Keysight UXG X–Series Agile Signal Generators

N5191A
N5193A

KEYSIGHT TECHNOLOGIES

Getting
Started Guide

Notices

Trademark Acknowledgments

Manual Part Number

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Warranty

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Safety Notices

CAUTION

A **CAUTION** notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a CAUTION notice until the indicated conditions are fully understood and met.

WARNING

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

Where to Find the Latest Information

Documentation is updated periodically. For the latest information about these products, including instrument software upgrades, application information, and product information, browse to one of the following URLs, according to the name of your product:

http://www.keysight.com/find/n5191a

http://www.keysight.com/find/n5193a

To receive the latest updates by email, subscribe to Keysight Email Updates at the following URL:

http://www.keysight.com/find/MyKeysight

Information on preventing instrument damage can be found at:

www.keysight.com/find/PreventingInstrumentRepair

Is your product software up-to-date?

Periodically, Keysight releases software updates to fix known defects and incorporate product enhancements. To search for software updates for your product, go to the Keysight Technical Support website at:

http://www.keysight.com/find/techsupport

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1 Safety Information

Warnings, Cautions, and Notes

The documentation for this product uses the following safety notations. Familiarize yourself with each notation and its meaning before operating the signal generator.

WARNING	*Warning* denotes a hazard. It calls attention to a condition or situation that could result in personal injury or loss of life. Do not proceed beyond a warning until you fully understand the indicated conditions or situations.
CAUTION	*Caution* calls attention to a condition or situation that could result in damage to or destruction of the signal generator, or in the loss of a user's settings or data. Do not proceed beyond a caution until you fully understand the indicated conditions.
NOTE	*Note* calls the user's attention to an important point or special information in the text

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General Safety Considerations

WARNING If the signal generator is not used as specified, the protection provided by the equipment could be impaired. The signal generator must be used in a normal condition only, in which all means for protection are intact.

WARNING No operator serviceable parts inside. Refer servicing to qualified personnel. To prevent electrical shock do not remove covers.

CAUTION The Mains wiring and connectors shall be compatible with the connector used in the premise electrical system. Failure, to ensure adequate earth grounding by not using the correct components may cause product damage, and serious injury.

Safety
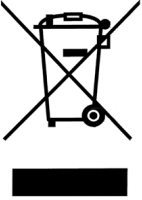
Complies with European Low Voltage Directive 2014/35/EU

- IEC 61010-1 (3rd Edition)
- Canada: CSA C22.2 No. 61010-1
- USA: UL std no. 61010-1 (3rd Edition)

Instrument Markings

The signal generator has the following markings. Familiarize yourself with each marking and its meaning before operating the signal generator.

⏻	This symbol marks the standby position of the power line switch.
∿	This symbol indicates that the input power required is AC.
⚠	The instruction manual symbol. The product is marked with this symbol when it is necessary for you to refer to instructions in the manual.
CE	The CE mark is a registered trademark of the European Community. If this symbol is accompanied by a year, it is the year when the design was proven.
CSA ® C US	The CSA mark is a registered trademark of the Canadian Standards Association International.
C-Tick	The C-Tick Mark is a trademark registered to the Australian Spectrum Management Agency. This indicates compliance with all Australian EMC regulatory information.
ICES/NMB-001	This is a marking to indicate product compliance with the Canadian Interference-Causing Equipment Standard (ICES-001)
ICES/NMB-001	Cet appareil ISM est conforme a la norme NMB du Canada. This is a marking to indicate product compliance with the Industry Canadia Interference-Causing Equipment Standard (ICES-001)
ISM1-A	This is the symbol of an Industrial Scientific and Medical Group 1 Class A Product. (CISPR 11, Clause 4)
LXI	This symbol indicates conformance to the standard specifications.
40	indicates the time period during which no hazardous or toxic substance elements are expected to leak or deteriorate during normal use. Forty years is the expected useful life of the product.

	This symbol indicates separate collection for electrical and electronic equipment, mandated under EU law as of August 13, 2005. All electric and electronic equipment are required to be separated from normal waste for disposal (Reference WEEE Directive, 2002/96/EC).
	This symbol on all primary and secondary packaging indicates compliance to China standard GB 18455-2001.
	This equipment is Class A suitable for professional use and is for use in electromagnetic environments outside of the home. **South Korean Class A EMC Declaration** A 급 기기 (업무용 방송통신기자재) 이 기기는 업무용 (A 급) 전자파적합기기로서 판 매자 또는 사용자는 이 점을 주의하시기 바라 며 , 가정외의 지역에서 사용하는 것을 목적으 로 합니다 .

