KEITHLEY

Model 2910 Vector Signal Generator

Quick Start Guide

2910-903-01 Rev. C / March 2007

KEITHLEY

A G R E A T E R M E A S U R E O F C O N F I D E N C E

Model 2910-VSG

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WARRANTY

Keithley Instruments, Inc. warrants this product to be free from defects in material and workmanship for a period of three (3) years from date of shipment.

Keithley Instruments, Inc. warrants the following items for 90 days from the date of shipment: probes, cables, software, rechargeable batteries, diskettes, and documentation.

During the warranty period, Keithley Instruments, will, at its option, either repair or replace any product that proves to be defective.

To exercise this warranty, write or call your local Keithley Instruments representative, or contact Keithley Instruments headquarters in Cleveland, Ohio. You will be given prompt assistance and return instructions. Send the product, transportation prepaid, to the indicated service facility. Repairs will be made and the product returned, transportation prepaid. Repaired or replaced products are warranted for the balance of the original warranty period, or at least 90 days.

LIMITATION OF WARRANTY

This warranty does not apply to defects resulting from product modification without Keithley's express written consent, or misuse of any product or part. This warranty also does not apply to fuses, software, non-rechargeable batteries, damage from battery leakage, or problems arising from normal wear or failure to follow instructions.

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A G R E A T E R M E A S U R E O F C O N F I D E N C E

Keithley Instruments, Inc.

The following safety precautions should be observed before using this product and any associated instrumentation. Although some instruments and accessories would normally be used with non-hazardous voltages, there are situations where hazardous conditions may be present.

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. Refer to the user documentation for complete product specifications.

If the product is used in a manner not specified, the protection provided by the product warranty may be impaired.

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 that 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.

Keithley Instruments 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.

If a ⏚ screw is present, connect it to safety earth ground using the wire recommended in the user documentation.

The ⚠ symbol on an instrument indicates that the user should refer to the operating instructions located in the user documentaion.

The ⚡ symbol on an instrument shows that it can source or measure 1000V or more, including the combined effect of normal and common mode voltages. Use standard safety precautions to avoid personal contact with these voltages.

The ⚠ symbol on an instrument shows that the surface may be hot. Avoid personal contact to prevent burns.

The ⏚ symbol indicates a connection terminal to the equipment frame.

The **WARNING** heading in the user documentation explains dangers that might result in personal injury or death. Always read the associated information very carefully before performing the indicated procedure.

The **CAUTION** heading in the user documentation explains hazards that could damage the instrument. Such damage may invalidate the warranty.

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 Keithley Instruments. 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 Keithley Instruments to maintain accuracy and functionality of the product). If you are unsure about the applicability of a replacement component, call a Keithley Instruments office for information.

To clean an instrument, use a damp cloth or mild, water-based cleaner. Clean the exterior of the instrument only. Do not apply cleaner directly to the instrument or allow liquids to enter or spill on the instrument. Products that consist of a circuit board with no case or chassis (e.g., a data acquisition board for installation into a computer) should never require cleaning if handled according to instructions. If the board becomes contaminated and operation is affected, the board should be returned to the factory for proper cleaning/servicing.

Series 2900

Model 2910 Vector Signal Generator

Quick Start Guide

Manual Print History

The print history shown below lists the printing dates of all Revisions and Addenda created for this manual. The Revision Level letter increases alphabetically as the manual undergoes subsequent updates. Addenda, which are released between Revisions, contain important change information that the user should incorporate immediately into the manual. Addenda are numbered sequentially. When a new Revision is created, all Addenda associated with the previous Revision of the manual are incorporated into the new Revision of the manual. Each new Revision includes a revised copy of this print history page.

Document Number: 2910-903-01 Rev. C / March 2007

Revision	Print Date
B	April 2006
A	February 2006

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Introduction

If you have any questions after reviewing this information, please contact your local Keithley Instruments representative or call one of our Applications Engineers at 1-888-KEITHLEY (1-888-534-8453) or contact us through our website at www.keithley.com.

In this section

Warranty information

Warranty information is located at the front of this manual. Should your Model 2910 require warranty service, contact the Keithley Instruments representative or authorized repair facility in your area for further information. When returning the instrument for repair, ensure that you complete and include the Service Form at the back of this manual to provide the repair facility with the necessary information.

NOTE	The Service Form requires the serial number of the Model 2910. The serial number label is located on the rear panel of the instrument. The serial number can also be read from the instrument front panel interface by selecting Menu > Help > About Keithley 2910.

Safety symbols and terms

The following symbols and terms may be found on the Model 2910 Vector Signal Generator or used in this manual:

The ⚠ symbol indicates that the user should refer to the operating instructions located in the manual.

The ⚡ symbol shows that high voltage may be present on the terminal(s). Use standard safety precautions to avoid personal contact with these voltages.

The ⚠ symbol on an instrument shows that the surface may be hot. Avoid personal contact to prevent burns.

The *WARNING* heading used in this manual explains dangers that might result in personal injury or death. Always read the associated information very carefully before performing the indicated procedure.

The **CAUTION** heading used in this manual explains hazards that could damage the unit. Such damage may invalidate the warranty.

Specifications

Refer to the product data sheet for updated Model 2910 Vector Signal Generator specifications. Check the Keithley Instruments website at www.keithley.com for the latest updates to the specifications.

Installing the system

In this section

Unpacking and inspecting the system

Inspection for damage

After unpacking the Keithley Instruments Model 2910 Vector Signal Generator, carefully inspect the unit for any shipping damage. Report any damage to the shipping agent immediately, as such damage is not covered by the warranty (warranty information can be found at the beginning of this manual).

