M8100 Series Arbitrary Waveform Generators

M8008A Clock Generator

M8198A Arbitrary Waveform Generator

M8199A Arbitrary Waveform Generator

M8158A AWG Remote Head for M8199A

M8199B Arbitrary Waveform Generator

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Manual Part Number

M8100-91B40

Edition

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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.

Obtaining Source Code

This product uses open source packages. To the extent required by the applicable open source license(s), Keysight makes source code available upon request. To request source code, contact Keysight Support at www.keysight.com/main/support.jspx.

Safety Summary

The following general safety precautions must be observed during all phases of operation of this instrument. Failure to comply with these precautions or with specific warnings or operating instructions in the product manuals violates safety standards of design, manufacture, and intended use of the instrument. Keysight Technologies assumes no liability for the customer's failure to comply with these requirements. Product manuals are provided with your instrument on CD-ROM and/or in printed form. Printed manuals are an option for many products. Manuals may also be available on the Web. Go to www.keysight.com and type in your product number in the Search field at the top of the page.

General

This product is a Safety Class 1 instrument (provided with a protective earth terminal). The protective features of this product may be impaired if it is used in a manner not specified in the operation instructions.

All Light Emitting Diodes (LEDs) used in this product are Class 1 LEDs as per IEC 60825-1.

Environment Conditions

This instrument is intended for indoor use in an overvoltage category II, pollution degree 2 environment. It is designed to operate at a maximum relative humidity of 95% and at altitudes of up to 2000 meters.

Refer to the specifications tables for the ac mains voltage requirements and ambient operating temperature range.

Before Applying Power

Verify that all safety precautions are taken. The power cable inlet of the instrument serves as a device to disconnect from the mains in case of hazard. The instrument must be positioned so that the operator can easily access the power cable inlet. When the instrument is rack mounted the rack must be provided with an easily accessible mains switch.

Ground the Instrument

To minimize shock hazard, the instrument chassis and cover must be connected to an electrical protective earth ground. The instrument must be connected to the ac power mains through a grounded power cable, with the ground wire firmly connected to an electrical ground (safety ground) at the power outlet. Any interruption of the protective (grounding) conductor or disconnection of the protective earth terminal will cause a potential shock hazard that could result in personal injury.

Do Not Operate in an Explosive Atmosphere

Do not operate the instrument in the presence of flammable gases or fumes.

Do Not Remove the Instrument Cover

Operating personnel must not remove instrument covers. Component replacement and internal adjustments must be made only by qualified personnel.

Instruments that appear damaged or defective should be made inoperative and secured against unintended operation until they can be repaired by qualified service personnel.

Safety Symbols

Table 1   **Safety Symbols**

Symbol	Description
	Indicates warning or caution. If you see this symbol on a product, you must refer to the manuals for specific Warning or Caution information to avoid personal injury or damage to the product.
	Frame or chassis ground terminal. Typically connects to the equipment's metal frame.
	KC is the Korean certification mark to demonstrate that the equipment is Class A suitable for professional use and is for use in electromagnetic environments outside of the home.
	Contains parts or assemblies susceptible to damage by electrostatic discharge (ESD). Use electrostatic discharge protective handling procedures to avoid malfunctions or potential damage to the instruments.
	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.
	The RCM Mark is a compliance mark to the ACMA (Australian Spectrum Management Agency). This indicates compliance with all Australian EMC regulatory information.
	Indicates that the product was tested and has met the certification requirements for electrical, plumbing and/or mechanical products.

Symbol	Description
CAN ICES/NMB-001(A) ISM GRP 1-A	The CE mark is a registered trademark of the European Community. This CE mark shows that the product complies with all the relevant European Legal Directives. CAN ICES/NMB-001(A) - This ISM device complies with the Canadian ICES-001(A). Cet appareil ISM est conforme a la norme NMB-001(A) du Canada. ISM GRP 1-A - This is an Industrial Scientific and Medical (ISM) Group 1 Class A product.
	This symbol on all primary and secondary packaging indicates compliance to China standard GB 18455-2001.

Compliance and Environmental Information

Table 2   **Compliance and Environmental Information**

Safety Symbol	Description
	The crossed out wheeled bin symbol indicates that separate collection for waste electric and electronic equipment (WEEE) is required, as obligated by DIRECTIVE 2012/19/EU and other National legislation. See http://about.keysight.com/en/companyinfo/environment/takeback.shtml to understand your Trade in options with Keysight in addition to product takeback instructions.

About This Guide

Here is how the information in this document is organized.

Introduction

This chapter provides an overview of the M8100 Series Arbitrary Waveform Generator modules and the M8070B System Software.

