

Keysight  
N5166B CXG  
N5171B/72B/73B EXG  
N5181B/82B/83B MXG  
X-Series Signal Generators

Security Features  
and Document of  
Volatility

# Notices

## Copyright Notice

© Keysight Technologies 2014-2019

No part of this manual may be reproduced in any form or by any means (including electronic storage and retrieval or translation into a foreign language) without prior agreement and written consent from Keysight Technologies, Inc. as governed by United States and international copyright laws.

## Manual Part Number

N5180-90079

## Edition

Edition: 1, June 2019

Supersedes: June 2017

## Published by:

Keysight Technologies Inc.  
1400 Fountaingrove Parkway  
Santa Rosa, CA 95403

## Technology Licenses

The hardware and/or software described in this document are furnished under a license and may be used or copied only in accordance with the terms of such license.

## U.S Government Rights

The Software is “commercial computer software,” as defined by Federal Acquisition Regulation (“FAR”) 2.101. Pursuant to FAR 12.212 and 27.405-3 and Department of Defense FAR Supplement (“DFARS”) 227.7202, the U.S. government acquires commercial computer software under the same terms by which the software is customarily provided to the public. Accordingly, Keysight provides the Software to U.S. government customers under its standard commercial license, which is embodied in its End User License Agreement (EULA), a copy of which can be found at

<http://www.keysight.com/find/sweula>

The license set forth in the EULA represents the exclusive authority by which the U.S. government may use, modify, distribute, or disclose the Software. The EULA and the license set forth therein, does not require or permit, among other things, that Keysight: (1) Furnish technical information related to commercial computer software or commercial computer software documentation that is not customarily provided to the public; or (2) Relinquish to, or otherwise provide, the government rights in excess of these rights customarily provided to the public to use, modify, reproduce, release, perform, display, or disclose commercial computer software or commercial computer software documentation. No additional government requirements beyond those set forth in the EULA shall apply, except to the extent that those terms, rights, or licenses are explicitly required from all providers of commercial computer software pursuant to the FAR and the DFARS and are set forth specifically in writing elsewhere in the EULA. Keysight shall be under no obligation to update, revise or otherwise modify the Software. With respect to any technical data as defined by FAR 2.101, pursuant to FAR 12.211 and 27.404.2 and DFARS 227.7102, the U.S. government acquires no greater than Limited Rights as defined in FAR 27.401 or DFAR 227.7103-5 (c), as applicable in any technical data.

## Warranty

THE MATERIAL CONTAINED IN THIS DOCUMENT IS PROVIDED “AS IS,” AND IS SUBJECT TO BEING CHANGED, WITHOUT NOTICE, IN FUTURE EDITIONS. FURTHER, TO THE MAXIMUM EXTENT PERMITTED BY APPLICABLE LAW, KEYSIGHT DISCLAIMS ALL WARRANTIES, EITHER EXPRESS OR IMPLIED, WITH REGARD TO THIS MANUAL AND ANY INFORMATION CONTAINED HEREIN, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. KEYSIGHT SHALL NOT BE LIABLE FOR ERRORS OR FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES IN CONNECTION WITH THE FURNISHING, USE, OR PERFORMANCE OF THIS DOCUMENT OR OF ANY INFORMATION CONTAINED HEREIN. SHOULD KEYSIGHT AND THE USER HAVE A SEPARATE WRITTEN AGREEMENT WITH WARRANTY TERMS COVERING THE MATERIAL IN THIS DOCUMENT THAT CONFLICT WITH THESE TERMS, THE WARRANTY TERMS IN THE SEPARATE AGREEMENT SHALL CONTROL.