Shipment contents

The following items are included with every Model 2910 Vector Signal Generator order:

- Model 2910 Vector Signal Generator Product Information CD-ROM (containing software, drivers, and the Model 2910 Help system)
- AC power cord
- Model 2910 Vector Signal Generator Quick Start Guide
- Calibration certificate

One of the following models:

- 2910-F Front RF output with bench-top bumpers and handles
- 2910-R Rear RF output with bench-top bumpers and handles
- 2910-FRK Front RF output with Rack-Mount Kit
- 2910-RRK Rear RF output with Rack-Mount Kit

The following items are options than can be ordered for the Model 2910:

- 2910-GSM (GSM/GPRS/EDGE Signal Generation Personality)
- 2910-Reverse Link CDMA2000 (CDMAOne/2000 Signal Generation Personality)
- 2910-Uplink WCDMA (W-CDMA Signal Generation Personality)
- 2910-GPS (GPS Signal Generation Personality)
- 2910-DIG (Digital Modulation Signal Generation Personality)
- 2910-ALG (Analog Modulation Signal Generation Personality)
- 2910-LPN (Low-Phase Noise)
- 2910-ARB (64 M-Sample Arbitrary Waveform Generator)
- 2910-ADAPTER-KIT (RF cables and RF connector adapters)
    - Type-N Male to Type-N Male cable (quantity 2, length 1M)
    - SMB Male to SMB Male cable (quantity 2, length 1M)
    - SMB Male to SMB Male cable (quantity 2, length 0.3M)
    - SMB Male to BNC Male cable (quantity 4, length 1M)
    - BNC Male to BNC Male cable (quantity 2, length 1M)
    - Type-N Male to SMA Female adapter (quantity 2)
    - USB Host to USB Device cable (quantity 1, length 1M)
    - Carry case (quantity 1)
- 2910-DCBLOCK (External DC Block)
- RF INSTRUMENTS-RMK (Dual Fixed Rack-Mount Kit with flanges)
- RF INSTRUMENTS-BENCH-KIT (Bench-Top Kit with bumpers and handles)
- Factory Calibration Report of Instrument Calibration Data

Repacking for return shipment

Should it become necessary to return the Model 2910 for repair, carefully pack the entire unit in its original packing carton or the equivalent, and perform the following steps:

- Contact Keithley Instruments to get a Return Material Authorization (RMA). You can contact Keithley Instruments through your local Keithley Instruments representative; by calling the Keithley Instruments factory at 1-888-534-8453 (1-888-KEITHLEY); or through the Keithley Instruments website at www.keithley.com.
- On the shipping label, write ATTENTION REPAIR DEPARTMENT and the RMA number.
- Complete and include the Service Form located at the back of this manual.

Warranty information is located at the front of this manual.

Becoming familiar with the instrument

Figure 1: Front panel features

> ***WARNING:***   ***The safe procedure to power-up the Model 2910 is provided in "Powering the Model 2910 Vector Signal Generator." Do not turn on the Model 2910 until you have reviewed that information.***
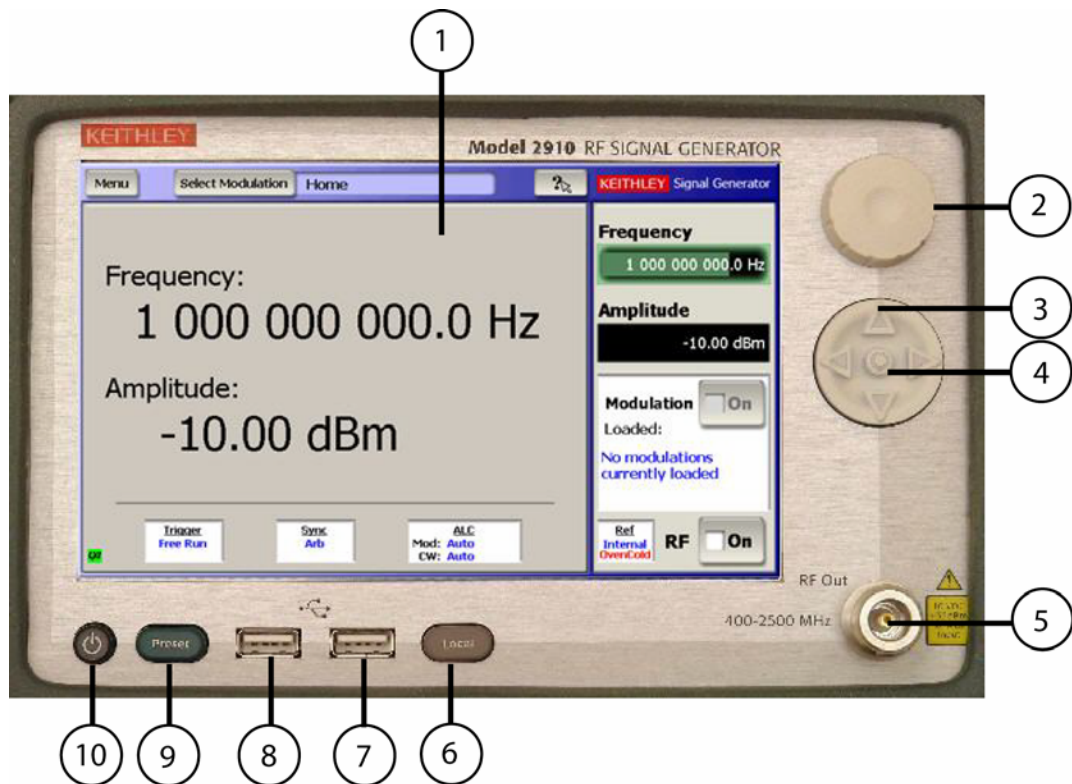
1. Display/touch screen displays the state of the instrument, allows input of settings, and is the primary mechanism for entering data.

2. Rotary knob changes the value of the selected numeric parameter.

3.   Puck/arrow keys change the value of the selected numeric parameters incrementally, or in a
       user-defined step.

4.   Puck center button brings up the on-screen numeric entry keypad.

5.   RF output connector outputs the RF signal from instruments that have a front Type-N RF output
       (Models 2910-F and 2910-FRK).