Quick tour of the M8070B User Interface

This chapter provides information about how to access the M8070B system software and helps you with some of the features and functionalities that pertain to the viewing and configuring of the M8100 series AWG modules.

Using M8070B Utilities to Manage AWGs

This chapter describes the utilities provided by the M8070B system software to manage the M8100 series AWG instrument drivers.

Controlling AWGs using the M8070B software

This chapter describes the various parameters pertaining to the M8100 series Arbitrary Waveform Generators and the ways to configure them.

Licenses

This chapter provides information about the licenses required for the M8100 series AWG modules and the procedure to install them.

Appendix

This chapter provides information about basic troubleshooting.

Contents

1   Introduction

KEYSIGHT
TECHNOLOGIES

Introduction to the M8100 Series AWGs

The M8100 Series arbitrary waveform generators (AWGs) offer a level of versatility that enables you to set up complex real-world signals — whether you need precise signals to characterize the performance of a design or need to stress a device to its limits. From low-observable radar to high-density communications, testing is more realistic with Keysight's precision arbitrary waveform generators.

The M8100 modules are recognized by the model number and name located on their front panel. Each of the supported modules has some standard hardware and software features that are available with a standard license for that module. Some upgraded features/components of a module are licensed and are only available when you purchase and install a license for that option.

The M8100 modules are controlled by the M8070B systems application software. In addition, a MATLAB based free utility named IQTools is included with the instrument software that provides a large number of waveform generation utilities as well as an option to download user-defined waveforms. The IQtools also supports "in-system calibration" to measure and compensate the frequency and phase response of the AWG and any external circuitry. It can compensate skew between all channels. When using the ILV-option in case of M8199A, IQtools additionally provides an automated skew calibration to optimize system performance.

For more details and to download the IQTools, visit the following URL: www.keysight.com/find/IQTools

The following M8100 Series modules are supported by the M8070B system software. All these modules require the M8008A Clock Generator as the clock source for the sample clock.

·   M8198A 128 GSa/s Arbitrary Waveform Generator

·   M8199A 128/256 GSa/s Arbitrary Waveform Generator

    ·   M8158A Arbitrary Waveform Generator Remote Head

·   M8199B 256 GSa/s Arbitrary Waveform Generator

M8198A 128 GSa/s Arbitrary Waveform Generator

Keysight's M8198A 128 GSa/s Arbitrary Waveform Generator is a high-performance signal source with large memory for generation of arbitrary signals, to aid engineers in quick development and design of complex electronic and computing systems.

Key Features

The M8198A Arbitrary Waveform Generator provides the following key benefits:

· Up to two channels per module at 128 GSa/s with an analog bandwidth of 58 GHz

· Integrated, ready-to-use instrument, requires M8008A clock module

· Operates with well-known software, like MATLAB or Keysight IQTools and SCPI programming interface based on M8070B

· Offers up to 8 GSa sample memory per channel

Figure 1 displays the front panel of the M8198A module:

Figure 1   Front Panel of the M8198A AWG module

The M8198A module occupies three slots of the 5-slot M9505A AXIe chassis. It must be installed in the slot immediately above the M8008A Clock Generator module. The M8008A module must be installed in slot 1; therefore, the M8198A module must be installed in slots 2 to 4 of the AXIe chassis.

If the M9537A AXIe Embedded Controller is also being used, the Controller module must be installed in slot 1, followed by the M8008A module in slot 2 and M8198A module in slots 3 to 5, respectively.

> **CAUTION** This device is ESD-sensitive when operated. The electrostatic discharge to any part of the module or chassis may cause timing alignment issues of the channels, which can be mitigated by toggling the sample rate. Therefore, take necessary anti-static precautions, such as wearing a grounded wrist strap, to minimize the possibility of electrostatic damage.

Figure 2 displays a typical configuration of M8198A and M8008A.

Figure 2   Configuration of M8198A AWG & M8008A Clock Source in M9505A

M8008A Clock Generator

Keysight's M8008A clock generator is designed as sample clock source for the M8198A 128 GSa/s, M8199A 128/256 GSa/s and M8199B 256 GSa/s Arbitrary Waveform Generators. It can also be used as a standalone low-jitter clock source for other applications. It has four outputs that provides an output frequency of 32 GHz to 64 GHz. It has two system trigger inputs that allow system control from external hardware. It also allows synchronous trigger distribution over local bus on the AXIe chassis backplane to adjacent AWG modules.

The M8008A is an instrument module that can be installed into the M9505A 5-slot AXIe chassis. It comes as a 1-slot AXIe module, which allows the M8008A plus one M8198A and up to two M8199A / M8199B modules to be plugged into a single 5-slot AXIe chassis.