2 Getting Started

CAUTION   To avoid damaging or degrading the performance of the sig-
nal generator, do not exceed 27 dBm (0.5 W) *maximum* of
reverse power levels at the RF input. See also *Tips for Pre-
venting Signal Generator Damage* on http://www.key-
sight.com.

NOTE   Is your product software up-to-date? Periodically, Keysight
releases software updates to fix known defects and incor-
porate product enhancements. To search for software
updates for your product, go to the Keysight Technical Sup-
port website at http://www.keysight.com.

NOTE   Is your product documentation up-to-date? To search for
documentation updates for your product, go to the Key-
sight UXG x-series agile signal generator websites:

  − http://www.keysight.com/find/n5191a
  − http://www.keysight.com/find/n5193a

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Checking the Shipment

1. Inspect the shipping container for damage.
   Signs of damage can include a dented or torn shipping container or cushioning material that indicates signs of unusual stress or compacting.

2. Carefully remove the contents from the shipping container and verify that your order is complete.
   The following items are included with each signal generator:
   - Getting Started Guide
   - documentation CD-ROM (CD-ROM contents are also available in hardcopy format)
   - three-prong AC power cord specific to geographic location

3. Verify that the options you ordered are included with the shipment by checking the serial number label on the rear of the signal generator and the packing literature included with the shipment.

4. If a pre-installed software license is part of the instrument order, verify its installation using the directions outlined in .

Verifying Pre-Installed Software License

If you purchased a signal generator where the order included the pre-installation of a fixed perpetual Signal Studio license (N76xx), or a Test Management Environment (TME) software license (N78xxA), or both, verify the license installation using the following key path:

System > Instrument Info > Options Info

This opens a menu with the choices: Instrument Options, and Auxiliary Software Options. To view the license, press the appropriate menu key:

- For a Signal Studio license, press **Instrument Options**.
- For the TME license, press **Auxiliary Software Options**.

If a license is pre-installed, the software for the license still needs to be downloaded onto your PC. Use the following links to access the software for download and installation:

- Signal Studio software—http://www.keysight.com/find/signalstudio
- TME software—http://www.keysight.com/find/calibrationsoftware

If the software license(s) was ordered with the instrument for pre-installation and it does not show in the instrument, please contact Keysight Technologies:

http://www.keysight.com/find/contactus

Signal Generator Physical Characteristics

- Height: 134 mm (5.25 in) (148 mm including bottom feet)
- Depth: 515 mm (20.3 in) (555 mm including rear bumpers but not including front connectors)
- Width : 426 mm (16.8 in)
- Weight: 22 kg (48 lb)

Meeting Environmental and Electrical Requirements

CAUTION   To avoid the loss of data, GPIB settings, or current user instrument states that have not been permanently saved to non-volatile memory, the signal generator should always be powered down either via the signal generator's front panel power button or the appropriate SCPI command. Signal generator's installed in rack systems and powered down with the system rack power switch rather than the signal generator's front panel switch display a Error -310 due to the signal generator not being powered down correctly.

Environment

- indoor use
- altitudes < 15,000 feet (4,572 meters)
- 0 to 55°C temperature, unless otherwise specified
- humidity 10% - 95% (non-condensing)

CAUTION   This product is designed for use in INSTALLATION CATEGORY II and POLLUTION DEGREE 2, per IEC 61010-1 Third Edition

Environmental Testing

Samples of this product have been type tested in accordance with the Keysight Environmental Test Manual and verified to be robust against the environmental stresses of Storage, Transportation and End-use; those stresses include but are not limited to temperature, humidity, shock, vibration, altitude and power line conditions. Test Methods are aligned with IEC 60068-2 and levels are similar to MIL-PRF-28800F Class 3.

EMC

Complies with European EMC Directive 2014/30/EU

- IEC/EN 61326-1
- CISPR Pub 11 Group 1, class A
- AS/NZS CISPR 11
- ICES/NMB-001
  This ISM device complies with Canadian ICES-001.
  Cet appareil ISM est conforme a la norme NMB-001 du Canada.