6.   Local button switches instrument to front panel control after remote use.

7.   USB port connects to USB devices: mouse, keyboard, or USB flash drives.

8.   USB port connects to USB devices: mouse, keyboard, or USB flash drives.

9.   Preset button resets the instrument to the factory default-state settings.

10.   Power button switches the instrument power off and on.

Figure 2: Rear panel features
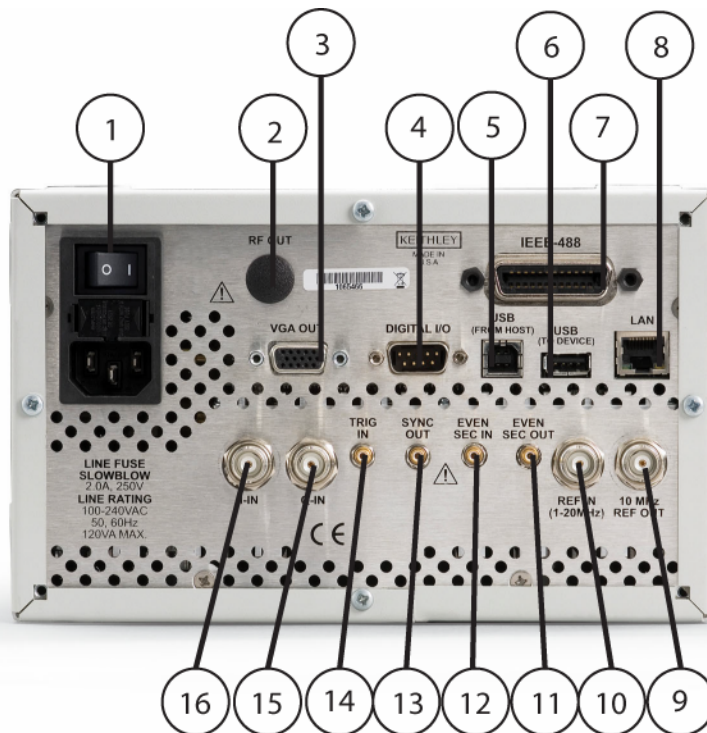
1. Power inlet/switch, fuse module connects the instrument to AC power.

2. RF OUT outputs the RF signal from instruments that have a rear Type-N RF output (Models 2910-R and 2910-RRK).

3. VGA OUT connects the instrument display to an external monitor.

4. Digital I/O outputs four programmable TTL signals.

5. USB (from host) connects to a USB port on a computer. The computer can then remotely control the instrument.

6. USB (to device) connects to a USB device: mouse, keyboard, or flash drive.

7. GPIB connects to GPIB control bus for remote operation.

8. LAN connects to an Ethernet network for remote operation.

9. REF OUT provides a frequency reference to synchronize other instruments (10MHz).

10. REF IN synchronizes the internal frequency reference to an external frequency reference (programmable from 1MHz to 20MHz in 10Hz increments).

11. EVEN SEC OUT provides an even-second clock to synchronize other instruments.

12. EVEN SEC IN synchronizes the internal frequency reference to an even-second clock.

13. SYNC OUT provides a signal for synchronizing events. It is often used in conjunction with the trigger input signal to notify another device that the requested event has been performed.

14. TRIG IN accepts a trigger from an external device to initiate an event in the Model 2910.

15. Q-IN accepts an external signal to directly drive the Q-input of the I/Q modulator.

16. I-IN accepts an external signal to directly drive the I-input of the I/Q modulator.

Figure 3: Instrument screen
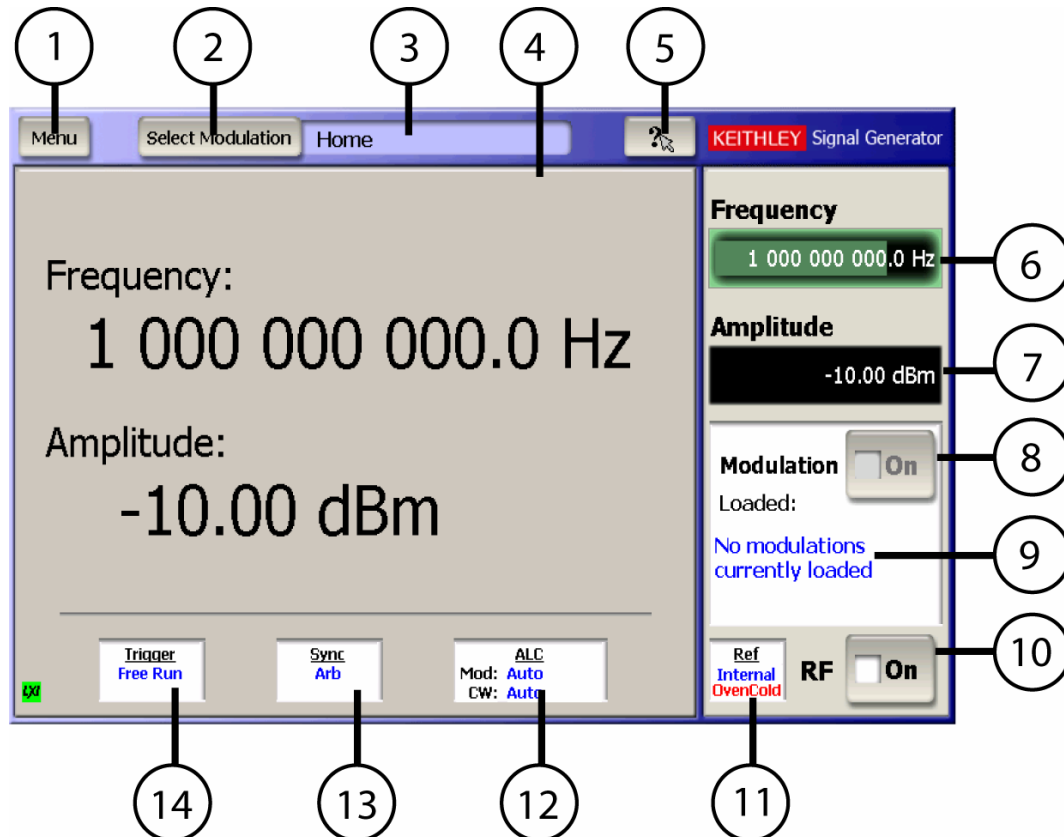
1.   Menu displays a drop-down menu that allows you to choose from File, Settings, Utility, and Help.

2.   Select Modulation displays a drop-down menu that allows you to choose from the various modulation formats.

3.   Modulation screen display indicates the modulation personality that is displayed in the Modulation Personality Window.

4.   Modulation personality display window displays the modulation format window that allows waveform editing and control.

