KEITHLEY

Model 2810 RF Vector Signal Analyzer

Quick Start Guide

2810-903-01 Rev. A / August 2006

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Model 2810 RF Vector Signal Analyzer

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

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

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

To exercise this warranty, write or call your local Keithley representative, or contact Keithley 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.

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Should you have any questions concerning this Agreement, or if you desire to contact Keithley Instruments for any reason, please call 1-800-552-1115, or write at Keithley Instruments, 28775 Aurora Rd., Solon, Ohio, USA 44139.

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A GREATER MEASURE OF CONFIDENCE

Keithley Instruments, Inc.

Corporate Headquarters • 28775 Aurora Road • Cleveland, Ohio 44139
440-248-0400 • Fax: 440-248-6168 • 1-888-KEITHLEY (534-8453) • www.keithley.com

12/04

Model 2810
RF Vector Signal Analyzer
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.

Revision A (Document Number 2810-903-01) ....August 2006

KEITHLEY Safety Precautions

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 manual for complete product specifications.

If the product is used in a manner not specified, the protection provided by the product 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 manual. 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, and perform safe installations and repairs of products. Only properly trained service personnel may perform installation and service procedures.

Keithley 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 Manual.

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 1000 volts, 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, make sure 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 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 manual.

The ⚡ symbol on an instrument shows that it can source or measure 1000 volts 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 indicates a connection terminal to the equipment frame.

The WARNING heading in a 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 in a manual 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., 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.

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Installing the Instrument

In this section:

Unpacking and inspecting the instrument

Inspection for damage

After unpacking the Keithley Instruments Model 2810 RF Vector Signal Analyzer (VSA), 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 2810-VSA order:

- Model 2810 RF Vector Signal Analyzer Product Information CD-ROM (containing software, drivers, and the 2810-VSA Help system)
- AC power cord
- Model 2810 RF Vector Signal Analyzer Quick Start Guide
- Calibration certificate

One of the following models:

- 2810-F Front RF input with bench-top bumpers and handles
- 2810-R Rear RF input with bench-top bumpers and handles
- 2810-FRK Front RF input with rack-mount kit
- 2810-RRK Rear RF input with rack-mount kit

The following items are options than can be ordered for the 2810-VSA:

- 2810-GSM GSM/GPRS/EDGE Measurement Personality
- 2810-Reverse link CDMA2000 CDMAOne/2000 Measurement Personality
- 2810-Uplink WCDMA Measurement Personality
- RF INSTRUMENTS-RMK Dual Fixed Rack Mounting 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 2810-VSA 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, or 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.

Warranty information is located at the front of this manual.

Becoming familiar with the instrument

WARNING   **The safe procedure to power-up the 2810-VSA is provided in "Powering the 2810-VSA" found later in this section. Do not turn on the 2810-VSA until you have reviewed that information.**

Figure 1-1
**Front Panel Features**
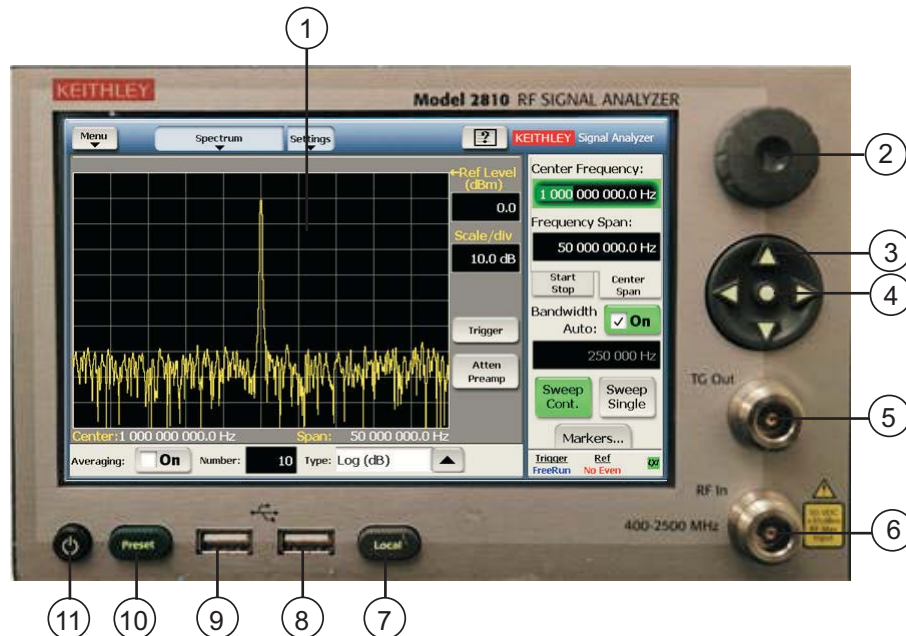
1.   **Display/touch screen** — Displays state of the instrument, allows input of settings, and is the primary mechanism for entering data.