Ventilation

CAUTION   VENTILATION REQUIREMENTS: When installing the instrument(s) into a cabinet consideration shall be given to the convection flow into and out of the cabinet. Consideration shall also be given to the individual instruments to avoid having the heated discharge of one instrument, now becoming the cooling intake air for another instrument.
Another area of concern is verification that the maximum ambient operating temperature of the instrument(s) is not exceeded by cabinet installation.
Keysight Technologies recommends forced air convection whenever an instrument(s) are installed in a cabinet and further recommends that the maximum operating temperature of the cabinet be reduced 10°C from the lowest of the maximum operating temperature of a single instrument
If there are any concerns or special requirements a Keysight Field Engineer should be consulted to assure

CAUTION   instrument(s) temperature compliance and performance.

Line Setting Requirements

CAUTION   The instrument has auto-ranging line voltage input; be sure that the supply voltage is within the specified range and voltage fluctuations do not exceed 10 percent of the nominal supply voltage.

NOTE   The instruments can operate with mains supply voltage fluctuations up to ± 10% of the nominal voltage.

Voltage:	100/120 volts nominal
	220/240 volts nominal
Frequency:	for 100/120 volts: 50/60/400 Hz nominal
	for 220/240 volts: 50/60 Hz nominal
Power:	400 W maximum

Connecting the AC Power Cord

Install the instrument so that the detachable power cord is readily identifiable and is easily reached by the operator. The detachable power cord is the instrument disconnecting device. It disconnects the mains circuits from the mains supply before other parts of the instrument. The front panel switch is only a standby switch and is not a LINE switch. Alternatively, an externally installed switch or circuit breaker (which is readily identifiable and is easily reached by the operator) may be used as a disconnecting device.

> **WARNING** The instrument shall be set flat in its normal use position so that the detachable power cord is readily identifiable and is easily reached by the operator. It shall not be placed on the four feet of the rear panel in normal use.

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

> **CAUTION** The mains wiring and connectors shall be compatible with the connector used in the premise electrical system. Inadequate earth grounding can damage the signal generator. Always use the three-prong AC power cord supplied with the signal generator.

Connect the AC power cord as follows:

1. Ensure that the power cord is not damaged
2. Install the signal generator so that one of the following items is readily identifiable and easily reached by the operator: AC power cord, alternative switch, or circuit breaker.
3. Insert the mains plug into a socket outlet provided with a protective earth grounding.

Configuring the Display

Screen saver settings are persistent states; they are unaffected by preset or a power cycle.

Use the arrow keys, numeric keypad, or front panel knob to adjust numeric values.

NOTE UXG x-series agile signal generators are shipped from the factory with default display settings. When the signal generator display is not required to be active for long periods of time, consider using the Screen Saver Mode to extend the life of the display.

Display Softkeys

Range: 0 - 100

Light Only turns the display light off, leaving the text visible at a low intensity

Light & Text turns the display light and the text off.
If the display remains unchanged for long periods of time, use this mode to prevent the text from burning the display.

Range: 1 - 12 hours, in 1 hour increments

Dark text on a light background

When on, commands executed through the remote control bus update the signal generator display accordingly.

For details on a key, press **Help** and then the desired key

NOTE With the brightness set to minimum, the display may be too dark to see the softkeys. If this happens, use the above figure to locate the brightness softkey and adjust the value so that you can see the display.