5.   What's This Help displays help information for the screen shown.

6.   Frequency field shows the frequency setting. Select to edit the value.

7.   Amplitude field shows the RF power level. Select to edit the value.

8.   Modulation state switches the modulation on and off.

9.   Loaded: shows the modulation waveform currently loaded and output from the RF Output.

10.   RF state switches the RF output on and off.

11.   Ref state shows the frequency reference source. Select to edit the setting.

12.   ALC state shows the ALC setting. Select to edit the setting.

13.   Sync state shows the sync out setting. Select to edit the setting.

14.   Trigger state shows the trigger setting. Select to edit the setting.

Locating the instrument in the proper environment

Locate the Model 2910 such that it will operate within the following ambient temperature and humidity limits (refer to the instrument specifications for the complete set of environmental limits):

- Temperature: 0°C to +50°C (+23°C is optimal)
- Relative humidity: 5% to 70% relative humidity (RH), non-condensing (-25°C to +65°C)

NOTE: Accuracy specifications are based on operation at 23°C ±5°C and between 5% and 70% RH. Refer to the product specifications for derating factors outside these ranges. Air-conditioned environments are highly recommended.

CAUTION: To avoid overheating, operate the unit only in an area with proper ventilation. Allow at least eight inches of clearance at the back of the instrument to assure sufficient airflow, and adhere to the following:

Operate the unit in a clean, dust-free environment.

Keep the rear exhaust vent free of any obstructions. Even partial blockage may impair proper cooling. Also keep at least one vent at the front of the instrument free of obstruction.

Allow at least 1U (1.75 inch) of space at the top and bottom of the instrument.

Make sure there is adequate airflow around at least one side of the instrument. Adequate air flow ensures that air temperatures around the instrument remain within specified limits under all operating conditions.

To ensure proper cooling in rack environments with only convection cooling, position the hottest equipment at the top of the rack. Place precision equipment, such as the Model 2910, as low as possible in the rack, where temperatures are the coolest. Add spacer panels below the unit to help ensure adequate airflow.

Installing the instrument in a rack

If you have a Keithley Instruments RF Instruments-RMK Dual Fixed Rack Mounting Kit with flanges, refer to the document that accompanied the kit for installation instructions. Perform the rack-mounting kit installation now.

Powering the Model 2910 Vector Signal Generator

The Model 2910 operates within the following ranges:

- Line voltage of 100VAC to 240VAC
- Frequency of 50Hz or 60Hz

Connect and power the Model 2910 as follows:

1   Ensure that the operating voltage in your area is compatible with the Model 2910.

2   Operate the Model 2910 from a dedicated power source to avoid possible problems caused by electrical transients or line voltage fluctuations.

CAUTION:	Operating the instrument on an incorrect line voltage may cause damage, possibly voiding the warranty.

3   Before plugging in the power cord, ensure that the rear panel power switch is OFF (**O**).

4   Connect the female end of the supplied power cord to the AC receptacle on the rear panel.

Figure 4: Line power receptacle

WARNING:	*Use only the supplied, grounded line cord (or the equivalent) to assure proper safety grounding.*
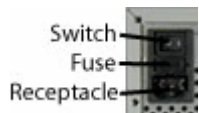
5   Connect the other end of the supplied line cord to a grounded AC line power receptacle.

WARNING:	*The power cord supplied with the unit contains a separate ground for use with grounded outlets. When proper connections are made, the instrument chassis is connected to power line ground through the ground wire in the power cord. Failure to use a grounded outlet may result in personal injury or death due to electric shock.*

6   Switch the rear panel power switch to the ON (**|**) position. The front panel power button displays an amber illumination.

7   Switch the instrument on by pushing the front panel power button. The power button now displays a green illumination. The Model 2910 performs a series of self-tests. If it detects a failure, the unit displays an error message.

NOTE: If you notice that the power button is not illuminated or the Model 2910 seems completely unresponsive after three minutes, you may need to change the fuse. In this case, refer to "Replacing a fuse."

NOTE: If a problem develops, return the Model 2910 to Keithley Instruments, Inc. for repair. Refer to "Repacking for return shipment" located earlier in this section for more information on returning the Model 2910 to the factory.

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8   When the Model 2910 passes the self tests, it automatically boots the system software and displays the start-up screen.

9   Warm-up the instrument. The Model 2910 can be used immediately after being switched ON. However, to achieve specified performance, warm-up the instrument for at least 30 minutes.

Replacing a fuse
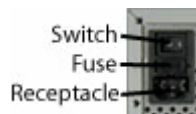
If the line fuse needs to be replaced, perform the following steps:

WARNING: *Verify that the instrument is disconnected from the AC line and other equipment before changing line fuse.*

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1   Using a small flat-blade screwdriver, push the retaining clip toward the center of the module to release the fuse holder assembly.

2   Pull the fuse holder out of the power module.

3   Remove the blown fuse and replace it with a similar 2.0 Amp, 250 VAC, 5x20 mm slow-blow fuse.

CAUTION: For continued protection against fire or instrument damage, only replace fuses with the type and rating listed. If the instrument repeatedly blows fuses, return the unit to Keithley Instruments.

Verifying modulation licenses

The Model 2910 Vector Signal Generator requires a license file to access the modulation waveforms in the source. To view the current licenses select Menu > Utilities > Licensing.

You can purchase the following licenses for your instrument:

- License Option 2910-ARB (64 Mega-Sample Arbitrary Waveform Generator)
- License Option 2910-GSM (GSM Signal Generation Personality)
- License Option 2910-CDMA2000 (CDMA2000 Signal Generation Personality)
- License Option 2910-WCDMA (WCDMA Signal Generation Personality)
- License Option 2910-GPS (GPS Signal Generation Personality)
- License Option 2910-DIG (Digital Modulation Signal Generation Personality)
- License Option 2910-ALG (Analog Modulation Signal Generation Personality)

NOTE: Each instrument must have an arbitrary waveform generator license (2910-ARB) for the other digital modulation licenses to operate.

Purchasing modulation licenses

You can purchase modulation license files at the time of ordering your instrument or at any time after you have received your instrument.

Contact your Keithley Instruments sales representative or use one of the following numbers/addresses to purchase a license or receive a replacement license certificate.