2.   **Front panel knob** — Changes the value of the selected numeric parameter.

3.   **Front panel puck** — Changes the value of the selected numeric parameter incrementally or in a user-defined step.

4.   **Puck center button** — Brings up the on-screen numeric entry keypad.

5.   **TG Out connector** — This Tracking Generator Output provides a frequency sweep of fixed amplitude. It can be cabled through a DUT (filter) for testing. When used in calibration, its output is internally switched to RF In.

6.   **RF In connector** —This front panel connector (Models 2810-F and 2810-FRK) inputs the RF signal from an RF signal source. This input accepts signals from 400 MHz to 2.5 GHz.

7.   **Local button** — Restores the instrument to manual or front panel control. This is often used to break the control of a remote controller such as a PC.

8.   **USB port** — Connects to USB devices: mouse, keyboard, or USB memory stick drives.

9.   **USB port** — Connects to USB devices: mouse, keyboard, or USB memory stick drives.

10.   **Preset button** — Restores the instrument to a state with its initialized settings.

11.   **Power On / Off switch** — Press this to turn the instrument on or off. Associated with this switch are two LEDs. The amber LED shows the instrument to be in the standby state. The green LED shows the instrument to be in the operating state.

Figure 1-2
Rear Panel Features
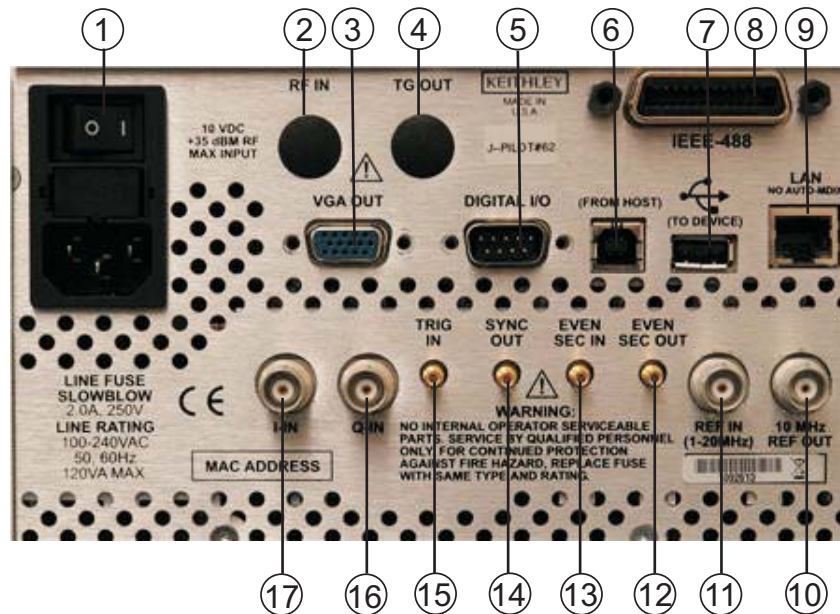
1.   **Power inlet/switch, fuse module** — Connects the instrument to AC power.
2.   **RF IN** — Inputs the RF signal from instruments that have a rear Type-N RF output (Models 2810-R and 2810-RRK). This input accepts signals from 400 MHz to 2.5 GHz.
3.   **VGA OUT** — Connects the instrument display to an external monitor.
4.   **TG OUT** — This rear Tracking Generator Output panel (Models 2810-R and 2810-RRK) provides a frequency sweep of fixed amplitude. It can be cabled through a DUT (filter) for testing. When used in calibration, its output is internally switched to RF In.
5.   **DIGITAL I/O** — Outputs four programmable TTL signals.
6.   **USB (from host)** — Connects to a USB port on a computer. The computer then remotely controls the instrument.
7.   **USB (to device)** — Connects to a USB device: mouse, keyboard, or memory stick drive.
8.   **GPIB** connector — Connects to GPIB control bus for remote operation.
9.   **LAN** — Connects to an Ethernet network for remote operation.
10.   **REF OUT** — Provides a frequency reference to synchronize other instruments (10 MHz).
11.   **REF IN** — Synchronizes the internal frequency reference to an external frequency reference (programmable from 1 MHz to 20 MHz in 10 Hz increments).
12.   **EVEN SEC OUT** — Provides an even second clock to synchronize other instruments.
13.   **EVEN SEC IN** — Synchronizes the internal frequency reference to an even-second clock.
14.   **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.
15.   **TRIG IN** — Accepts a trigger from an external device to initiate an event in the 2810-VSA.
16.   **Q-IN** — Accepts an external signal to directly drive the Q-input of the I / Q modulator.
17.   **I-IN** — Accepts an external signal to directly drive the I-input of the I / Q modulator.