Configuring for Remote Control

Lan Configuration

Configuring the LAN Interface
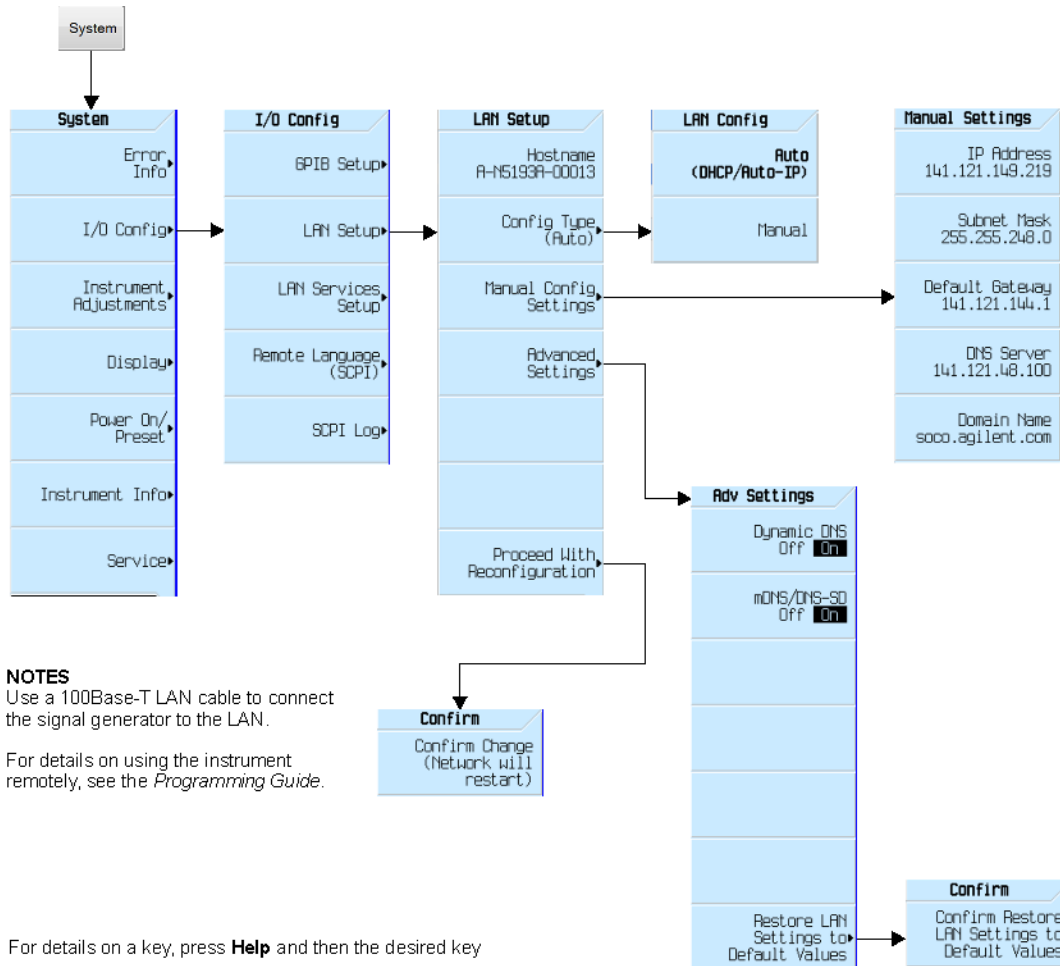
NOTES
Use a 100Base-T LAN cable to connect the signal generator to the LAN.

For details on using the instrument remotely, see the *Programming Guide*.

For details on a key, press **Help** and then the desired key

Enabling LAN Services: Browser, Sockets, and VXI-11
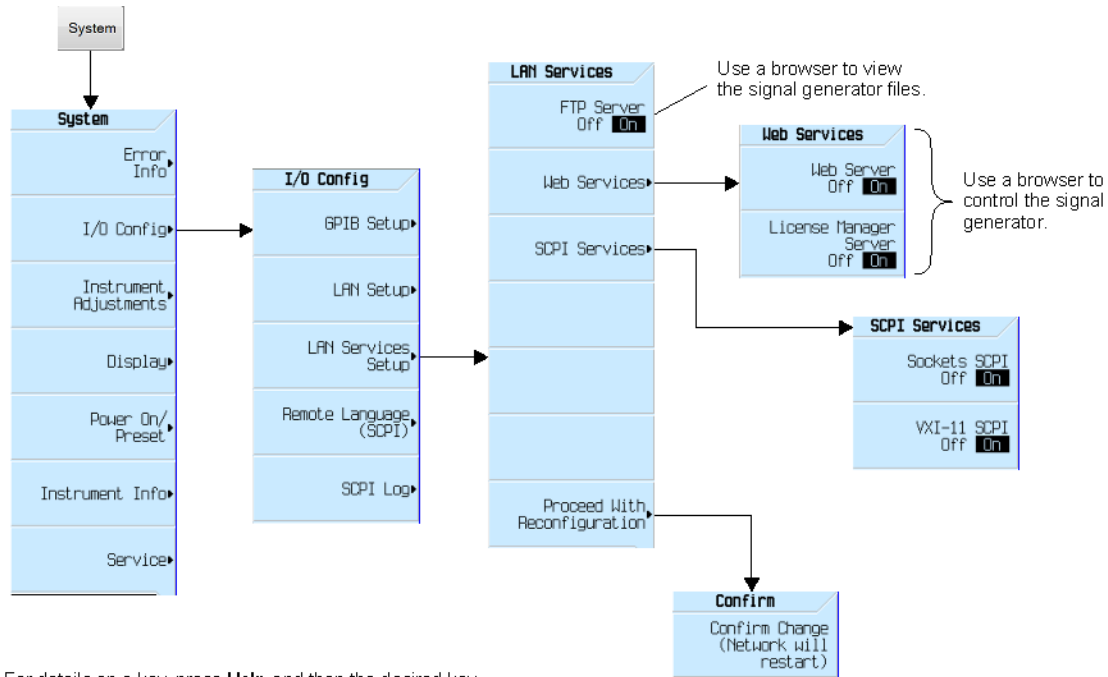
For details on a key, press **Help** and then the desired key