- Toll-free (North America only): 1-888-KEITHLEY (1-888-534-8453)
- Phone: 440-248-0400
- Email: info@keithley.com (mailto:info@keithley.com)
- Website: www.keithley.com

Connecting system components

NOTE: This is a typical installation, with the Model 2810-VSA connected to the system controller. This arrangement facilitates making screen captures of the VSA display. The rear panel SCPI control connectors are the same on both instruments. Thus, either or both of the instruments could be directly connected to the system controller for remote control. Connection by LAN enables use of the LXI web interface for licensing operations and other features.

Figure 5: System connection diagram
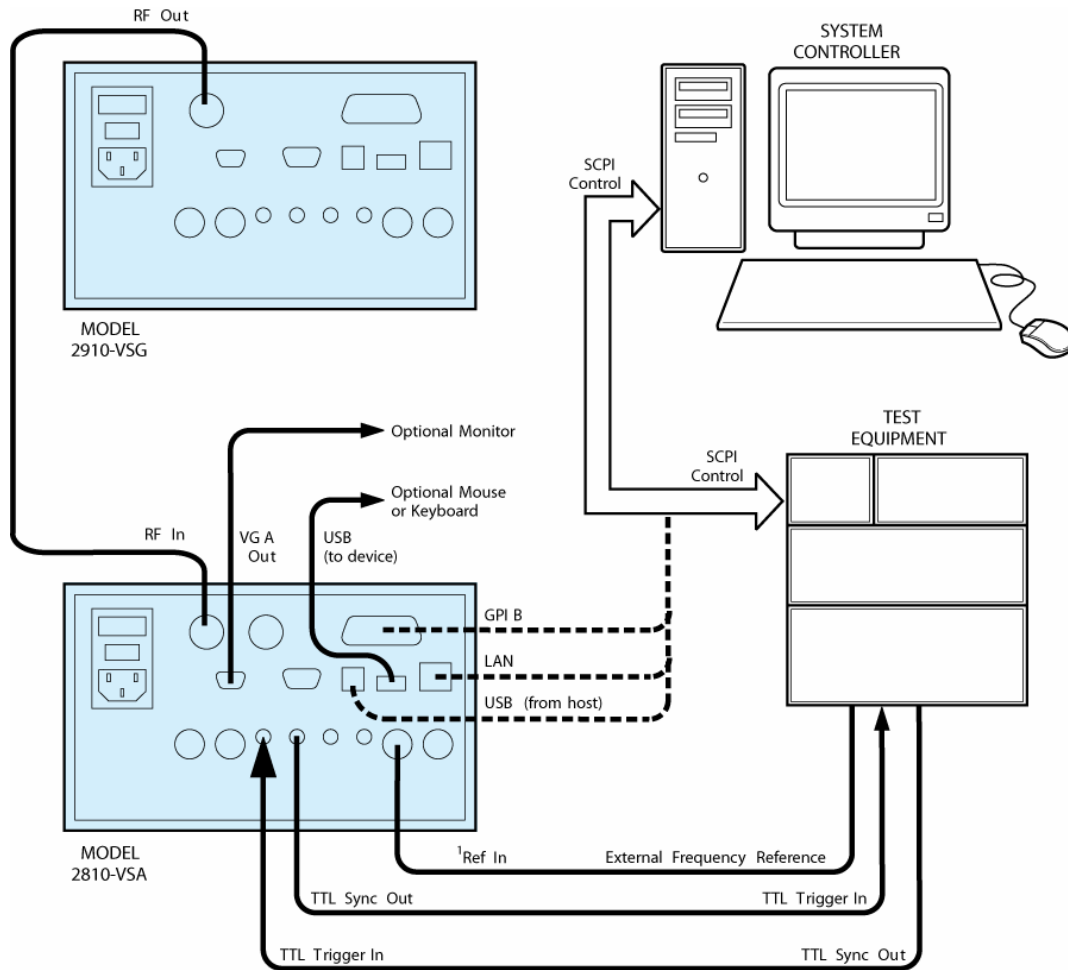
1. REF IN can accept an input frequency reference of 1-20MHz.

GPIB connections

- Connect a GPIB bus cable equipped with standard IEEE-488 connectors to the Model 2910 back panel **IEEE-488** connector.
- Connect many instruments to one instrument, using parallel connections that stack the connectors.

NOTE: To prevent physical damage, do not stack more than three connectors on any one unit.

Two screws are located on each connector to ensure that connections remain secure. Present standards call for metric threads, which are identified with dark-colored screws. Earlier versions have different screws, which are silver-colored. Do not use these silver-colored types of screws on the Model 2910; it is designed for metric threads.

To minimize interference caused by electromagnetic radiation, use only shielded IEEE-488 cables. Available shielded cables from Keithley Instruments are Models 7007-1 and 7007-2.

LAN (Ethernet) connections

- Connect the Model 2910 back panel **LAN** connector to an existing site network through a router, switch, or hub. Use a standard patch cable for this connection.

Or

- Connect the Model 2910 back panel **LAN** connector directly to a computer. You must use a crossover cable for this connection to ensure that the computer transmit connections are input to the Model 2910 receive connections, and the other way around (Model CA-180-3A crossover cable is available for ordering from Keithley Instruments).

NOTE: The Ethernet crossover cable can be up to 100 meters in length.

USB connections

- Connect a computer controller to the Model 2910 back panel USB (FROM HOST) connector.
- Connect all other USB devices to the Model 2910 back panel USB (TO DEVICE) connector or to the two USB connectors on the front panel.

Configuring the system for remote control or network

After adding supported external instruments as described in the previous section, "Connecting system components" (external GPIB instruments, LAN (Ethernet) network, and computers), you must properly configure the system so that the Model 2910 can operate correctly in one of the following system configurations:

- GPIB interface configuration
- LAN (Ethernet) interface configuration
- USB interface configuration

GPIB interface configuration

To avoid communication conflicts over the bus, each device in a GPIB system must have a unique primary address. The Model 2910 is shipped from the factory with the primary address set to 12.

If you want to verify the GPIB address or change it, perform the following steps:

1   Select Menu > Utilities > GPIB Address.

2   Use the front panel knob to change the GPIB address, if necessary.

3   Select Close.

NOTE: You may also want to install the Keithley Instruments IVI-COM/IVI-C Driver for the Model 2910 Vector Signal Generator. This instrument driver provides access to the functionality of the Model 2910 through a COM server or C API, which also complies with the IVI specifications. This driver works in any development environment that supports COM programming, including Microsoft® Visual Basic, Microsoft Visual C++, Microsoft .NET, Agilent VEE Pro, National Instruments LabView, National Instruments LabWindows, and others. The IVI-COM driver can be installed from the Keithley Instruments website at www.keithley.com.