## Safety Information

### 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, see one of the following URLs, depending on the model number of your instrument:

<http://www.keysight.com/find/mxg>

<http://www.keysight.com/find/exg>

<http://www.keysight.com/find/cxg>

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

<http://www.keysight.com/find/emailupdates>

Information on preventing instrument damage can be found at:

<http://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>

# Table of Contents

1	Contacting Keysight Sales and Service Offices	5
2	Products Covered by this Document	6
	Document Purpose	6
3	Security Terms and Definitions	7
4	Instrument Memory & Volatility	8
	Current Memory Information	9
	Past Memory Information	12
	CPU Board Change—Serial Number Break ≥MY/SG/US5910xxxx	13
5	Memory Clearing, Sanitization and Removal Procedures	15
	Erase All (Option 006 Only)	16
	Erase and Sanitize All (Option 006 Only)	17
	Force Internal to SD Card (Option 006 Only)	18
	Clear Persistent State Information	19
	Instrument Setup	19
	LAN Setup	19
	User IQ Cal File (Vector Models Only)	19
6	Using Secure Display (Option 006 Only)	20
	Secure Display (Option 006 Only)	20
7	Procedure for Declassifying a Faulty Instrument	21
	Appendix A References	22

## 1 Contacting Keysight Sales and Service Offices

Assistance with test and measurement needs, and information to help you find a local Keysight office, is available via the internet at, <http://www.keysight.com/find/assist>. If you do not have internet access, please contact your designated Keysight representative.

### NOTE

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

---

## 2 Products Covered by this Document

Product Family Name	Product Name	Model Number	Firmware Revision
X-Series Signal Generators	MXG Microwave Analog Signal Generator	N5183B	All
	MXG RF Vector Signal Generator	N5182B	All
	MXG RF Analog Signal Generator	N5181B	All
	EXG Microwave Analog Signal Generator	N5173B	All
	EXG RF Vector Signal Generator	N5172B	All
	EXG RF Analog Signal Generator	N5171B	All
	CXG RF Vector Signal Generator	N5166B	≥B.01.80

### Document Purpose

This document describes instrument memory types and security features. It provides a statement regarding the volatility of all memory types, and specifies the steps required to declassify an instrument through memory clearing, sanitization, or removal.

For additional information, go to:

<http://www.keysight.com/find/security>

#### IMPORTANT

Be sure that all information stored by the user in the instrument that needs to be saved is properly backed up before attempting to clear any of the instrument memory. Keysight Technologies cannot be held responsible for any lost files or data resulting from the clearing of memory.

Be sure to read this document entirely before proceeding with any file deletion or memory clearing.

---

### 3 Security Terms and Definitions

Term	Definition
Clearing	As defined in Section 8-301a of DoD 5220.22-M, “National Industrial Security Program Operating Manual (NISPOM)”, clearing is the process of eradicating the data on media before reusing the media in an environment that provides an acceptable level of protection for the data that was on the media before clearing. Hence, clearing is typically used when the instrument is to remain in an environment with an acceptable level of protection.
Instrument Declassification	A term that refers to procedures that must be undertaken before an instrument can be removed from a secure environment, such as is the case when the instrument is returned for calibration. Declassification procedures include memory sanitization or memory removal, or both. Keysight declassification procedures are designed to meet the requirements specified in DoD 5220.22-M, “National Industrial Security Program Operating Manual (NISPOM)”, Chapter 8.
Sanitization	<p>As defined in Section 8-301b of DoD 5220.22-M, “National Industrial Security Program Operating Manual (NISPOM)”, sanitization is the process of removing the data from media before reusing the media in an environment that does <b>not</b> provide an acceptable level of protection for the data that was in the media before sanitizing. Hence, instrument sanitization is typically required when an instrument is moved from a secure to a non-secure environment, such as when it is returned to the factory for calibration.</p> <p>Keysight memory sanitization procedures are designed for customers who need to meet the requirements specified by the US Defense Security Service (DSS). These requirements are specified in the “Clearing and Sanitization Matrix” in Section 5.2.5.5.5 of the <i>ISFO Process Manual for the Certification and Accreditation of Classified Systems under the NISPOM</i>.</p>
Secure Erase	Secure Erase is a term that is used to refer to either the clearing or sanitization features of Keysight instruments.

## 4 Instrument Memory & Volatility

This chapter contains information on the memory components in your instrument and contains the following sections:

- “Current Memory Information” on page 9
- “Past Memory Information” on page 12

The Past memory Information section captures the information where the memory size or any other item changes.