GPIB Configuration
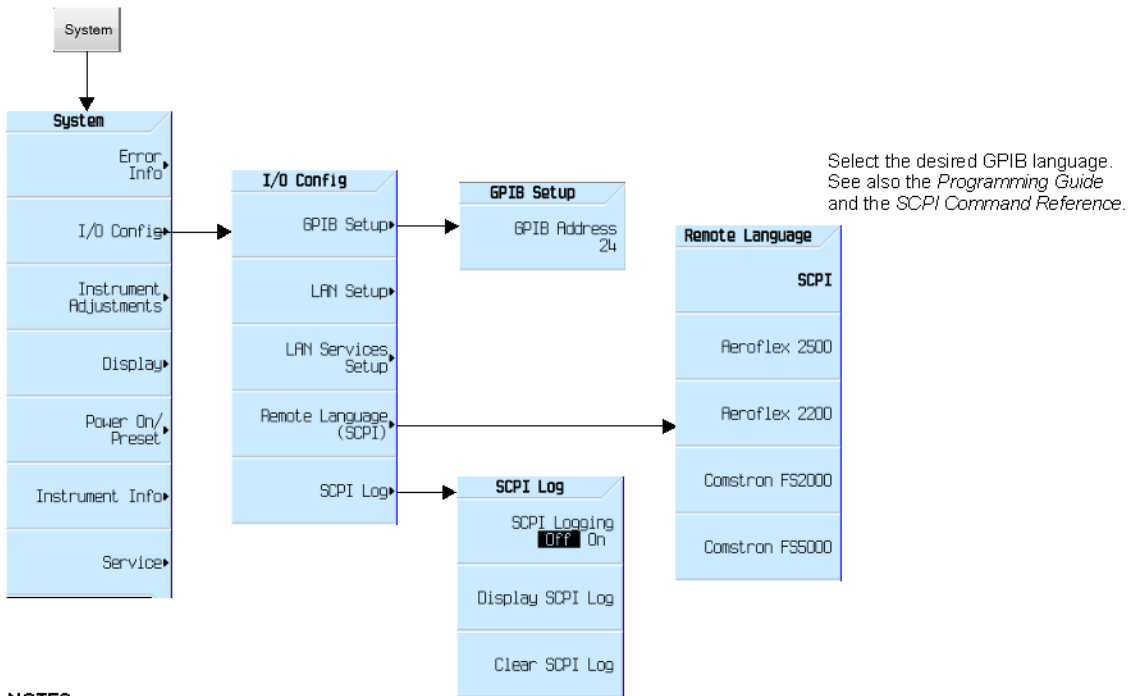
NOTES
USB is also available. It is not shown in the menu because it requires no configuration.
For details on using the instrument remotely, see the *Programming Guide*.

For details on a key, press **Help** and then the desired key

Ordering Accessories

You can purchase accessories from Keysight Technologies online at http://www.keysight.com/find/n5191a or http://www.keysight.com/find/n5193a. Documentation is also available online (see the table below). Always refer to the documentation links in the table for the most up-to-date documentation. If you do not have access to the Internet, please contact your Keysight field engineer.

See "Contacting Keysight" on page 23.

Model, Option, or Part Number	Description[a]
CC1	Additional LVDS I/O interface
CC2	Additional BCD I/O interface
SSD	Additional removable solid state drive
1CN007A	Front Handle Kit, 3U
34192A	Rack Mount flange kit
1CP008A	Rack Mount Flange w/front handles, 3U
N5191-10001	Firmware CD
N5191-90001	Quick Start Poster

N5191-90002	Documentation CD-ROM
	
	PDF files:
	  − Data Sheet
	  − Getting Started Guide
	  − Service Guide
	  − Error Messages
	
	HTML files:
	  − Documentation Set
	    − User's Guide
	    − SCPI Command Reference
	    − Programming Guide
	    − Getting Started Guide

N5191-90003	Getting Started Guide

Available online
http://www.keysight.com/find/n5193a-documents
http://www.keysight.com/find/n5191a-documents
The online documentation is a composite help file that contains the listed documents and is available as a file to download, or to view directly from the website (webhelp).
	Online Documentation Set
	  − **User's Guide**
	  − **SCPI Command Reference**
	  − **Programming Guide**
	  − Getting Started Guide

a. For a description of the contents of each guide, See "Documentation Overview" on page 7

Proper Use and Cleaning

The signal generator cover protects against physical contact with internal assemblies that contain hazardous voltages, but does not protect internal assemblies against contact with liquids. To avoid damage and personal injury, ensure that liquids are positioned away from the signal generator.