Figure 1-3
Graphic User Interface Features
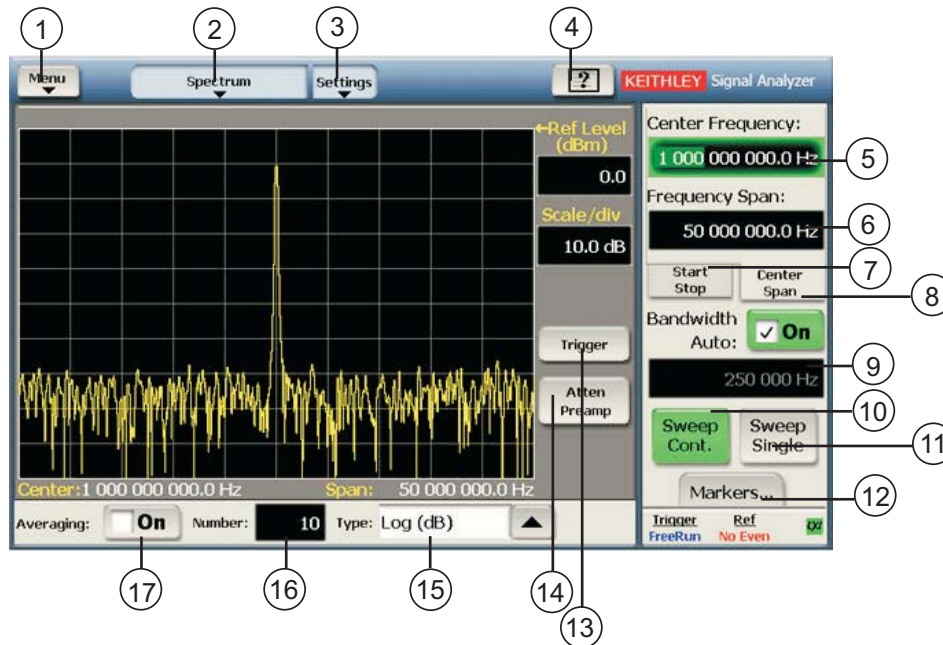
1. **Menu** — Displays a drop-down menu that allows you to choose from File, Global Settings, Utilities, and Help.
2. **Spectrum** — Displays a drop-down menu that allows you to choose from the various modulation formats.
3. **Settings** —Displays a drop-down menu that allows you to choose from a group of settings associated with the setup and modification of the measurement.
4. **Help** — Activates the context-sensitive Help system.
5. **Center Frequency:** — Shows the center frequency setting. Select to edit the value.
6. **Frequency Span:** — Shows the frequency span. Select to edit the value.
7. **Start Stop** — Displays a field to enter a start frequency and a field to enter a stop frequency.
8. **Center Span** — This default setting displays the center frequency field and the frequency span field.
9. **Bandwidth:** — Sets the bandwidth of the channel that you specified for the channel parameter.
10. **Sweep Cont.** — This default setting continuously sweeps the span that you have specified.
11. **Sweep Single** — Takes one sweep of the span that you have specified.
12. **Markers:** — Opens a dialog screen to enable you to set up to four markers.
13. **Trigger** — Opens a dialog screen to enable you to control triggering.
14. **Atten / Pre** — Opens a dialog screen to enable you to insert an attenuator or preamplifier to optimize the signal level into the mixer section of the 2810-VSA.
15. **Type:** — Specifies what data type is used in the measurement.
16. **Number:** — Specifies how many measurements to take into consideration for the averaging calculation of the measurement results.