Verify remote control over GPIB

If you want to verify communication between a computer and the Model 2910 instrument over the GPIB, install the KI RFI Communicator application (included on the Model 2910 Vector Signal Generator Product Information CD-ROM) that allows you to test SCPI communication of your instrument. Perform the following steps:

1   Ensure you have a GPIB cable connected between the instrument back panel IEEE-488 connector and the computer GPIB board connector.

2   Insert the Model 2910 Vector Signal Generator Product Information CD-ROM into the computer drive.

3   After the CD-ROM launches, click Applications Info > KI RFI Communicator to download the application installation program.

4   Click the downloaded setup.exe file to install the application on your computer.

5   On your computer desktop, click the KI RFI Communicator icon to start the application.

6   In the KI RFI Communicator home screen, click Setup Interface.

7   In the Configure VISA Interface dialog, select the GPIB tab.

8   Set the values for the following GPIB settings:

   ▪ GPIB board # (leave this set to zero, unless you have more than one GPIB
      interface board in your computer)

   ▪ GPIB primary address

9   Click OK.

10   Click Send Command to send the command *IDN? that is shown in the Command: box.

11   You should see the instrument identification information in the Response: field.

12   Continue sending any other SCPI commands of interest.

   Refer to the Model 2910 Help (either in the instrument or on the product information
   CD-ROM) for a complete list of compatible SCPI commands.

LAN (Ethernet) interface configuration

It is necessary to assign an IP address to the Model 2910. The IP address is a persistent
state; it is not affected by an instrument preset or a power cycle. The following procedures
assume that you have connected the equipment as instructed in "Connecting system
components."

The appropriate procedure depends on the Model 2910 connection configuration. Refer to
the procedure that applies to your system configuration:

▪ Existing site network configuration

Or

▪ Direct connection configuration

NOTE: This procedure assumes that the instrument is connected to the LAN using a
         CAT 5e or better patch cable.

NOTE: You may also want to install the Keithley Instruments IVI-COM/IVI-C Driver for
         the Model 2910 Vector Signal Generator. This instrument driver provides access
         to the functionality of the Model 2910 through a COM server or C API, which
         also complies with the IVI specifications. This driver works in any development
         environment that supports COM programming, including Microsoft® Visual
         Basic, Microsoft Visual C++, Microsoft .NET, Agilent VEE Pro, National
         Instruments LabView, National Instruments LabWindows, and others. The
         IVI-COM driver can be installed from the Keithley Instruments website at
         www.keithley.com.

Existing site network configuration

Contact your I.T. administrator to receive direction on the preferred method of assigning IP addresses. Refer to the procedure that applies to your system:

- Static IP address assignment
- DHCP address assignment

Static IP address assignment in an existing site network

Perform the following steps to assign a static IP address for an instrument in an existing site network:

1   From the Model 2910, select Menu > Utilities > Ethernet Settings.

2   Select the IP Address tab.

3   Enter an IP address:

    a)   Select Specify an IP address.

    b)   Select the IP Address field or the keyboard button next to it.

    c)   Repeatedly select the ← (backspace) button to clear the current IP address.

    d)   Select the desired IP address and then select Enter.

4   Enter a subnet mask:

    a)   Select the Subnet Mask field or the keyboard button next to it.

    b)   Repeatedly select the ← (backspace) button to clear the current subnet mask.

    c)   Select the desired subnet mask and then select Enter.

5   Set the following values per your I.T. administrator's recommendations (you can leave the values blank if there are no recommendations):

- Default gateway
- Primary DNS
- Primary WINS

6   Select the Apply button.

7   Select Close to close the dialog.

NOTE:	Ensure that the combination of Model 2910 IP address and subnet mask is within the range of directly addressable IP addresses of the computer. For example: Computer IP address: 192.168.1.50 Computer subnet mask: 255.255.255.0 Model 2910 IP address: 192.168.1.51 Model 2910 subnet mask: 255.255.255.0

DHCP address assignment in an existing site network

If a DHCP server is on the LAN, you can choose to have a DHCP automatically assign an IP address:

1 From the Model 2910, select Menu > Utilities > Ethernet Settings.

2 Select the IP Address tab.

3 Select Obtain an IP address via DHCP.

4 Select the Apply button.

This configures the signal generator as a DHCP client. In DHCP mode, the signal generator requests a new IP address from the DHCP server. The assigned address appears in the IP Address field.

5 Select Close to close the dialog.

Direct connection configuration

Assigning a static IP address is the preferred method of assigning an IP address for a configuration that has the Model 2910 directly connected to the computer. Optionally, you can use the DHCP method, which results in a Link Local Address (LLA) being assigned to the Model 2910. Refer to the procedure that applies to your system:

▪ Static IP address assignment

▪ DHCP address assignment

Static IP address assignment on a direct connection

Perform the following steps to assign a static IP address for an instrument that has a direct connection to a computer:

1 From the Model 2910, select Menu > Utilities > Ethernet Settings.

2 Select the IP Address tab.

3 Enter an IP address:

    a) Select Specify an IP address.

    b) Select the IP Address field or the keyboard button next to it.

    c) Repeatedly select the ← (backspace) button to clear the current IP address.

    d) Select the desired IP address and then select Enter.

4 Enter a subnet mask:

    a) Select the Subnet Mask field or the keyboard button next to it.

    b) Repeatedly select the ← (backspace) button to clear the current subnet mask.

    c) Select the desired subnet mask and then select Enter.

5 Set the following values per your I.T. administrator's recommendations (you can leave the values blank if there are no recommendations):

- Default gateway

- Primary DNS

- Primary WINS

6 Select the Apply button.

7 Select Close to close the dialog.

NOTE: Ensure that the combination of Model 2910 IP address and subnet mask is within the range of directly addressable IP addresses of the computer.