WARNING If this product is not used as specified, the protection provided by the equipment could be impaired. This product must be used in a normal condition (in which all means for protection are intact) only.

Cleaning Suggestions

WARNING To prevent electrical shock, disconnect the signal generator from mains before cleaning. Use a dry cloth or one slightly dampened with water to clean the external case parts. Do not attempt to clean internally. Cleaning connectors with alcohol shall only be done with the instruments power cord removed, and in a well-ventilated room. Allow all residual alcohol moisture to evaporate, and the fumes to dissipate prior to energizing the instrument.

To ensure good connections, regularly clean the instrument's front and rear panel connectors with alcohol.

To prevent dust build-up that could potentially obstruct ventilation, periodically clean the instrument's cover. Use a dry cloth or a cloth slightly dampened with water to clean the external case parts.

Returning a Signal Generator to Keysight Technologies

1. Gather as much information as possible about the signal generator's problem.
2. Contact Keysight using the phone number that is specific to your geographic location. These phone numbers are listed on the Internet at http://www.keysight.com/find/assist. If you do not have access to the Internet, contact your Keysight field engineer.
   After you provide information about the signal generator and its condition, you will receive information about where to ship your signal generator for repair.
3. Ship the signal generator in the original factory packaging materials, if available, or use similar packaging to properly protect the signal generator.

Contacting Keysight

Assistance with test and measurements needs, information on finding a local Keysight office, and information on purchasing accessories and documentation are available on the Internet at:

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

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

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

Keysight UXG X-Series Agile Signal Generators Getting Started Guide

3 Operation Verification

CAUTION To avoid damaging or degrading the performance of the signal generator, do not exceed 27 dBm (0.5 W) maximum of reverse power levels at the RF input. See also *Tips for Preventing Signal Generator Damage* on http://www.key-sight.com.

NOTE For the instrument to meet performance specifications allow a warm up period of 45 minutes within an operational temperature range of 0 to 55 °C. For more information, refer to the Data Sheet for your signal generator.

Operation verification is a series of tests used to confirm that the signal generator is operating properly, or to diagnose problems. Operation verification does not verify performance to instrument specifications.

Perform operation verification when you initially set up the signal generator, after a minor repair (refer to the Service Guide for details), or when the integrity of the signal generator is in question.

- See "Running Self Test" on page 25
- See "Checking Output Power" on page 28

Running Self Test

Self Test is a series of internal tests of signal generator functions. If this test fails, refer to See "Self Test Failure" on page 27 for further instructions.

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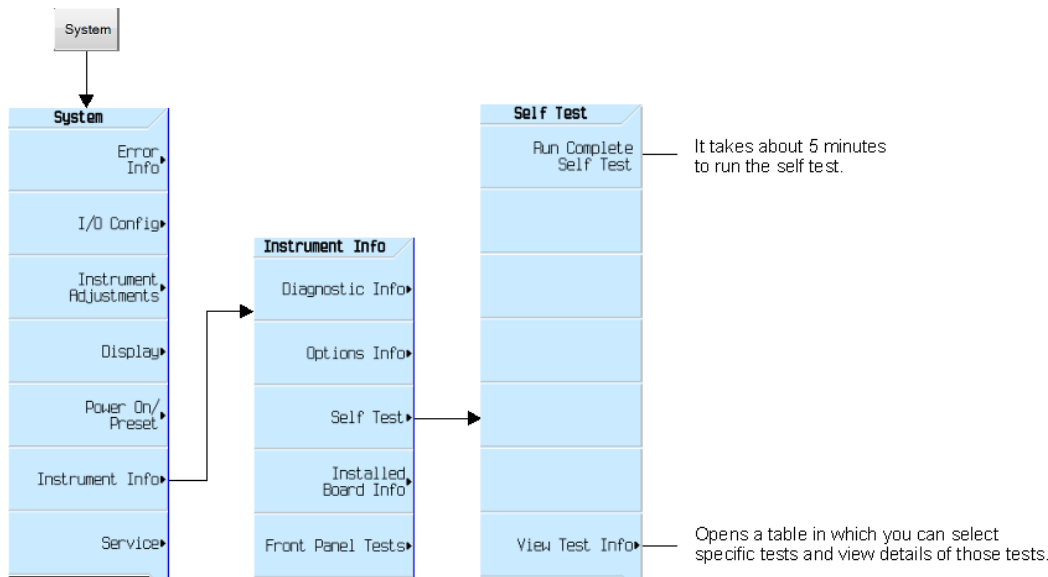
Self Test