17.   **Averaging:** — The averaging function minimizes the effects of noise by averaging the results of multiple measurements. This control switches on averaging, if the check box is selected.

Locating the instrument in the proper environment

Locate the 2810-VSA 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° to +50°C (+23°C is optimal)
- Relative humidity: 5% to 70% relative humidity (RH), non-condensing (-25° to +65°C)

NOTE   *Accuracy specifications are based on operation at 23° ±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 2810-VSA, 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 2810-VSA

The 2810-VSA operates within the following ranges:

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

Connect and power the 2810-VSA as follows:

1. Check to be sure the operating voltage in your area is compatible with the 2810-VSA.
2. Operate the 2810-VSA from a dedicated power source to avoid possible problems caused by electrical transients or line voltage fluctuations.

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

3. Before plugging in the power cord, make sure 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.

WARNING   **Use only the supplied, grounded line cord, or the equivalent, to assure proper safety grounding.**

Figure 1-4
Line power receptacle
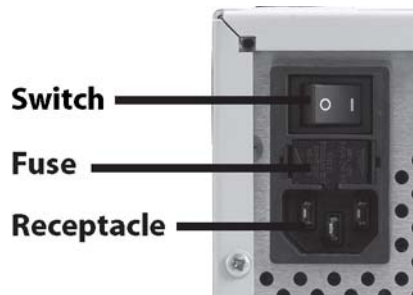
5. Connect the other end of the supplied line cord to a grounded AC line power receptacle.

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 2810-VSA 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 2810-VSA seems completely unresponsive after three minutes, you may need to change the fuse. In this case, refer to "Replacing a fuse" later in this section.*

> *If a problem develops, return the 2810-VSA to Keithley Instruments, Inc. for repair. Refer to "Repacking for return shipment" earlier in this section for more information on returning the 2810-VSA to the factory.*

8. When the 2810-VSA passes the self tests, it automatically boots the system software and displays the start-up screen.
9. Warm-up the instrument. The 2810-VSA can be used immediately after being switched ON. However, to achieve specified performance, warm-up for at least 30 minutes.

Replacing a fuse

Figure 1-5
Fuse location
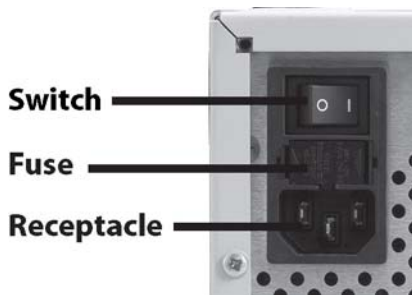
If the line fuse needs to be replaced, perform the following steps:

WARNING   **Make sure the instrument is disconnected from the AC line and other equipment before changing line fuse.**
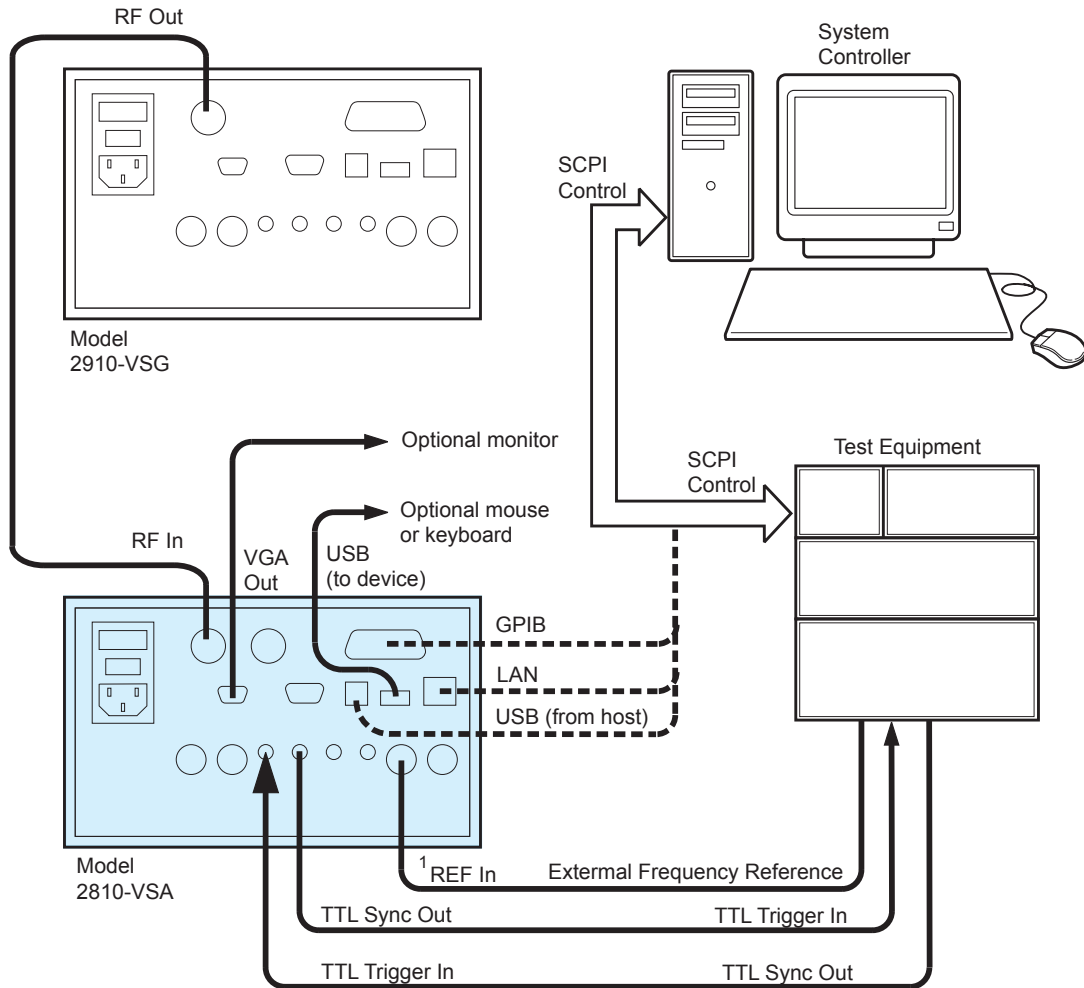
1. Using a small flat-blade screwdriver, push the retaining clip toward the center of the module to release the fuse holder assembly.
2. Pull the fuse holder out of the power module.
3. Remove the blown fuse and replace it with a similar 2.0 Amp, 250 VAC, 5 x 20 mm slow-blow fuse.

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

Connecting system components

The following diagram shows how typical system components are installed.

Figure 1-6
**Back panel view, instrument connectors, and system connections**

RF Out

System
Controller

SCPI
Control

Model
2910-VSG

Optional monitor

SCPI
Control

Test Equipment

Optional mouse
or keyboard

RF In   VGA   USB
              Out   (to device)

GPIB

LAN

USB (from host)

Model
2810-VSA   [1]REF In   External Frequency Reference

TTL Sync Out   TTL Trigger In

TTL Trigger In   TTL Sync Out

[1] REF IN can accept an input frequency reference of 1 to 20 MHz.

GPIB connections

- Connect a GPIB bus cable equipped with standard IEEE-488 connectors to the 2810-VSA back panel IEEE-488 connector.
- Connect many instruments to one instrument, using parallel connections that stack the connectors, as shown in Figure 1-7.

