	Orange	Red	Off
M9300A	The Soft Front Panel has initialized the connection to the module	n/a	Indicates that the VCXO is unlocked.	<ul style="list-style-type: none"> Not connected by the SFP. Failure in the power supplies. Module hardware health can't be determined until the power supply failure is resolved.
M9301A	The Soft Front Panel has initialized the connection to the module	Tuning is in progress, or the M9301A is unlocked from the reference.	n/a	<ul style="list-style-type: none"> Not connected by the SFP. Failure in the power supplies. Module hardware health can't be determined until the power supply failure is resolved.
M9310A	The Soft Front Panel has initialized the connection to the module	n/a	n/a	<ul style="list-style-type: none"> Not connected by the SFP. Failure in the power supplies. Module hardware health can't be determined until the power supply failure is resolved.
M9311A	<ul style="list-style-type: none"> The Soft Front Panel has initialized the connection to the module. The module has returned to idle from modulation. 	<ul style="list-style-type: none"> Modulation is turned on. 	<ul style="list-style-type: none"> DAC over-load detected. IQ over-load detected 	<ul style="list-style-type: none"> Not connected by the SFP. Failure in the power supplies. Module hardware health can't be determined until the power supply failure is resolved.
M9214A	The Soft Front Panel has initialized the connection to the module	Missing 100 MHz Reference.	n/a	<ul style="list-style-type: none"> Not connected by the SFP. Failure in the power supplies. Module hardware health can't be determined until the power supply failure is resolved.
M9350A	The Soft Front Panel has initialized the connection to the module	Missing 100 MHz Reference.	n/a	<ul style="list-style-type: none"> Not connected by the SFP. Failure in the power supplies. Module hardware health can't be determined until the power supply failure is resolved.

CAUTION

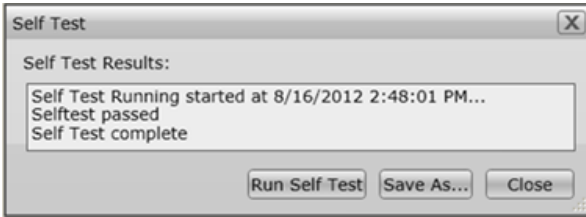
It is important that no signal is present at the RF Input of the Keysight M9350A PXIe Downconverter when doing a Self Test. If a signal is present, it may result in a false failure.

4. Conduct a Self Test on all modules (**Utilities > Self Test... > Run Self Test**).



If the Self Test passes (see results below), go to [Step 6: Make a Measurement \(page 30\)](#).

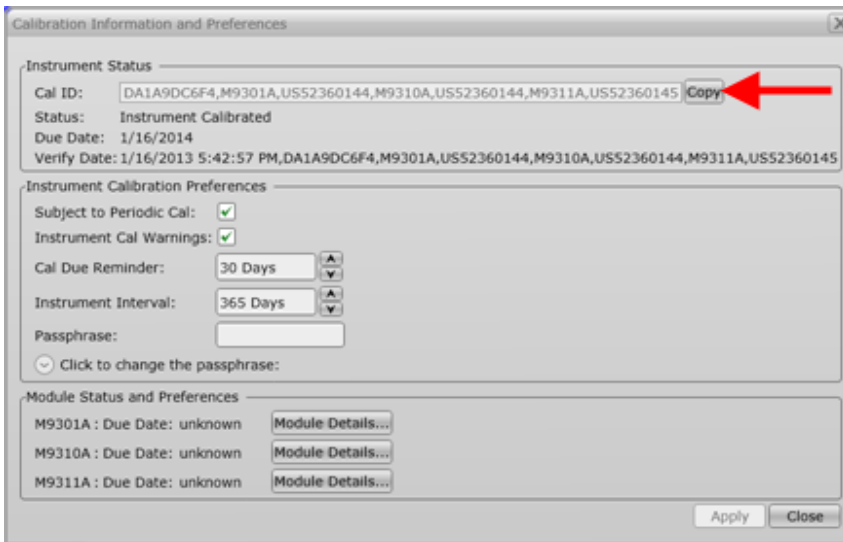
Step 5: Verify Operation of the M9381A Vector Signal Generator and M9391A PXIe Vector Signal Analyzer



Self Test Failure

If the Self Test does not pass for any of the multi-module instruments, the test indicates which module is likely to need service. However, you should return all modules (except the M9300A) and all cables for that particular instrument.

To ensure that you send in the group of modules that was reported in a Self Test failure, go to **Utilities > Calibration Options...** to view this screen:



The string pointed out in this image is the Cal ID. The first 10 characters represent the Unique ID and the remaining characters show the modules (and their serial numbers) that constitute the M9381A or M9391A instrument. A Certificate of Calibration for that instrument contains the same information. Additionally, you may see this same information from the SFP by using **Help > About**.

See [Return an Instrument for Service \(page 12\)](#).

CAUTION

It is important that no signal is present at the RF Input of the Keysight M9350A PXIe Downconverter when doing a Self Test. If a signal is present, it may result in a false failure.