## Current Memory Information

The tables provide details of the size of each memory component, its type, how it is used, its location, volatility, and the sanitization procedure.

Table 4-1 Base Instrument (All models and options)

Memory Component, Type and Size	Writable During Normal Operation?	Data Retained When Powered Off?	Purpose/Contents	Data Input Method	Location in Instrument and Remarks	Sanitization Procedure
1. Main Memory (DRAM) 768 MByte	Yes	No	Firmware operating memory. User data	Operating system	CPU board, not battery backed.  Volatile memory.	Turn off instrument power.
2. Main Memory (Flash) 4 GByte, partitioned as follows: 200 MByte: Boot (Main firmware image, Operating system) 50 MByte: System (Calibration/ Configuration) 5 MByte: Secure Storage (Configuration) 3.5 GByte: User <sup>a</sup> (User file system)	Yes	Yes	Factory calibration and configuration data  User file system <sup>b</sup> , which includes flatness calibration, instrument states, and sweep lists	Firmware upgrades and user-saved data	CPU board	Boot Area: no user data  User and Secure Storage Areas: see <b>“Erase and Sanitize All (Option 006 Only)”</b> on page 17.  Without Option 006, there is no erase, nor erase and sanitize, only declassify, see <b>Chapter 7, “Procedure for Declassifying a Faulty Instrument.”</b>
3. Front Panel Memory (Flash) 24 KByte	No	Yes	Front panel keyboard controller firmware	Operating system	Front Panel board	None required (no user data)

Table 4-1 Base Instrument (All models and options)

Memory Component, Type and Size	Writable During Normal Operation?	Data Retained When Powered Off?	Purpose/Contents	Data Input Method	Location in Instrument and Remarks	Sanitization Procedure
4. Front Panel Memory (SRAM) 2 KByte	Yes	No	Front panel operating memory	Front panel firmware	Front Panel board Volatile memory.	Turn off instrument power.
5. Front Panel Memory (EEPROM) 256 Byte	No	Yes	Unused	None	Front Panel board	None required
6. SD Card (Option 006) <sup>c,d,e</sup> (Flash) 32 GByte	Yes	Yes	Optional storage of User data	User-saved data	Removable card may be retained in Secure Area	None required

- a. With Option SDO installed, the 3.5 GB of user data is *not* available. Option SDO is *not* supported by the CXG, see **Table 2, “Product Family Name.”**.
- b. Analog instruments only.
- c. Options 006 and SDO are *not* supported by the CXG, see **Table 2, “Product Family Name.”**
- d. With Option SDO installed, this location must still be selected as a storage location.  
Option 006 is *not* required for Option SDO.
- e. With  $\geq$ SN MY/SG/US5910xxxx, the MultiMediaCard (MNC) memory is *not* supported. The serial number break is a change in the CPU board to part number 0960-3295. For more information on this change, see **“CPU Board Change—Serial Number Break  $\geq$ MY/SG/US5910xxxx”**.

Table 4-2 Vector Models with Baseband Generator

Memory Component, Type and Size	Writable During Normal Operation?	Data Retained When Powered Off?	Purpose/Contents	Data Input Method	Location in Instrument and Remarks	Sanitization Procedure
1. Waveform Memory (DRAM) 160 MB to 5.12 GByte	Yes	No	Waveforms (including header and marker data)	Normal user operation	A2 Vector BBG assembly Volatile memory. Not battery backed.	Turn off instrument power.
2. SSD (Flash) 40, 128, or 256 GByte, partitioned as follows: 4 GByte: Apps 4 GByte: Base User Remainder: Option 009 Extended User	Yes	Yes	All user data	Normal user operation	A4 Solid State Disk Drive assembly	Without Option SDO see <b>“Erase and Sanitize All (Option 006 Only)”</b> on page 17.  Without Option 006, there is no erase, nor erase and sanitize, only declassify, see <b>Chapter 7, “Procedure for Declassifying a Faulty Instrument.”</b>  With Option SDO, no action needed. <sup>a</sup>
Calibration Data Memory (Flash) 128 KByte	No	Yes		Factory or service only		None required (no user data)

a. Option SDO removes the SSD so that files are *not* stored to it. Option 006 (SD card) and USB capability are still valid, Options 006 and SDO are *not* supported by the CXG, see **Table 2, “Product Family Name.”**

## Past Memory Information

This section captures prior memory sizes along with its memory component, type, how it is used, its location, volatility, and the sanitization procedure.