For details on a key, press **Help** and then the desired key

Use the following procedure to run self test:

1. Disconnect all external cables, including GPIB, LAN, and USB cables.

2. Preset the signal generator: Press Preset > System > Instrument Info > Self Test.
   The following message appears:
   - The current status of the self-test is: Incomplete. Not all tests have been run.

3. Press Run Complete Self Test.
   An activity bar displays on the screen `indicating` the test progress.
   If you press Abort while self-test is running, the following message displays:
   - The current status of the self-test is: Incomplete. Not all tests have been run.

   When self-test completes, one of the following messages displays:
   - The current status of the self-test is: Passed
   - The current status of the self-test is: Failure. One or more tests have failed.
     System diagnostics indicate this test as the root failure: xxx

   If the signal generator fails only one test, the title of the failed test displays. If the signal generator fails more than one test, the test number of the most significant failure (`root failure`) displays.

NOTE   The root failure is the error to report to Keysight Support. "See "Contacting Keysight" on page 23.

Self Test Failure

1. Confirm that all external cables, including GPIB, LAN, and USB cables, are disconnected from the signal generator and repeat the self-test

2. If the self-test continues to fail, the signal generator requires service. If you are unable to service the signal generator, send it to an Keysight service center for repair. Include a detailed description of the most significant failure (root failure) and any displayed error messages. Also include the model, serial number, installed options, and firmware version.
   See "Returning a Signal Generator to Keysight Technologies" on page 23 for return instructions.

Viewing Test Results

If Self Test fails, the summary indicates the most significant failure (root failure).

Self Test
Run Complete Self Test

FREQUENCY
10.000 000 /MHz
AMPLITUDE
−10.00 dBm
ALC ON   MOD ON

Self Test Summary

The current status of self test is: Failure
One or more tests have failed. System diagnostics
indicate this test as the root failure: 707

View Test Info

Passes: 80   Fails: 2

This information is *supplemental*.
Please disregard unless Keysight *specifically requests* this information.

Checking Output Power

This test verifies that the CW output power from the signal generator is within defined limits. The following table lists the preferred equipment for this test.

Testing Equipment	Recommended Model
Power Meter	N1914A[1]
Power Sensor, low frequency	N8485A
Power sensor, mid frequency (Only required for Option 54E/540)	N8487A

1. Power meter N1914A with serial number ranging between MY00000000 – MY53040007 requires Service Note N1914A-07 to be applied for measurement repeatability. Please have this service note applied or verify it was applied before using this power meter.

If this test fails, refer to See "Troubleshooting Problems with the Output Power Check" on page 30 for further instructions.

Test Setup

1. Zero and calibrate the power sensor to the power meter:
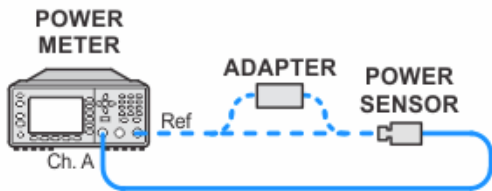
2. Connect the equipment as shown:
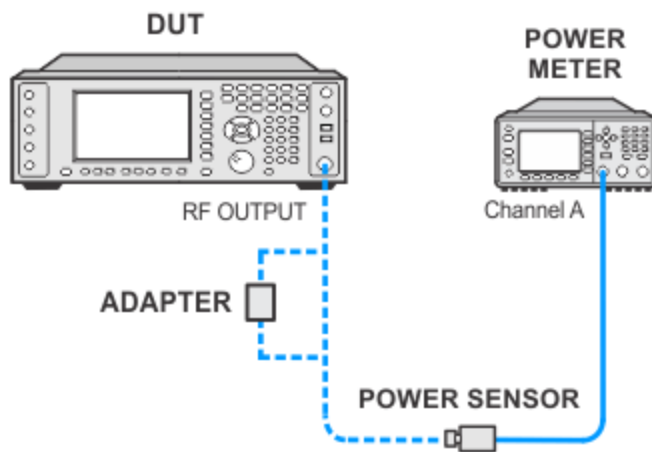
3. Preset the signal generator: Press Preset.