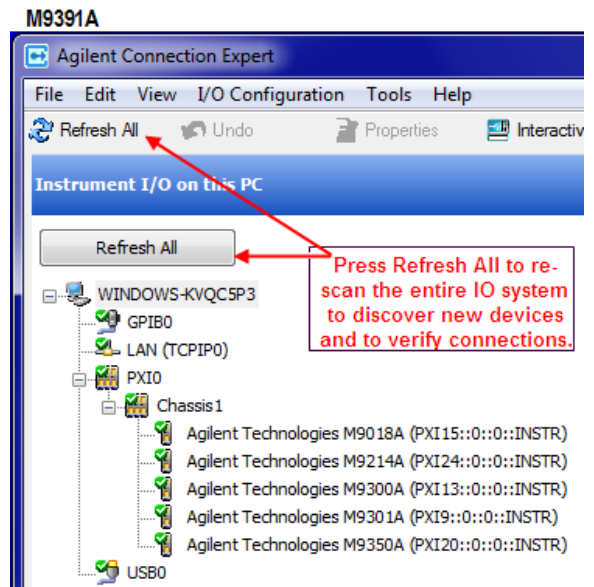
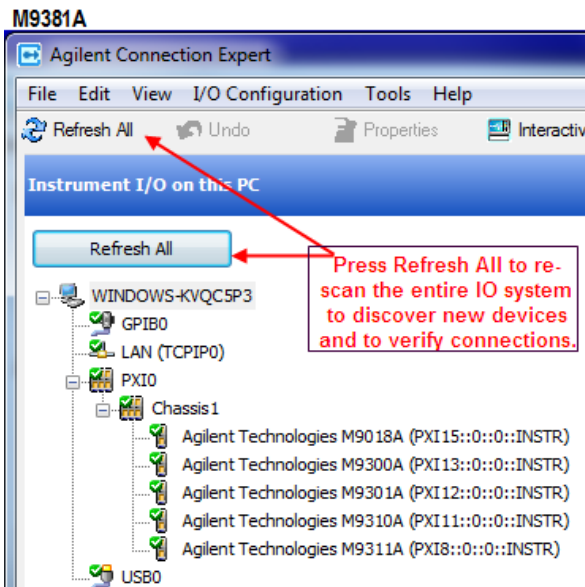
Communications

If you are unable to communicate with the M9381A/M9391A, verify that the following installations are correct:

- Keysight IO Libraries Suite
- M9381A and M9391A SFP programs
- Module and chassis drivers
- System Interface Card, cable and PC PXIe card connections, if you are using an external host PC

If not all modules and their slot locations are visible in the SFP "Connect to Instrument" dialog:

1. Close the SFP.
2. Start Keysight Connection Expert, by selecting **Start > All Programs > Keysight Connection Expert**. If any or all modules and their slot locations are still not visible, select **Refresh All**.
3. Restart the SFP.

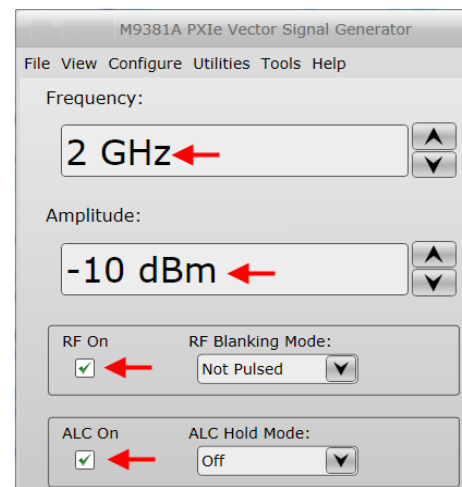


Step 6: Make a Measurement

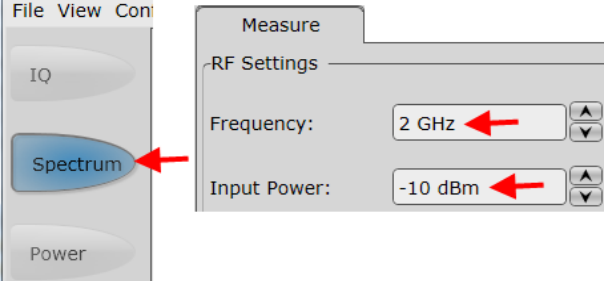
NOTE As a best practice, always run a Self Test of each instrument before making a measurement..

1. The first step in this process is to open the SFP of the M9381A and the .
 - a. Open the M9381A SFP by selecting **Start > All Programs > Keysight > M938x > M9381 SFP**.
 - b. Open the M9391A SFP by selecting **Start > All Programs > Keysight > M9391 > M9391 SFP**.
 - c. For each SFP, you are presented with the "Connect to Instrument" dialog. Use **Ctrl/Select** to select all of the modules that are components of the M9381A and the and press **Connect**.
2. Connect a high quality SMA (male) to SMA (male) cable between the RF Out connector on the Keysight M9310A PXle Source Output and the RF In connector on the Keysight M9350A PXle Downconverter.
3. Torque the connectors to 8 Lb-In (0.904 Nm).
4. On the M9381A SFP make the following settings:

- a. Frequency: 2 GHz
- b. Amplitude: -10 dBm
- c. RF On: checked
- d. ALC On: checked.

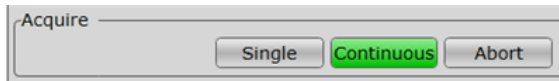


5. On the M9391A SFP Measure Tab, make the following settings:
 - a. Frequency: 2 GHz
 - b. Input Power: -10 dBm
 - c. Acquisition: Spectrum

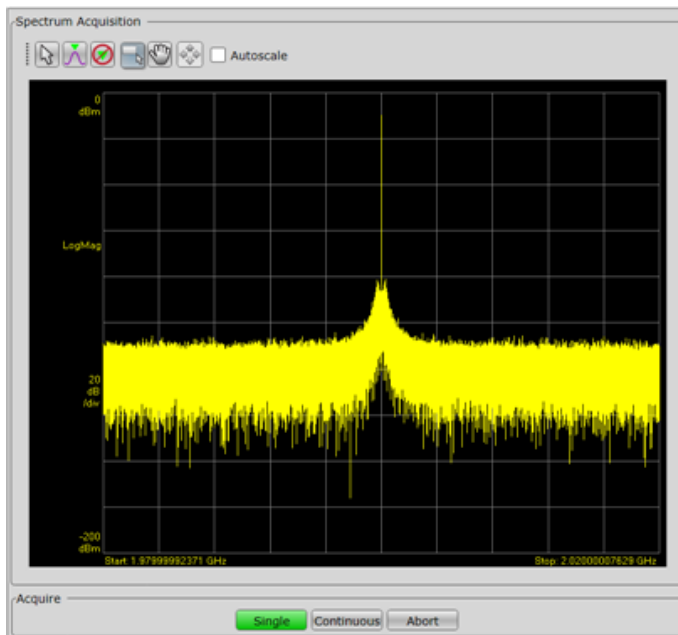


Step 6: Make a Measurement

6. Below the display, select Continuous for a sustained sweep of the analyzer.



You should see the following display on your M9391A SFP. The frequency of the signal is 2 GHz and the amplitude is -10 dBm.