Use this section in conjunction with the [“Current Memory Information” on page 9](#), for a complete listing of all memory locations.

### NOTE

Changes to the memory size of the internal solid-state drive (SSD) is recorded in [Table 4-2 on page 11](#) of the section [“Current Memory Information” on page 9](#).

---

This section contains the following section:

- [“CPU Board Change–Serial Number Break ≥MY/SG/US5910xxxx” on page 13](#)

## CPU Board Change—Serial Number Break $\geq$ MY/SG/US5910xxxx

**NOTE**

This section applies to only the EXG and MXG.

The serial number break is a change in the CPU board to part number 0960-3295. The old part number is 0960-2870

To view the board part number, use the following key path:

Key Sequence:

**Utility > Instrument Info > Installed Board Info**

If an instrument with an earlier serial number has a CPU repair, it may then include the upgraded CPU board 0960-3295.

The following table list the CPU memory information that applies to the CPU board part number 0960-2870.

Table 4-3

Base Instrument (All EXG and MXG models and options, except Option SD0)

Memory Component, Type and Size	Writable During Normal Operation?	Data Retained When Powered Off?	Purpose/Contents	Data Input Method	Location in Instrument and Remarks	Sanitization Procedure
1. Main Memory (DRAM) 512 MByte	Yes	No	Firmware operating memory. User data	Operating system	CPU board, not battery backed.  Volatile memory.	Turn off instrument power.

Table 4-3 Base Instrument (All EXG and MXG models and options, except Option SD0)

Memory Component, Type and Size	Writable During Normal Operation?	Data Retained When Powered Off?	Purpose/Contents	Data Input Method	Location in Instrument and Remarks	Sanitization Procedure
2. Main Memory (Flash) 512 MByte, partitioned as follows: 200 MByte: Boot (Main firmware image, Operating system) 50 MByte: System (Calibration/ Configuration) 1 MByte: Secure Storage (Configuration) 180 MByte: User (User file system)	Yes	Yes	Factory calibration and configuration data  User file system <sup>a</sup> , which includes flatness calibration, instrument states, and sweep lists	Firmware upgrades and user-saved data	CPU board	Boot Area: no user data  User and Secure Storage Areas: see "Erase and Sanitize All (Option 006 Only)" on page 17.  Without Option 006, there is no erase, nor erase and sanitize, only declassify, see Chapter 7, "Procedure for Declassifying a Faulty Instrument."
6. SD Card (Option 006) (Flash) 8 GByte	Yes	Yes	Optional storage of User data	User-saved data	Removable card may be retained in Secure Area	None required

a. Analog instruments only.

## 5 Memory Clearing, Sanitization and Removal Procedures

This chapter describes several security functions you can use to remove sensitive data stored in the instrument before moving it from a secure development environment. The functions described are:

- “Erase All (Option 006 Only)” on page 16
- “Erase and Sanitize All (Option 006 Only)” on page 17
- “Force Internal to SD Card (Option 006 Only)” on page 18
- “Clear Persistent State Information” on page 19

### CAUTION

These functions do **not** erase or sanitize external media connected to the instrument's USB port.

---

## Erase All (Option 006 Only)

### NOTE

Option 006 is not supported by the CXG, see [Table 2, “Product Family Name.”](#)

---

This function removes all user files, user flatness calibrations, user I/Q calibrations, and resets all table editors with original factory values, ensuring that user data and configurations are not accessible or viewable. The instrument appears as if it is in its original factory state, however, the memory is not sanitized. This action is relatively quick, typically taking less than one minute (the exact time depends on the number of files).