Figure 1-7
GPIB Connections
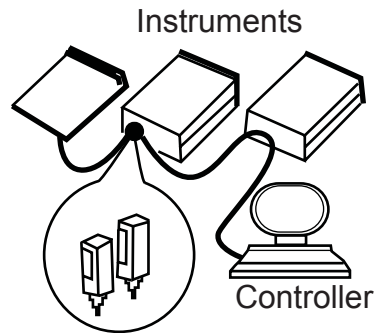
NOTE *To prevent physical damage, do not stack more than three connectors on any one unit.*

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 connectors on the 2810-VSA; 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 2810-VSA 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 2810-VSA 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 2810-VSA receive connections and vice versa (Model CA-180-3A crossover can be ordered from Keithley Instruments).

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

USB connections

- Connect a computer controller to the 2810-VSA back panel **USB (FROM HOST)** connector.
- Connect all other USB devices to the 2810-VSA back panel **USB (TO DEVICE)** connector or to the two USB connectors on the front panel.

Verifying digital modulation licenses

The 2810-VSA requires a license file to access the digital 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 2810-GSM GSM/GPRS/EDGE Measurement Personality
- License Option 2810-Reverse link CDMA2000 CDMAOne/2000 Measurement Personality
- License Option 2810-Uplink WCDMA Measurement Personality

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 receive a 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

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 2810-VSA can operate correctly in one of the following system configurations:

- GPIB configuration
- Ethernet configuration
- USB configuration

GPIB interface configuration

To avoid communication conflicts over the bus, each device in a GPIB system must have a unique primary address. The 2810-VSA is shipped from the factory with the primary address set to **10**.

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**.

Verify remote control over GPIB

If you want to verify communication between a computer and the 2810-VSA instrument over the GPIB, install the **KI RFI Communicator** application (included on the Model 2810 RF Vector Signal Analyzer Product Information CD-ROM) that allows you to test SCPI communication of your instrument. Perform the following steps:

1. Make sure you have a GPIB cable connected between the instrument back panel **IEEE-488** connector and the computer GPIB board connector.
2. Insert the Model 2810 RF Vector Signal Analyzer 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 **2810-VSA Help** for a complete list of compatible SCPI commands.

LAN (Ethernet) interface configuration

It is necessary to assign an IP address to the 2810-VSA. 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" earlier in this section.

The appropriate procedure depends on the 2810-VSA connection configuration:

- *Existing site network connection* (refer to "Existing site network configuration" below)

or

- *Direct connection to a computer* (refer to "Direct connection configuration" on page 1-15)

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

Existing site network configuration

Contact your I.T. administrator to receive direction on the preferred method of assigning IP addresses:

- Static IP address assignment (below)
- DHCP address assignment (page 1-14)

Static IP address assignment

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

1. From the 2810-VSA, 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 default gateway and DNS per your I.T. administrator's recommendations.
6. 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
7. Select the **Apply** button.
8. Select **Close** to close the dialog.

NOTE   *Make sure that the combination of 2810-VSA 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

2810-VSA IP address: 192.168.1.51

2810-VSA subnet mask: 255.255.255.0

DHCP address assignment

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

1. From the 2810-VSA, select **Menu > Utilities > Ethernet Settings…**.
2. Select the **IP Address** tab.
3. Select **Obtain an IP address via DHCP**.
4. Select the **Apply** button.
5. This configures the signal analyzer as a DHCP client. In DHCP mode, the signal analyzer requests a new IP address from the DHCP server. The assigned address appears in the **IP Address** field.
6. 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 2810-VSA directly connected to the computer. Optionally, you can use the DHCP method, which results in a Link Local Address (LLA) being assigned to the 2810-VSA.

- Static IP address assignment (below)
- DHCP address assignment (page 1-15)

Static IP address assignment

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

1. From the 2810-VSA, 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   *Make sure that the combination of 2810-VSA 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

        2810-VSA IP address: 192.168.1.51

        2810-VSA subnet mask: 255.255.255.0

DHCP address assignment

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 2810-VSA to a computer, the instrument will timeout and then automatically assign itself a Link Local Address (LLA). This process takes 60 to 90 seconds.