7. Proceed to [Step 8: Installation is Complete \(page 39\)](#).

Step 7: Verify PA Test Configuration (Optional)

Introduction

The PA Demo Program can be used to demonstrate the measurement speed, repeatability and ranges of measurements for the Keysight PXI instruments used in the program. The measurements can be performed on a wide range of amplifiers or on a through RF cable by configuring the settings in the user interface.

Source code for the program can be provided. Contact your local Keysight representative to obtain the source code for the program.

NOTE Videos demonstrating how to use the PA Demo Program are provided in the installed Power Amplifier Test Demo Program folder (see Installation below).

Connect System Components

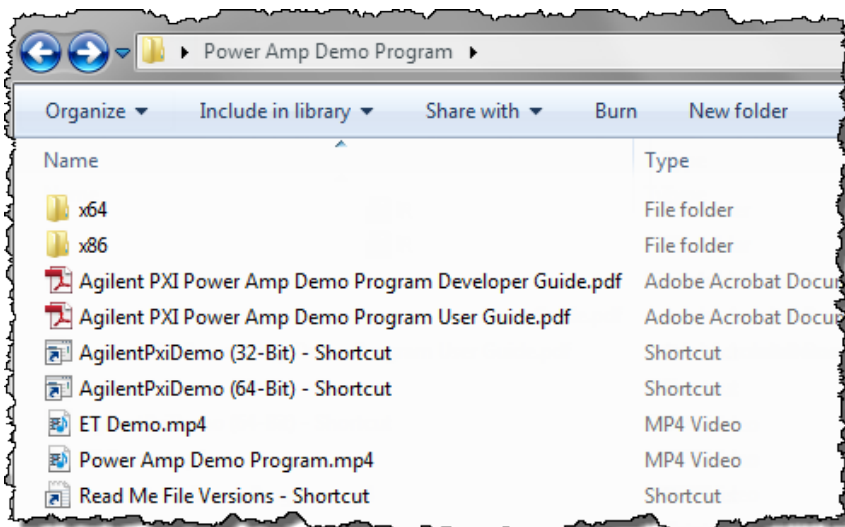
The system components will vary with customer needs. See ["Block Diagram" on page 8](#) for an example of a system configuration.

Installation

If you did not already install the PA Demo Tool according to [Software Installation \(page 23\)](#), do so now. The PA Demo Tool is provided on a Y1299A-002 PA Test Solution CD as a zip file.

1. Log into the controller (embedded controller or remote controller as installed; see ["Install the Controller" on page 16](#)).
2. Copy the zip file from the CD to the desktop.
3. Unzip to the current location. A folder named "Power Amp Demo Program" will be placed on the desktop. This folder contains the 32- and 64-bit versions of the program, demo videos, etc. The folder includes several short-cuts, which require that the folder is on the desktop. The following screen shot shows the contents of the folder:

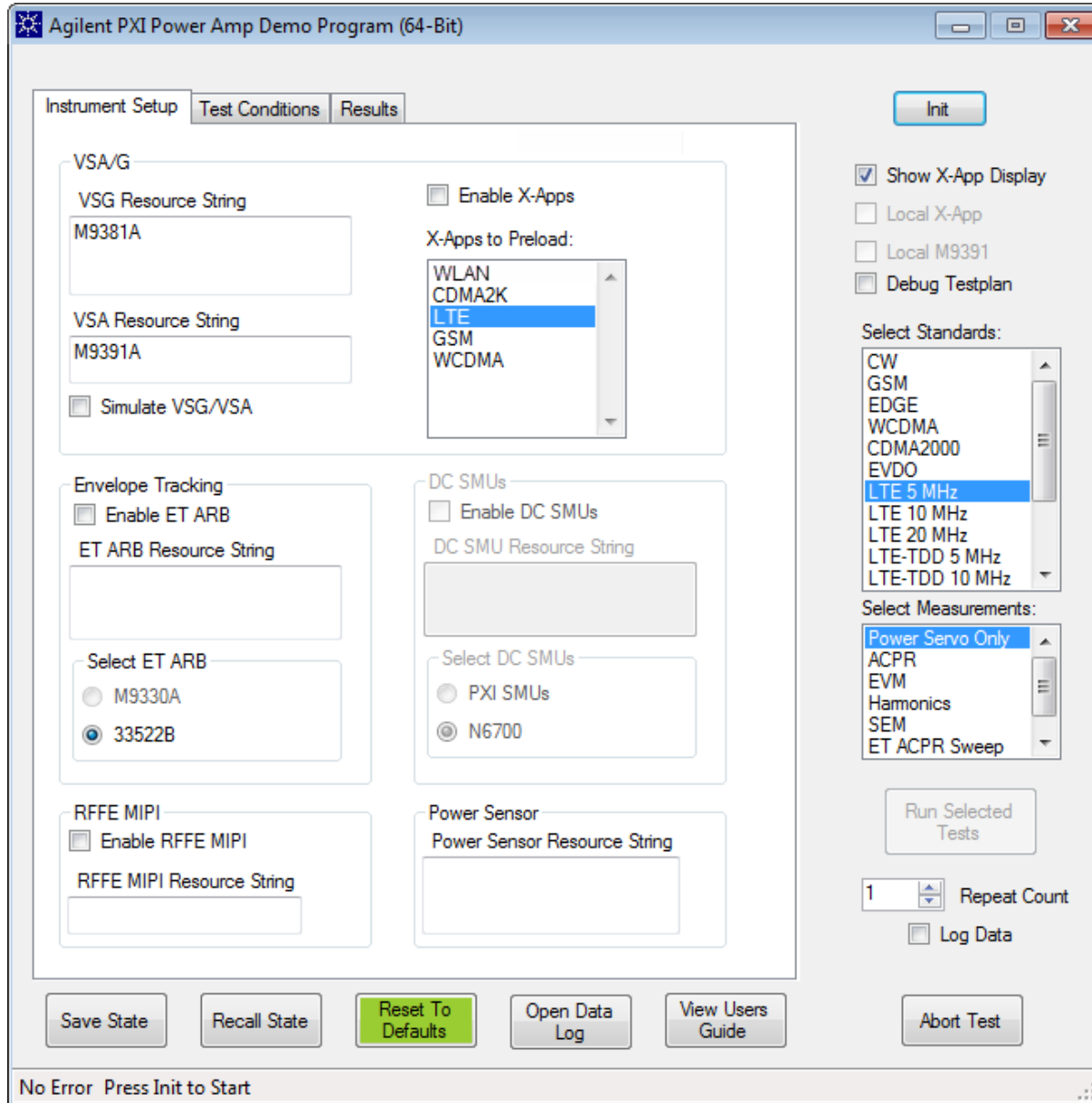
Step 7: Verify PA Test Configuration (Optional)