Key Sequence: **File > More > Security > Erase All > Confirm Erase**

SCPI Command: **:SYSTem:SECurity:ERASea11**

There is a similar but distinct function, as described below, that deletes all user files but does *not* reset the table editors:

Key Sequence: **File > Delete All Files > Confirm Delete Of All Files**

SCPI Command: **:MEMory:DELete:ALL**

## Erase and Sanitize All (Option 006 Only)

### NOTE

Option 006 is not supported by the CXG, see [Table 2, “Product Family Name.”](#)

This function performs the same actions as **Erase All**, plus it clears and overwrites the various memory types, as described below.

Memory Type	Models	Description
CPU Flash (Main Memory)	MXG Series B EXG	User and “Secure Storage” partitions on CPU flash are erased by flash vendor firmware. For algorithm details, see the Application Note <a href="#">Greenliant NANDrive Security Erase Feature, Purge Command Specification</a> .
Flash Drive	MXG N5182B EXG N5172B	Erased by drive vendor’s firmware, which erases user data area, SSD reserve area, and retired blocks.  The firmware accepts and implements the ATA commands <b>SECURITY ERASE UNIT</b> and <b>ENHANCED ERASE MODE</b> . For details of these commands, see <a href="#">AT Attachment 8 - ATA/ATAPI Command Set (ATA8-ACS)</a> .

Key Sequence: **File > More > Security > Erase and Sanitize All > Confirm Sanitize**

SCPI Command: **:SYSTEM:SECurity:SANitize**

## Force Internal to SD Card (Option 006 Only)

### NOTE

Option 006 is not supported by the CXG, see [Table 2, “Product Family Name.”](#)

---

The options for this setting are **Off** or **On**:

- **On**: Forces all internal settings and files to be stored only on the external SD memory card, including instrument states, user data files, sweep list files, and other user created files. If it becomes necessary to sanitize the instrument, these settings may then be securely retained by removing the SD card and retaining it in the secure area.
- **Off**: All internal settings are stored in the instrument’s Main Memory (see [“Instrument Memory & Volatility” on page 8](#)). This memory may be sanitized using the [Erase and Sanitize All \(Option 006 Only\)](#) function.

Key Sequence: **File > More > Security > Force Internal to SD Card Off On**

SCPI Command: **:SYSTem:FILEsystem:STORage:FSDCard ON|OFF|1|0**

## Clear Persistent State Information

The persistent state settings contain instrument setup information that can be toggled within predefined limits such as display intensity, contrast and the GPIB address. In vector models, the user IQ Cal is also saved in this area.

The following functions can be used to clear the IQ Cal file and to set the operating states that are not affected by an instrument power-on, preset, or **\*RST** command to their factory default:

### Instrument Setup

Key Sequence:       **Utility > Power On/Preset > Restore System Settings to Default Values > Confirm Restore Sys Settings to Default Values**

SCPI Command:       **:SYSTem:PRESet:PERSistent**

### LAN Setup

The LAN setup (hostname, IP address, subnet mask, and default gateway) information is not modified by an instrument power-on or **\*RST** command.

You can reset the instrument's LAN setup by using the following key sequence or SCPI command.

Key Sequence:       **Utility > I/O Config > LAN Setup > Advanced Settings > Restore LAN Settings to Default Values > Confirm Restore LAN Settings to Default Values**

SCPI Command:       **:SYSTem:COMMunicate:LAN:DEFaults**

### User IQ Cal File (Vector Models Only)

When a user-defined IQ Calibration has been performed, the cal file data is removed by using the **Erase All (Option 006 Only)** feature, or by setting the cal file to default, as follows:

Key Sequence:       **I/Q > I/Q Calibration > Revert to Default Cal Settings**

SCPI Command:       **:CAL:IQ:DEF**

## 6 Using Secure Display (Option 006 Only)

### Secure Display (Option 006 Only)

This function prevents unauthorized personnel from reading the instrument display or tampering with the current configuration via the front panel. When Secure Display is active, the display is blank, except for an advisory message, as shown in [Figure 6-1](#) below. All front panel keys are disabled.

To set Secure Display, press: **Utility > Display > More > Activate Secure Display > Confirm Secure Display**

Once Secure Display has been activated, the power must be cycled to re-enable the display and front panel keys.