4. Turn RF on: Press RF On/Off so that the RF On/Off LED lights.

5. Turn modulation off: Press Mod On/Off so that the Mod On/Off LED turns off.

6. Set the frequency: Press Frequency and enter the first frequency value listed in the table below.

7. Set the amplitude: Press Amplitude and enter the amplitude value for that frequency.

8. Configure the power meter for the measurement.

   a. Press the Frequency Cal Fac button on the power meter.

   b. Select a power meter channel (if applicable).

   c. Use the arrow keys to enter the frequency at which to measure the power.

9. Measure the output power level.

10. Repeat steps 6 through 9 to measure power at each frequency listed in the table below.

11. Confirm that the measured power levels are within the limits listed in the table.

Power Sensors by Frequency and Options

N5191A/93A Output Power		
Frequency (GHz)	Amplitude (dBm) Standard/Opt. AT1/Opt. AT2	Limits[a][b] (dB)
0.1	10	±2
0.5	10	±2
1.0	10	±2
2.0	10	±2
3.0	10	±2
6.0	10	±2
15.0	10	±2
20.0 (Option 52E/520)	10	±2
25.0 (Option 54E/540)	10	±2
32.0 (Option 54E/540)	10	±2
40.0 (Option 54E/540)	10	±2

a. Limit values are due to power meter uncertainty.

b. For questions about measurement uncertainty, refer to the Data Sheet.

Troubleshooting Problems with the Output Power Check

- Verify that you are using the appropriate power sensor.
- Normally, power sensor calibration factors are automatically downloaded to the power meter when the power meter turns on. If this does not occur, manually enter the correct calibration factors for the power sensor you are using.
- Verify that the power sensor is properly calibrated to the power meter.

4 Regulatory Information

Certification

Keysight Technologies certifies that this product met its published specifications at the time of shipment from the factory. Keysight Technologies further certifies that its calibration measurements are traceable to the United States National Institute of Standards and Technology, to the extent allowed by the Institute's calibration facility, and to the calibration facilities of other International Standards Organization members.

Assistance

Product maintenance agreements and other customer assistance agreements are available for Keysight Technologies products. For assistance, contact Keysight Technologies (see page 16).

EMC

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

- IEC/EN 61326-1
- CISPR Pub 11 Group 1, class A
- AS/NZS CISPR 11
- ICES/NMB-001
  This ISM device complies with Canadian ICES-001.
  Cet appareil ISM est conforme a la norme NMB-001 du Canada.

South Korean Class A EMC declaration:

This equipment is Class A suitable for professional use and is for use in electromagnetic environments outside of the home.

A 급 기기 (업무용 방송통신기자재)이 기기는 업무용 (A 급) 전자파적합기기로서 판 매자 또는 사용자는 이 점을 주 의하시기 바라 며 , 가정외의 지역에서 사용하는 것을 목적으 로 합니다 .

Safety

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

- IEC/EN 61010-1
- Canada: CSA C22.2 No. 61010-1
- USA: UL std no. 61010-1

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 Acoustic Statement: ((European Machinery Directive)

Acoustic noise emission

LpA < 70 dB

Operator position

Normal operation mode per ISO 7779

To find a current Declaration of Conformity for a specific Keysight product, go to:

http://www.keysight.com/go/conformity

5 Open Source Licenses

This chapter contains the licenses for open source software used in the signal generator.

Apple mDNSresponder

Apache License

Version 2.0, January 2004

http://www.apache.org/licenses/

1. Definitions

"License" shall mean the terms and conditions for use, reproduction, and distribution as defined by Sections 1 through 9 of this document.

"Licensor" shall mean the copyright owner or entity authorized by the copyright owner that is granting the License.

"Legal Entity" shall mean the union of the acting entity and all other entities that control, are controlled by, or are under common control with that entity. For the purposes of this definition, "control" means (i) the power, direct or indirect, to cause the direction or management of such entity, whether by contract or otherwise, or (ii) ownership of fifty percent (50%) or more of the outstanding shares, or (iii) beneficial ownership of such entity.

"You" (or "Your") shall mean an individual or Legal Entity exercising permissions granted by this License.

"Source" form shall mean the preferred form for making modifications, including but not limited to software source code,

documentation source, and configuration files.

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