The M90XA X-App Software also requires licenses to run each X-App. The Power Amplifier Demo systems from Keysight include the required licenses. To obtain a temporary license to run the program on a non-Keysight owned computer, please contact your local Keysight representative.

Running the Power Amp Demo Program

The Power Amp Demo program provides a user interface to run the tests and display the results. The following is a screen capture of the GUI after the program is launched.



Tool tip help is available for each control in the demo program by hovering the mouse over that control.

The **Save State**, **Recall State**, and **Reset to Default** buttons allow you to save the current configuration of the user interface controls to a file, reload previous setting from a file, or reset all of the values to a default condition.

The **View Users Guide** button shows the *Demo Program User Guide*, which is also contained on the CD.

Step 7: Verify PA Test Configuration (Optional)

The program saves test results and time data to a .CSV file. You can open the most recent data file by pressing the **Open Data Log** button

Configuring the Instruments

The Instrument Setup tab includes fields to enter the VISA resource address for the VSG and the VSA and controls to configure the use of the M90XA X-App software. The M9381A VSG resource string can be either a list of the individual module addresses or the name of a saved configuration that was created with the M9381A SFP. The VSG is controlled using the AgM938x IVI driver.

The M9391A VSA resource string is similar. However, if the X-App software is run, the resource string must be the name of a saved configuration from the M9391A SFP. The X-App software is loaded if the **Enable X-Apps** check box is checked. In this case, the M9000 resource manager is used to allow the VSA to be accessed both by the AgM9391 IVI driver and by the X-App software. If the X-App software is not selected, the VSA is controlled by the AgM9391 IVI driver. If the X-App software is loaded, one or more X-Apps can be selected from the list of applications to preload. The X-Apps in this list are loaded as part of the initialization process. Other X-Apps can be used later in the program, but there will be a delay while they load. For best results, select the X-Apps to be used to be preloaded.

You can enable the 33522B Waveform Generator by checking the enable button for each and entering the VISA resource string. For the power sensor, enter the VISA resource string if the calibration procedure will be run.

The waveform generator and power sensor can be connected using USB. When using USB, use the Keysight Connection Expert to determine the VISA addresses for the instruments as shown in the following screen capture.

Step 7: Verify PA Test Configuration (Optional)

The screenshot displays the Agilent Connection Expert interface. The main window is titled "Instrument I/O on this PC" and shows a tree view of hardware components. Under the "USB0" section, the instrument "33522B (USB0::0x0957::0x2C07::MY52800122::0::INSTR)" is selected, and its VISA alias "USBInstrument1" is highlighted. The right-hand pane, titled "VISA Alias Properties", provides details for this alias:

VISA Alias Properties

A VISA alias for an instrument. This alias can be used as the VISA name of the instrument in a program.

Go to the instrument node to view instrument information

Change Properties...

VISA Alias: USBInstrument1

This alias refers to the following instrument:

VISA address: USB0::0x0957::0x2C07::MY52800122::0::INSTR
 IDN string: Agilent Technologies,33522B,MY52800122,2.05-1
 Manufacturer: Agilent Technologies
 Model code: 33522B
 Serial number: MY52800122
 Firmware: 2.05-1.19-2.00-52-00

At the bottom of the interface, a status bar indicates "64 bit: 2 providers; 32 bit: Agilent VISA is secondary".

Basic System Test

NOTE The following procedure tests the connections and basic functionality of the Y1299A-002 basic system components. Pressing the **INIT** button in this procedure tests the connections and self tests of the M9381A VSG, M9391A VSA, and other standard Keysight equipment.

1. Select the **Instrument Setup** tab (as shown in the image above).
 - a. Enter M9381A in the **VSG Resource String** text box.
 - b. Enter M9391A in the **VSA Resource String** text box.
2. If connected to the system, do the following:
 - a. Select an **ET ARB**.
 - b. Select **Enable RFFE MIPI** and enter the **Resource String**.
3. Enter the **Power Sensor Resource String**.
4. Press the **INIT** button. The software conducts instrument self tests, and tests for correct cabling.
5. At the end of the **INIT** system test, a message confirms that the system instruments have passed their self-tests, and are cabled correctly.
6. If warnings or errors are displayed, consult the troubleshooting section. See "[Appendix: Troubleshooting](#)" on page 41.

Step 8: Installation is Complete

Now that you have completed the installation and validated operation, you can proceed to:

- Use the Power Amplifier Test Demo Program to run provided waveforms (you must have Agilent Signal Studio license)
- Program with:
 - Power Amplifier Test Demo Program source code
 - Supported driver APIs for the products that comprise your solution

Proceed to program your product by means of the applications programming interface (API) for the supplied drivers.