Figure 6-1 Signal Generator Screen with Secure Display Activated



## 7 Procedure for Declassifying a Faulty Instrument

If the instrument is not functional, and you are unable to use the security functions, you may physically remove the Processor board and Solid State Drive (SSD), if installed.

For removal and replacement procedures, refer to the [Service Guide](#) for your instrument.

Once the Processor and SSD assemblies have been removed, proceed as in [Table 7-1](#) below:

Table 7-1 Assembly Disposal Procedures

Assembly	Procedure
Processor (CPU) Board	<p><b>Either</b></p> <p>Discard the processor board and send the instrument to a repair facility. A new Processor Board will be installed, then the instrument will be repaired and calibrated. If the instrument is still under warranty, you will not be charged for the new Processor Board.</p> <p><b>or</b></p> <p>If you have another working instrument, install the Processor Board into that instrument and erase the memory. Then reinstall the Processor Board back into the non-working instrument and send it to a repair facility for repair and calibration. If you discover that the Processor Board does not function in the working instrument, discard the Processor Board and note that it caused the instrument failure on the repair order. If the instrument is still under warranty, you will not be charged for the new Processor Board.</p>
A4 Solid State Disk Drive (SSD) Assembly (Vector Instruments Only)	<p><b>Either</b></p> <p>Discard the SSD assembly and send the instrument to a repair facility. A new assembly will be installed, then the instrument will be repaired and calibrated. If the instrument is still under warranty, you will not be charged for the new assembly.</p> <p><b>or</b></p> <p>If you have another working instrument, install the SSD assembly into that instrument and erase its memory. Then reinstall the assembly back into the non-working instrument and send it to a repair facility for repair and calibration. If you discover that the assembly does not function in the working instrument, discard the assembly and note that it caused the instrument failure on the repair order. If the instrument is still under warranty, you will not be charged for the new assembly.</p>

## A: References

- 1. DoD 5220.22-M, “National Industrial Security Program Operating Manual (NISPOM)”**

United States Department of Defense. Revised February 28, 2006.

<https://www.dss.mil/ma/ctp/io/fcb/nisp/>

The document may also be found by using the search feature on the Defense Security Service (DSS) website:

<https://www.dss.mil/>
- 2. ISFO Process Manual for the Certification and Accreditation of Classified Systems under the NISPOM**

Defense Security Service.

The PDF of the document may be found at the following URL::

<https://www.dss.mil/Portals/69/documents/odaa/ODAA%20Process%20Manual%20Version%203.2.pdf?ver=2018-11-29-102431-710>

The document may also be found by using the search feature on the Defense Security Service (DSS) website:

<https://www.dss.mil/>
- 3. Greenliant NANDrive Security Erase Feature, Purge Command Specification**

This Application Note may be obtained in PDF format from Greenliant Systems Ltd., by contacting the company via their web site:

[http://www.greenliant.com/contact\\_us](http://www.greenliant.com/contact_us)
- 4. AT Attachment 8 - ATA/ATAPI Command Set (ATA8-ACS)**

INCITS Technical Committee T13/1699-D Revision 6a, September 6th, 2008

This standard may be downloaded in Acrobat (PDF) format from the INCITS T13 web site:

<http://www.t13.org/documents/UploadedDocuments/docs2008/D1699r6a-ATA8-ACS.pdf>
- 5. Installation Guide**

Keysight Technologies Inc.

<http://literature.cdn.keysight.com/litweb/pdf/N5180-90054.pdf>

## References

6.           **Programming Guide**  
Keysight Technologies Inc.  
<http://literature.cdn.keysight.com/litweb/pdf/N5180-90074.pdf>
7.           **SCPI Programmers Reference**  
Keysight Technologies Inc.  
<http://literature.cdn.keysight.com/litweb/pdf/N5180-90057.pdf>
8.           **Service Guide**  
Keysight Technologies Inc.  
<http://literature.cdn.keysight.com/litweb/pdf/N5180-90059.pdf>



This information is subject to change without notice.

© Keysight Technologies 2014-2019

Edition 1, June 2019

N5180-90079

[www.keysight.com](http://www.keysight.com)