1. From the 2810-VSA, 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 analyzer 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 2810-VSA instrument 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 the previous procedure, "Connecting system components."
2. Assign an IP address for the 2810-VSA by following a procedure for one of the configurations described in "LAN Interface configuration."
3. Insert the Model 2810 RF Vector Signal Analyzer Product Information CD-ROM into 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 2810-VSA
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.
13. Continue sending any other SCPI commands of interest. Refer to the **2810-VSA Help** for a complete list of compatible SCPI commands.

LAN troubleshooting

The 2810-VSA 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 onto the computer that will be running the remote control program. For convenience, the USB driver can be installed from the Model 2810 RF Vector Signal Analyzer Product Information CD-ROM. Updates for the USB driver can be downloaded from the Keithley Instruments Website at www.keithley.com.

Installing USB driver from the CD-ROM

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

1. Insert the Model 2810 RF Vector Signal Analyzer Product Information CD-ROM into the disk drive of the computer.
2. With the 2810-VSA powered on, connect a USB cable between the PC and the **USB (FROM HOST)** connector on the 2810-VSA rear panel.
3. Follow the operating system instructions to load the USB driver.

Installing 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 2810 RF Vector Signal Analyzer Product Information CD-ROM into the computer disk drive.
2. After the CD-ROM launches, click **Online Updates** to get to the Keithley Instruments Downloads Website, 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 2810-VSA.
7. Click the link to the USB driver for the 2810-VSA.
8. Download the 2810-VSA 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 2810-VSA instrument over the USB, install the Keithley Instruments **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 the procedure, "Connecting system components."
2. Insert the Model 2810 RF Vector Signal Analyzer Product Information CD-ROM in the computer drive and click **Application Info** then click **KI RFI Communicator** to install the application program.
3. Select **Run** and follow the instructions 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 by way of 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.
10. Continue sending any other SCPI commands of interest. Refer to the **2810-VSA Help** for a complete list of compatible SCPI commands.

Access the 2810-VSA from your PC

The Model 2810 RF Vector Signal Analyzer Product Information CD-ROM that accompanied your Keithley Instruments 2810-VSA contains a Java Runtime Environment [Java Runtime Environment (JRE) 5.0 Update 7]. This JRE contains the Java virtual machine, runtime class libraries, and Java applications launcher that are necessary to run programs written in the Java programming language.

Install the JRE from the CD-ROM:
1. Install the CD-ROM into your PC drive.
2. Download the JRE.

Check online for future updates to the JRE

You can receive free future updates to this JRE by downloading them from the Keithley Instruments Website. This JRE is appropriate only if you are operating in a Windows environment.

1. Using your internet browser, type in the following URL: http://www.keithley.com
2. Select and download the appropriate update.

If you are operating in a Unix, Linus, or Solaris environment, you may download the appropriate JRE from the Sun Microsystems website:

1. Using your internet browser, type in the following URL:
   http://java.sun.com/javase/downloads/index.jsp
2. Scroll to the Java Runtime Environment (JRE) 5.0 Update 7 and select "Download."
3. From this page you are able to download the appropriate executable file.

Making Measurements

In this section:

Loading and outputting a frequency domain (spectrum) signal on the Model 2910-VSG

The spectrum measurement sets up viewing and measurement of signals within the frequency range of the Keithley Instruments Model 2810 RF Vector Signal Analyzer (VSA). It shows where the signal is on the 2810-VSA measurement spectrum and where it is relative to other signals. This is useful for looking at a signal of interest and seeing where other signals (such as spurs) are in relation to it.

Common signal characteristics of interest are:

- Signal carrier frequency.
- The signal amplitude.
- The frequency bandwidth occupied by the signal.
- The nature of any modulation applied to the carrier signal.

Making a spectrum measurement

What follows is a simple procedure to display an RF signal in the frequency domain. The measurement assumes the presence of a dominant continuous signal.

The spectrum is set to maximum to view the signal. A marker is attached to the largest signal. The signal is moved to the center of the screen and the bandwidth adjusts around it for closer examination.