API Overview

IVI Drivers

Keysight's IVI drivers simplify the creation and maintenance of instrument control applications in a variety of development environments; they allow programmatic control of instrumentation while providing a greater

Step 8: Installation is Complete

degree of instrument interchangeability and code reuse. IVI drivers currently come in two basic types: IVI-COM and IVI-C. Although the functionality offered by both types of drivers is often very similar, the fundamental differences in interface technology results in a very different end-user experience. The IVI drivers support compiling application programs for 32- or 64-bit platforms.

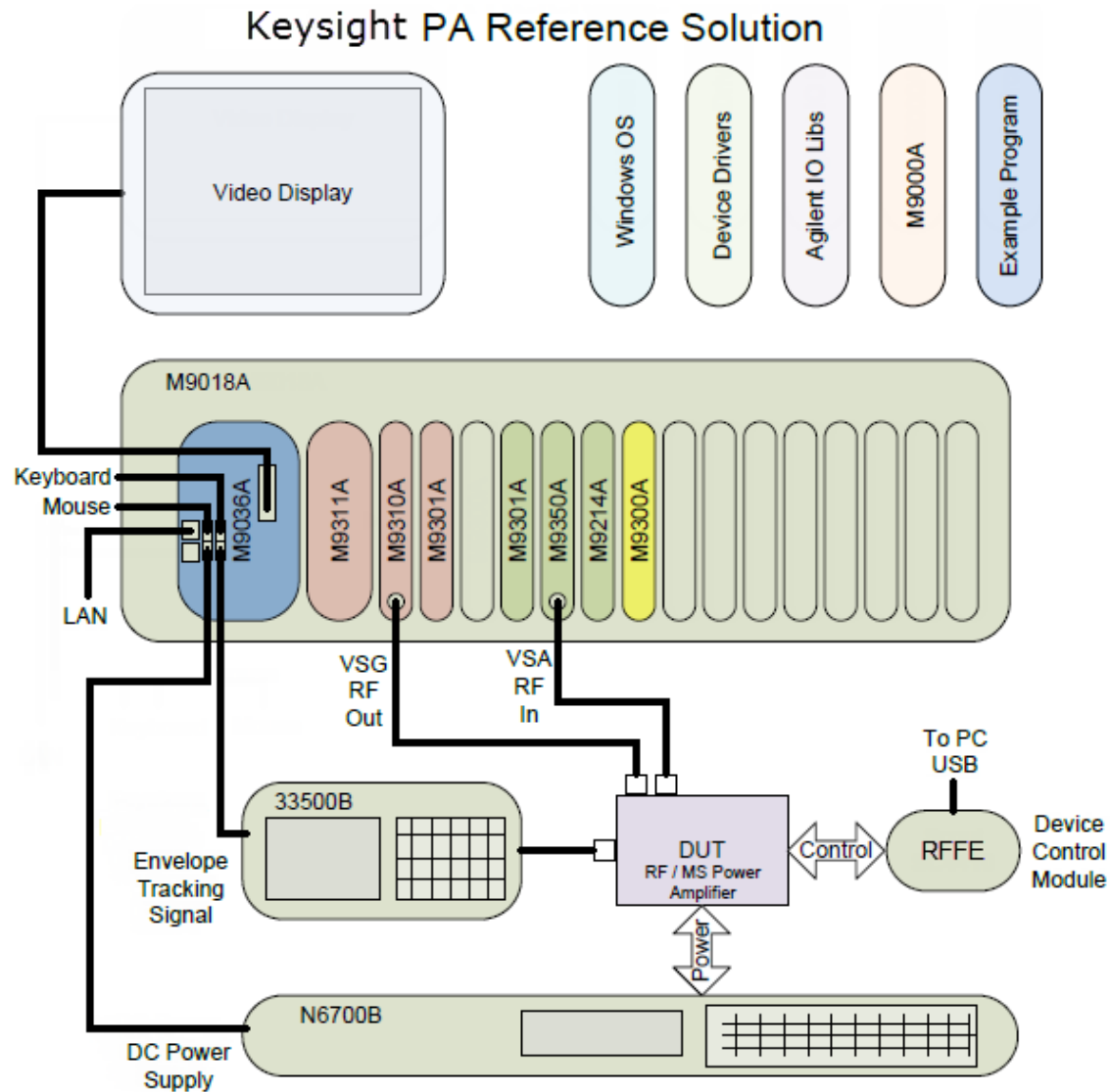
Supported ADEs (application development environments) Arguably the most important consideration in comparing IVI-COM and IVI-C drivers is the end user experience in various ADEs. Since IVI-COM drivers are based on Microsoft COM technology, it's not surprising that IVI-COM drivers offer the richest user experience in Microsoft ADEs. Users working in Visual C++, Visual C#, Visual Basic.NET, and Visual Basic 6 enjoy a host of features, such as object browsers, IntelliSense, and context-sensitive help.

When you install the product software, the IVI driver files are installed in the standard IVI Foundation directories (for example, C:\Program Files\IVI Foundation\IVI\Drivers\AgM9391). Example programs are provided to demonstrate most driver functionality (for example, C:\Program Files\IVI Foundation\IVI\Drivers\AgM9391\Examples). The reference material for the driver functions (a Microsoft HTML Help .chm file) is installed with the IVI driver and is available for Microsoft Visual Studio's IntelliSense context linking. In addition, you can directly access the .chm file (for example, AgM9391.chm) from this Start menu location: **Start > All Programs > Keysight IVI Drivers > AgM9391 VSA > Documentation**.