        For example:

        Computer IP address: 192.168.1.50

        Computer subnet mask: 255.255.255.0

        Model 2910 IP address: 192.168.1.51

        Model 2910 subnet mask: 255.255.255.0

DHCP address assignment on a direct connection

Optionally, you can use the DHCP method to assign an IP address. Since there is no DHCP server in a configuration that directly connects the Model 2910 to a computer, the instrument will timeout and then automatically assign itself a Link Local Address (LLA). This process takes 60-90 seconds.

1 From the Model 2910, select Menu > Utilities > Ethernet Settings.

2 Select the IP Address tab.

3 Select Obtain an IP address via DHCP.

4 Select the Apply button. This attempts to configure the signal generator as a DHCP client.

5   Select Close to close the dialog.

6   When the LAN error indicator disappears (60-90 seconds), select Menu > Utilities >
    Ethernet Settings. The LLA that was automatically assigned appears in the IP Address
    field.

7   Select Close to close the dialog.

Verify remote control over LAN

If you want to verify communication between a computer and the Model 2910 Vector
Signal Generator over the LAN, install the KI RFI Communicator application that allows
you to test SCPI communication of your instrument. Perform the following steps:

1   Set up the equipment as shown in "Connecting system components."

2   Assign an IP address for the Model 2910 by following a procedure for one of the
    configurations described in "LAN Interface configuration."

3   Insert the Model 2910 Vector Signal Generator CD-ROM in the computer drive.

4   When the CD-ROM launches, click Applications Info > KI RFI Communicator to download
    the application installation program.

5   Click the downloaded setup.exe file to install the application on your computer.

6   On your computer desktop, click the KI RFI Communicator icon to start the application.

7   In the KI RFI Communicator home screen, click Setup Interface.

8   In the Configure VISA Interface dialog, select the LAN/TCPIP tab.

9   Set the values for the following settings, or the values displayed in the Ethernet dialog
    if DHCP is used:

    ▪   NIC # (Leave this set to zero, unless you have more than one NIC card installed in
        your computer.)

    ▪   TCPIP port # = 5025

    ▪   TCPIP address = IP address that you assigned to the Model 2910

10 Click OK.

11 Click Send Command to send the *IDN? command that is in the Command: box.

12 You should see the instrument identification information in the Response: field.

Continue sending any other SCPI commands of interest.

Refer to the Model 2910 Help (either in the instrument or on the product information
CD-ROM) for a complete list of compatible SCPI commands.

LAN troubleshooting

The Model 2910 Vector Signal Generator defaults to an Ethernet setting of "Auto-negotiation On" to detect the speed of the network and set the instrument operation speed to match the network speed. If the auto-negotiation process fails, the operation speed must be set manually.

NOTE: If the instrument speed does not match the network speed, Auto-negotiation On is the recommended setting.

---

1   Select Menu > Utilities > Ethernet Settings.

2   Select the Advanced tab.

3   Select the appropriate speed.

  - ▪   10 Mbps

  - ▪   100 Mbps

4   Select Apply.

5   To ensure that both the instrument and the network recognize the speed change, you may need to disconnect and then reconnect the LAN cable.

USB configuration

It is necessary to load a USB driver on to the computer that will be running the remote control program. For convenience, the USB driver can be installed from the Model 2910 Vector Signal Generator Product Information CD-ROM. Updates for the USB driver can be downloaded from the Keithley Instruments website at www.keithley.com.

Installing the USB driver from the CD-ROM

Perform the following steps to install the USB driver to your computer:

1   Insert the Model 2910 Vector Signal Generator Product Information CD-ROM into the disk drive of the computer.

2   With the Model 2910 powered on, connect a USB cable between the PC and the USB (FROM HOST) connector on the Model 2910 rear panel.

3   Follow the operating system instructions to load the USB driver.

Installing the USB driver from the Keithley Instruments website

Perform the following steps to look for updates of the USB driver to install on your computer:

1   With the computer connected to the Internet, insert the Model 2910 Vector Signal Generator Product Information CD-ROM into the computer disk drive.

2   After the CD-ROM launches, click Online Updates to get to the Keithley Instruments website, http://www.keithley.com

3   In the search area at the top-right corner of the web page, select Downloads from the pull-down menu.

4   Type "drivers" in the text box to the right of the of the pull-down menu.

5   Select the search button to the right of the text box.

6   Scroll to the USB driver for the Model 2910.

7   Click the link to the USB driver for the Model 2910.

8   Download the Model 2910 USB driver from the website.

9   Click the driver setup file that you just downloaded.

Verify remote control over USB

If you want to verify communication between a computer and the Model 2910 over the USB, install the KI RFI Communicator application that allows you to test SCPI communication of your instrument. Perform the following steps:

1   Set up the equipment as shown in "Connecting system components."

2   Insert the Model 2910 Vector Signal Generator CD-ROM in the computer drive and click Install KI RFI Communicator to download the application installation program.

3   Select Run to install the program on your computer.

4   Select the KI RFI Communicator Icon that has been placed on the desktop.

5   In the KI RFI Communicator home screen, click Setup Interface.

6   In the Configure VISA Interface dialog, select the USB tab and click Find USB Devices. This will display a list of all instruments connected through USB.

7   Select the list item that corresponds with the serial number of the instrument that you want to communicate with, and then click OK.

8   Click Send Command to send the *IDN? command that is in the Command: box.

9   You should see the instrument identification information in the Response: field.

Continue sending any other SCPI commands of interest.

Refer to the Model 2910 Help (either in the instrument or on the product information CD-ROM) for a complete list of compatible SCPI commands.

Access the Model 2910 from your PC

The Model 2910 has a web interface that complies with LXI class C requirements and offers a convenient way to communicate with the Model 2910 from a PC browser.

The LXI Class C compliance includes the following features:

- Instrument Welcome page
- IP configuration control
- Status information: security, errors/warnings
- Administration password control

The web interface also offers the following features:

- Virtual instrument front panel access
- Print screen capability from a web browser
- Instrument help
- Modulation license file management
- Remote file browser

To access the web interface, launch a web browser and use the LAN-connected instrument IP address for the URL; for example, http://192.40.128.183.