This example procedure shows you how to load and output a 2-tone waveform on the 2910-VSG. Refer to Figure 1-6 for interconnect details.

1. Press instrument **Preset.**
2. Choose the Select Modulation button. Select Analog > 2 Tone.
3. Select **Load**. Under the green **Modulation** button, the 2910-VSG displays the file name and frequency span.
4. Turn RF on. Ensure that both Modulation and RF are on.

Making a frequency domain (2 tone) measurement on the 2810-VSA

1. Choose the measurement personality:
   a. Select Preset to get to a common starting point.
   b. From the measurement selection menu, choose **General Purpose** > **Spectrum**.
2. Set the measurement parameters:
   a. Double click the Frequency Span and set to 5 KHz.
   b. Select Settings and then Spur Cancellation.

The signal of interest is now in view on the screen.

3. Adjust the screen for optimum viewing:
   a. Apply a marker to the signal of interest.
   b. Select **Markers** and turn Marker 1 **On**.
   c. Select Marker to Max.
   d. Select Marker to Center, select Close.
   e. Adjust Frequency Span around the signal.
   f. Select **Frequency Span** and adjust it as desired.

When you are satisfied with the signal and marker position:

4. Transfer measurement results:
    a. Select Menu > File > Save Screen….

    b. Select **Look In**: and navigate to the storage location.
    c. Select **Keyboard**, type the image title, and select **Enter**.
    d. Select **Save**.
    e. Select **Yes**.

Loading and outputting a time domain (GSM) waveform on the 2910-VSG

GSM is based on Time Division Multiple Access (TDMA). TDMA works by dividing the frequency band up into individual time slots. Each time slot corresponds to an individual communications channel. In GSM there are eight time slots; a cell phone transmits during one time slot, receives in another and stays silent for the remaining six time slots. The GSM signal therefore appears as a signal burst in the time domain.

The 2810-VSA synchronizes and captures the GSM burst and displays it on the front panel screen. From this captured signal, many measurements can be made simultaneously. The results are compared with the settings and what is expected from the GSM Standard.

This example procedure shows you how to load and output a GSM modulation waveform on the 2910-VSG. Refer to "Verifying digital modulation licenses" for details. Refer to Figure 1-6 for interconnect details.

1. Press instrument **Preset.**
2. Choose the **Select Modulation** button. Select **GSM / EDGE.**
3. Select **Waveform File > Open** and choose the GSM waveform of interest**.**

The file for a GSM / EDGE waveform will have an *.csv notation, indicating that it is a comma separated value format.

4. Select **Open + Load** to apply the waveform to the RF carrier signal. Notice that the waveform filename appears below the **Modulation On** button.
5. Ensure that both the **RF On** and **Modulation On** buttons are selected.

Making a time domain (GSM) measurement on the 2810-VSA

This example procedure shows you how to view a demodulated GSM waveform in time domain on the 2810-VSA:

1. Choose the measurement personality:
    a. Select **Preset** to get to a common starting point.
    b. From the **Spectrum** pull-down menu, select **GSM.**
2. Set the measurement parameters.

The signal of interest is now visible on the 2810-VSA screen at the default settings.

3. Press the **View** button to choose between a view of the graph, table, or graph and table.
4. To optimize the measurement, open the **Trace Type** drop-down menu and select the view that is appropriate to your measurement.

When you are satisfied with the signal and marker position:

5. Transfer measurement results:

a. Select Menu > File > Save Screen….
b. Select **Look In**: and navigate to the storage location.
c. Select **Keyboard**, type the image title, and select **Enter**.
d. Select **Save**.
e. Select **Yes**.

Getting information from Help

You can quickly access information that shows you how to set-up and control output signals using the 2810-VSA front panel interface and programming commands. You can access the 2810-VSA 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 system from the 2810-VSA front panel, select **Menu > Help > Help System…**. Refer to Figure 1-3 for access to context-sensitive Help and command Help.

Help from the CD-ROM

To access the Help from the Model 2810 RF Vector Signal Analyzer 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 2810-VSA System Help** link.
4. Either **Open** the Help for immediate use or **Save** it to a computer file for later recall and use.

Index

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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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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