LabVIEW Driver

In addition to the IVI drivers, Keysight provides a LabVIEW driver that includes all the functionality of the IVI-C driver. When you install the product software, the LabVIEW driver is installed to each LabVIEW instr.lib directory for each version of LabVIEW you have on your computer (for example, C:\Program Files (x86)\National Instruments\<LabVIEW version>\instr.lib\<Agilent product model>). If you install LabVIEW drivers before you install LabVIEW itself, drivers will be installed in the Agilent directory instead of the National Instruments directory (for example, C:\Program Files (x86)\Agilent\<Agilent product model>\LabVIEW Driver\<LabVIEW version>\...). Example programs are provided to demonstrate most driver functionality. The reference information for the driver (a Microsoft HTML Help .chm file) is also installed with the driver and the content is available from LabVIEW's Context Help window. In addition, you can directly access the chm file (for example, AgM9391 LabVIEW_Help) from this Start menu location: **Start > All Programs > Keysight > M9391 > M9391 LabVIEW Help**.

Appendix: Troubleshooting



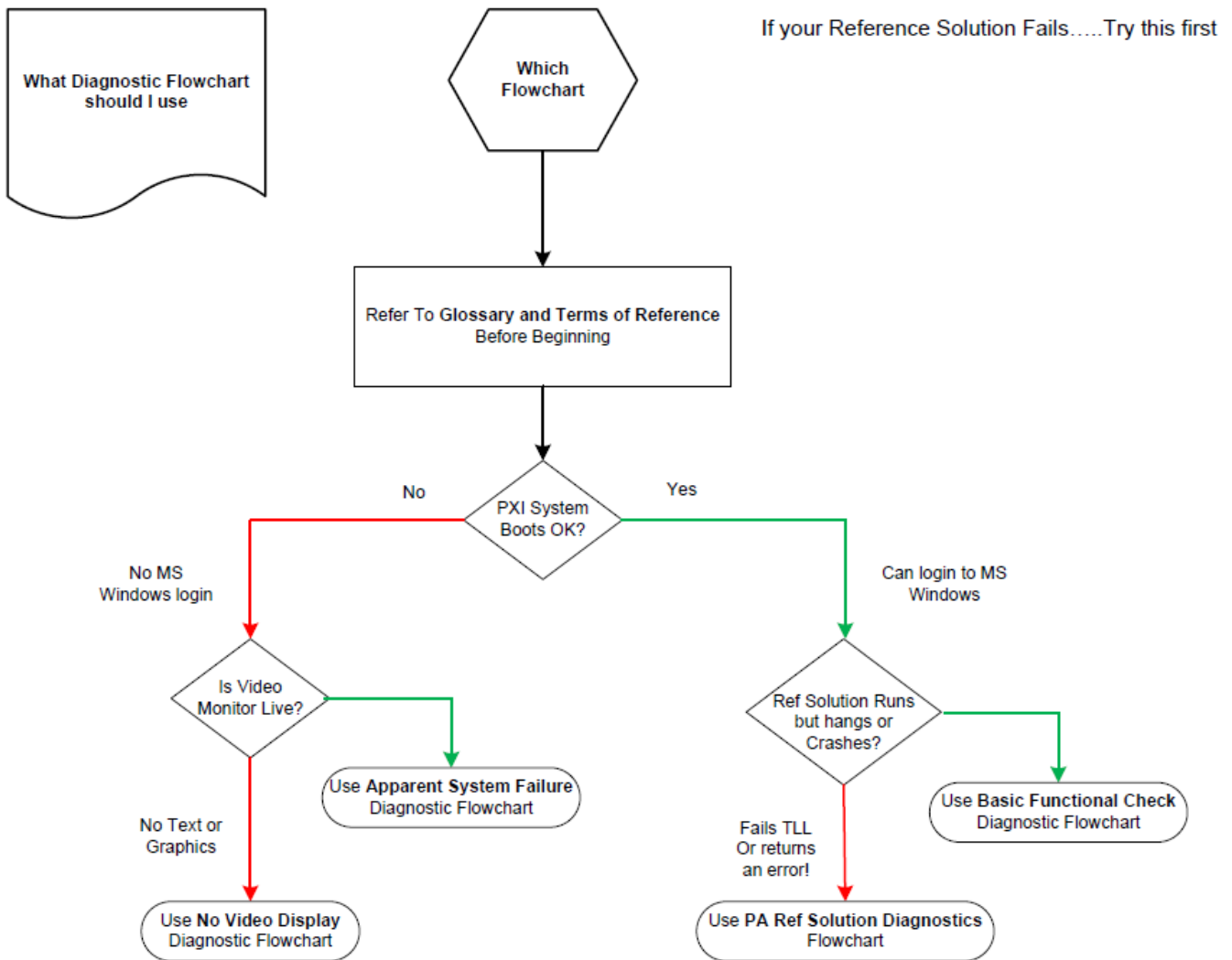
Assumptions for using Flowcharts

- The equipment being diagnosed is shown in the schematic (above).
- There are no additional modules in the PXI Chassis.
- The recommended instrument drivers and Keysight IO libraries are installed along with their dependencies. For information on Keysight IO libraries and dependencies, see [Tips to Achieve PCIe Connectivity](#).
- If the Keysight embedded controller is not being used, verify that the PC controller being used has been tested by Keysight. Many PCs cannot enumerate all the necessary PCIe slots required to support a full M9018A chassis. For details, consult the [Tested Computer List](#).
- If you added additional non-Keysight modules to the chassis, be advised that the PXI hardware and software co-existence has specific requirements. See [PXI Interoperability – How to achieve Multi-Vendor Interoperability](#).
- An Keysight reference solution may have a strong dependency on specific versions of instrument drivers, measurement software or Keysight IO Libraries. Make sure you understand these requirements before updating any of this software.

Diagnostic Flowcharts

Flowchart	Use this flow when...
Try This First (page 42)	You need to select which flowchart is most appropriate.
PXI System Will Not Boot (page 43)	The PXI system does not power up as expected or appears to have no power.
No Video Display (page 44)	The video display does not come up as expected.
Basic Functional Check (page 45)	There is an apparent system issue, and you need to verify basic HW and Software functionality.
PA Reference Solution (page 46)	The reference solution produces an error or unexpected test result.