If you do not know the instrument IP address, you can find it from the instrument front panel interface by selecting Menu > Utilities > Ethernet Settings.
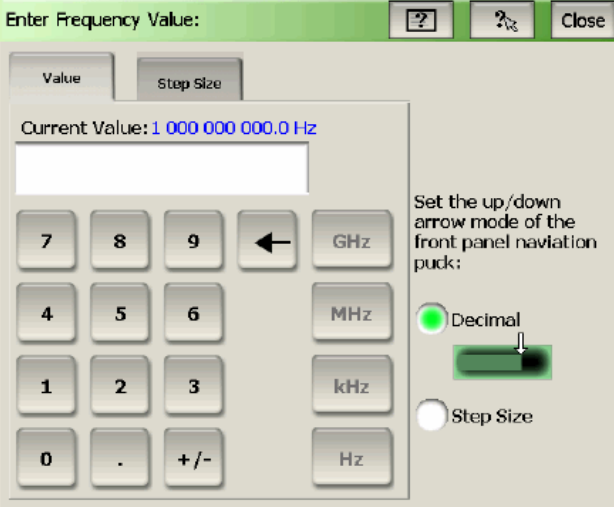
Generating signals

In this section

Setting up a basic signal with various input devices

This set of example procedures will show you how to set up the frequency and power of a signal with the following input devices:

Front panel puck	
Numeric keypad	
Front panel knob	

Mouse	

Setting up a carrier frequency

With the front panel puck

Follow these steps:

1 Select the Frequency field to activate it.

2 Press the left arrow on the puck to change the frequency step to 1GHz.

3 Press the up arrow on the puck to change the frequency to 2GHz.

4 Press the right arrow on the puck to change the frequency step to 0.01GHz.

5 Press the up arrow to change the frequency to 2.01GHz.

With the instrument screen

Follow these steps:

1 Select the Frequency field to activate it.

2 Bring up the instrument keypad, using one of the following methods:

- Press the center button on the front panel puck.
- Double-select the Frequency field.

3 Select a new frequency value of 400 MHz and then select Enter.

With the front panel knob

Follow these steps:

1 Select the Frequency field to activate it.

2 Adjust the front panel knob to lower the frequency to the minimum value.

With an attached mouse

Follow these steps:

1 Double-click the Frequency field to activate it and to display the instrument keypad.

2 On the displayed instrument keypad, click the keys to select a frequency value of 2500MHz.

3   Use the mouse wheel and the click-and-drag action to explore how you can also edit the frequency value. This method is similar to using the front panel knob and the left and right arrows on the puck.

4   On the displayed instrument keypad, click the Step Size tab.

5   Change the step size to 25kHz. Now, when you use the up/down arrow keys on the puck, the frequency will increment/decrement by 25kHz.

Setting up the RF power level

With the front panel puck

Follow these steps:

1   Select the RF On button to switch on the RF output power.

2   Select the Amplitude field to activate it.

3   Press the left arrow on the front panel puck to change the step value to 10 dB.

4   Press the down arrow on the puck to change the power to −10 dBm.

5   Press the right arrow on the puck to change the power increment to 0.1 dB.

6   Press the down arrow on the puck to change the power to −10.2 dBm.

With the instrument screen

Follow these steps:

1   Select the Amplitude field to activate it.

2   Bring up the instrument keypad, using one of the following methods:

   ▪   Press the center button on the front panel puck.

   ▪   Double-select the Amplitude field.

3   Select a new power value of −100 dBm and then select Enter.

With the front panel knob

Follow these steps:

1   Select the Amplitude field to activate it.

2   Adjust the front panel knob to lower the RF output power to the minimum value.

With an attached mouse

Follow these steps:

1   Double-click the Amplitude field to activate it and display the instrument keypad.

2   On the displayed instrument keypad, click 10 dBm to select a power value.

3   Use the mouse wheel to set the power level to the maximum value.

Loading a modulation waveform

This example procedure shows you how to load a GSM / EDGE modulation waveform. See "Verifying modulation licenses" for details.

1   Press instrument Preset.

2   Choose the Select Modulation button. Select GSM / EDGE.

3   Select Waveform File.

4   Select Open.

5   Navigate to the file to open a waveform file. The file for a GSM / EDGE waveform will have a *.csv notation indicating it is in a comma-separated value format.

6   Select the waveform file.

7   Select Load to place the file on the instrument display, get it ready for editing, or to apply it to the RF carrier signal.

8   Select Load to apply the waveform to the RF carrier signal. Notice that the waveform modulation details appear below the Modulation On button.

9   Ensure both the RF On and Modulation On buttons are selected.

Getting information from Help

You can quickly access information that shows you how to set up and control output signals using the Model 2910 front panel interface and programming commands. You can access the Model 2910 Help from the front panel menu, and from the CD-ROM that was shipped with the instrument.

Help from the Front panel

To access the Help from the Model 2910 front panel, select Menu > Help > Help System....

Help from the CD-ROM

To access the System Help from the Model 2910 Vector Signal Generator Product Information CD-ROM:

1   Insert the CD-ROM into the computer.

2   If the computer is not set up for Auto-Run, double-click the CD drive in Windows Explorer.

3   When the CD launches, double-click the Open the Model 2910 Vector Signal Generator System Help link.

4   Either Open the System Help for immediate use, or Save it as a file on your computer for later recall and use.

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Service Form

Model No._____ **Serial No.**_____ **Date**_____

Name and Telephone No._____

Company_____

List all control settings, describe problem and check boxes that apply to problem. _____

_____

- ☐ Intermittent
- ☐ Analog output follows display
- ☐ Particular range or function bad; specify

- ☐ IEEE failure
- ☐ Obvious problem on power-up
- ☐ Batteries and fuses are OK
- ☐ Front panel operational
- ☐ All ranges or functions are bad
- ☐ Checked all cables

Display or output (check one)

- ☐ Drifts
- ☐ Unable to zero
- ☐ Unstable
- ☐ Will not read applied input
- ☐ Overload

- ☐ Calibration only
- ☐ Certificate of calibration required
- ☐ Data required

(attach any additional sheets as necessary)

Show a block diagram of your measurement system including all instruments connected (whether power is turned on or not). Also, describe signal source.

Where is the measurement being performed? (factory, controlled laboratory, out-of-doors, etc.)

_____

What power line voltage is used? _____ Ambient temperature?°F _____

Relative humidity? _____ Other? _____

Any additional information (if special modifications have been made by the user, please describe).

_____

Be sure to include your name and phone number on this service form.

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