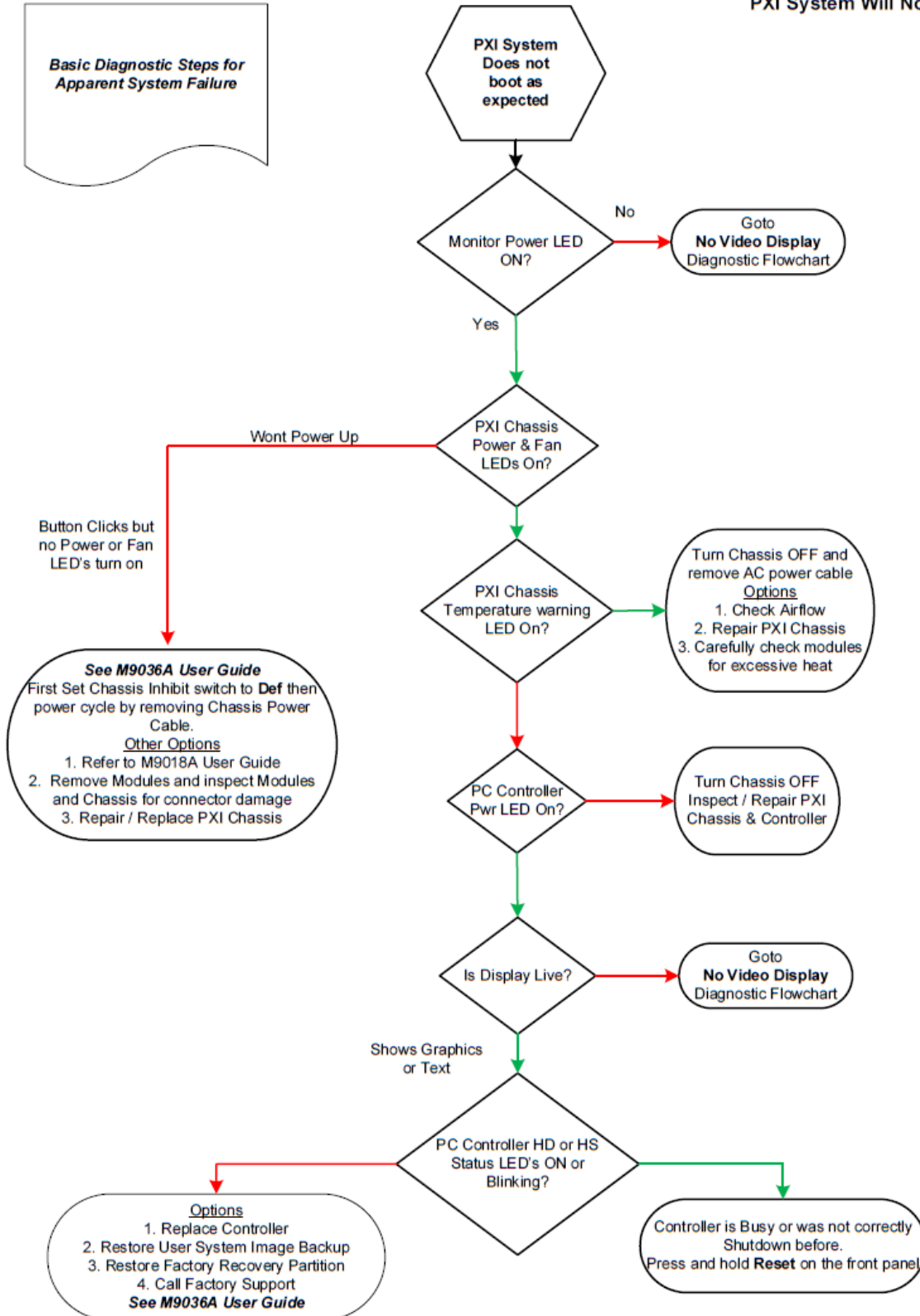
Try This First



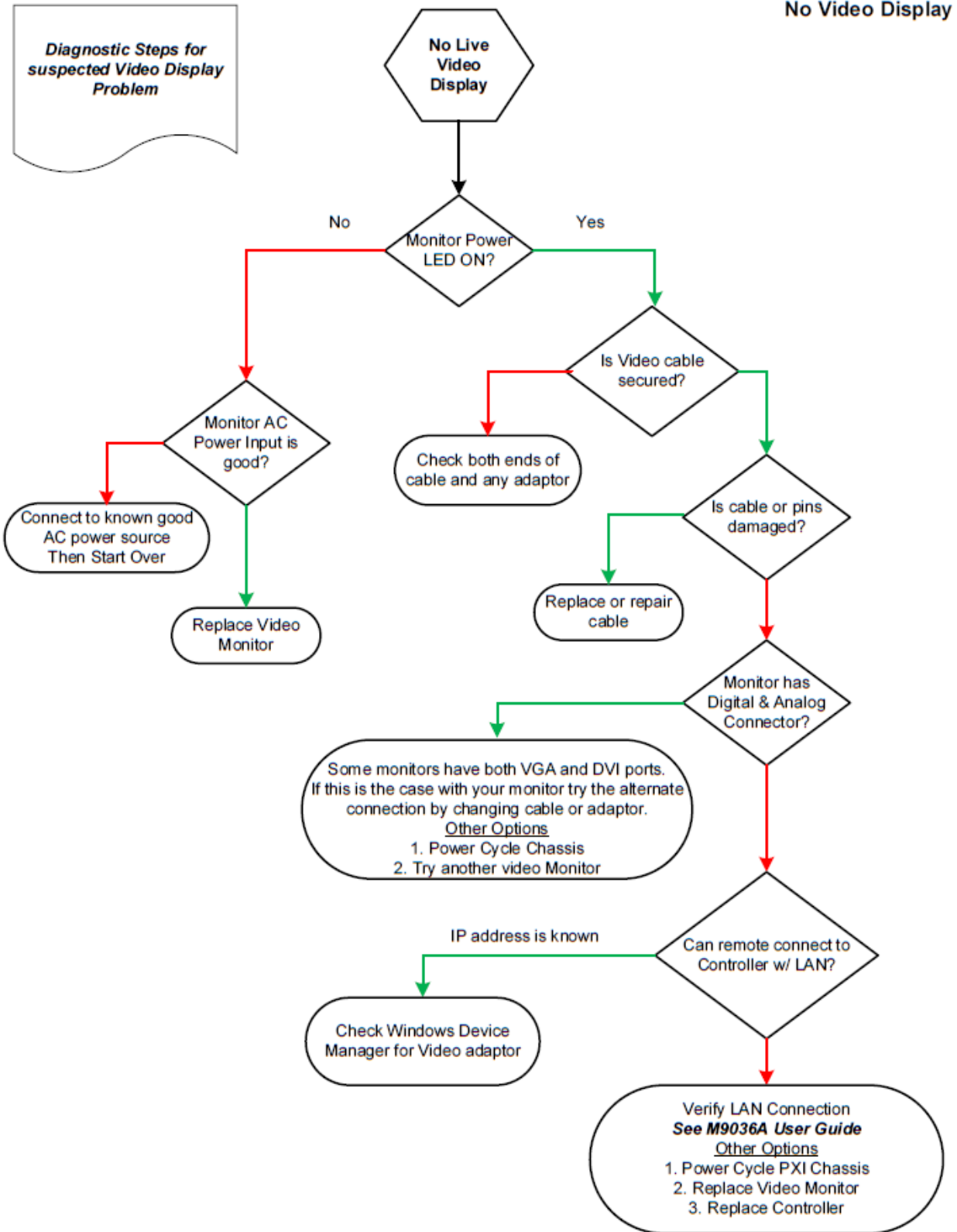
PXI System Will Not Boot

Basic Diagnostic Steps for Apparent System Failure

PXI System Will Not Boot



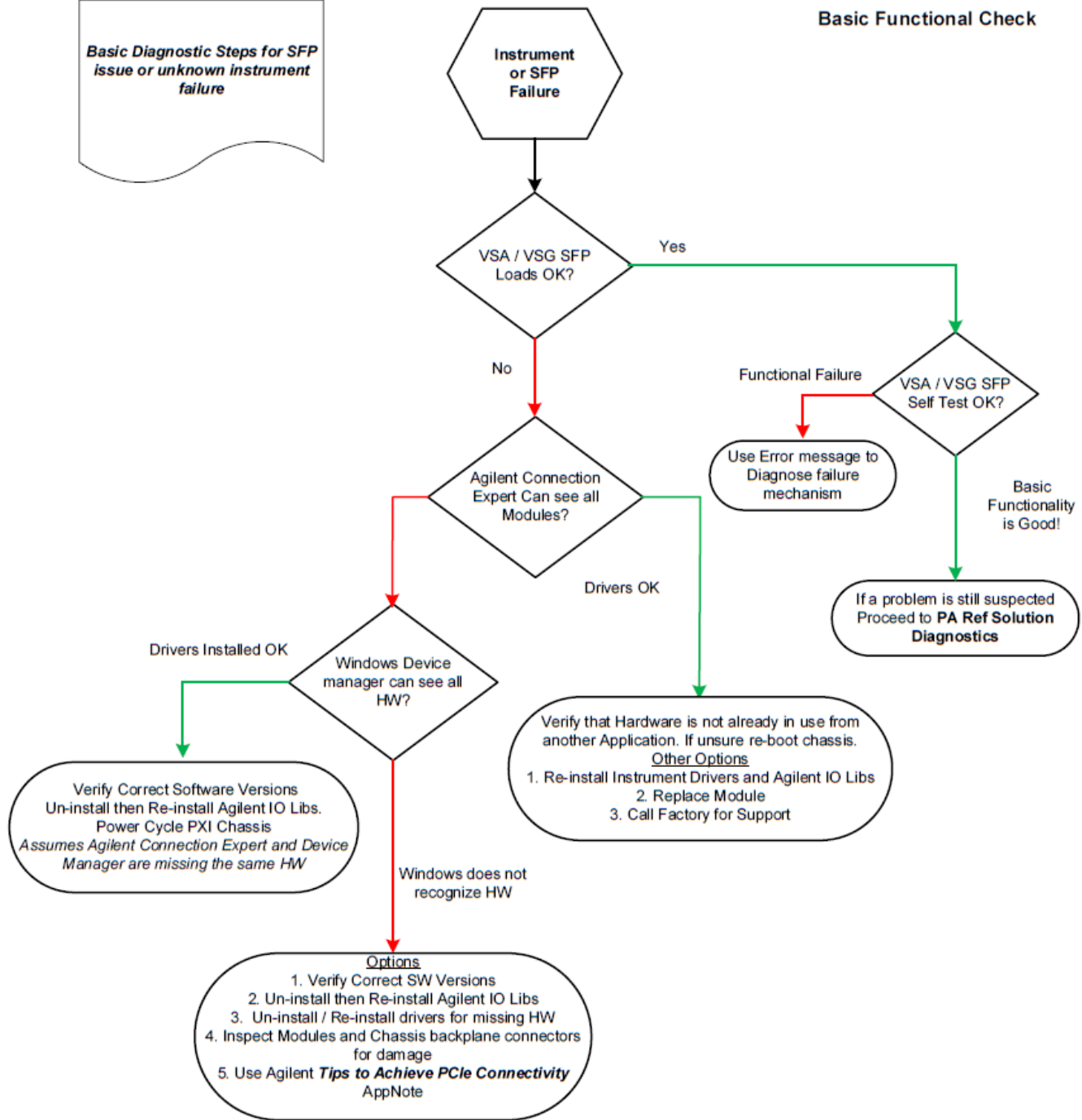
No Video Display



Basic Functional Check

Basic Diagnostic Steps for SFP issue or unknown instrument failure

Basic Functional Check



PA Reference Solution