Key Features

The M8008A Clock Generator module provides the following key features:

- 32 - 64 GHz continuous frequency range
- Output amplitude up to +10 dBm
- Very low intrinsic jitter and wideband phase noise
- Four clock outputs can drive one M8198A module (= 2 channels), up to four M8199A AWG modules (= 16 channels) and up to four M8199B AWG modules (= 8 channels)

Figure 3 displays the front panel of the M8008A clock generator module:

Figure 3   Front panel of the M8008A clock generator module

M8199A 128/256 GSa/s Arbitrary Waveform Generator

Keysight's M8199A 128/256 GSa/s Arbitrary Waveform Generator delivers twice the sampling rate, coupled with 50 percent more analog bandwidth and increased ENOB compared to legacy AWG products. This combination of industry-leading specifications enables research engineers to quickly and accurately develop advanced components for terabit transmission systems.

The M8199A is a powerful arbitrary waveform generator, which enables signal generation of up to 140 GBd with outstanding signal quality in a 2-slot AXIe module. Whether testing the discrete components of optical coherent systems or path-finding for terabit transmission in the next-generation data center, the M8199A is ideal for addressing the need for high sample rates and high analog bandwidth.

Key Features

The M8199A Arbitrary Waveform Generator provides the following key benefits:

- Four channels at 128 GSa/s or two channels 256 GSa/s with up to 70 GHz nominal analog bandwidth
- Provides research engineers a high-performance signal source for arbitrary signals, enabling development of designs up to 140 GBd.
- Delivers twice the sampling rate of any AWG, coupled with at least 50 percent higher analog bandwidth. As a result, research engineers can quickly develop advanced components for terabit transmission systems
- Integrated, ready-to-use instrument
- Operates with well-known software, like MATLAB or Keysight IQTools and SCPI programming interface based on M8070B
- High flexibility with upgrade options from 2 channels at 128 GSa/s to 4 channels at 256 GSa/s

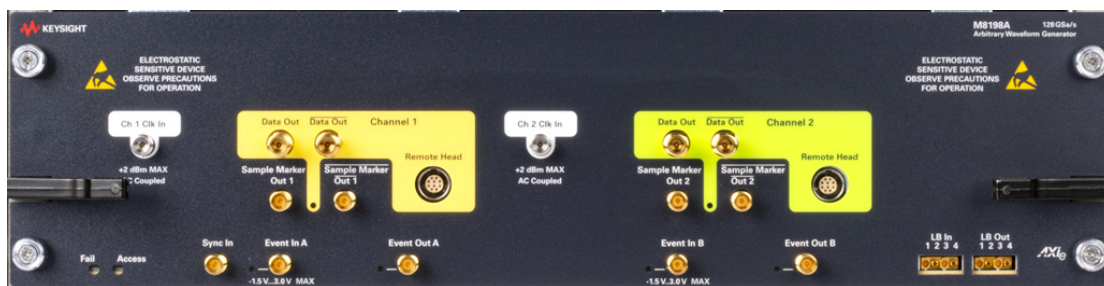Figure 1 displays the front panel of the M8199A module:

Figure 4   Front Panel of the M8199A AWG module

The M8199A module occupies two slots of the 5-slot M9505A AXIe chassis. It must be installed in the slot immediately above the M8008A Clock Generator module. The M8008A module must be installed in slot 1; therefore, the M8199A module must be installed in slots 2 and 3 of the AXIe chassis.

If the M9537A AXIe Embedded Controller is also being used, the Controller module must be installed in slot 1, followed by the M8008A module in slot 2 and M8199A module in slots 3 and 4, respectively.

CAUTION	This device is ESD-sensitive when operated. The electrostatic discharge to any part of the module or chassis may cause timing alignment issues of the channels, which can be mitigated by toggling the sample rate. Therefore, take necessary anti-static precautions, such as wearing a grounded wrist strap, to minimize the possibility of electrostatic damage.

M8158A Remote Head for M8199A

The M8158A arbitrary waveform generator remote head is an external amplifier that is optional and can be used in conjunction with the M8199A-ILV Passive Combiner. It helps in minimizing signal degradations caused by lossy channels.

Figure 2 displays a typical configuration of M8199A and M8158A.

Figure 5   Configuration of M8199A AWG & M158A Remote Head in M9505A

M8199B 256 GSa/s Arbitrary Waveform Generator

Keysight's M8199B 256 GSa/s Arbitrary Waveform Generator (AWG) is a high-performance signal source for arbitrary signals, with the highest sample rate and the widest bandwidth in its class. The M8199B enables generation of high-quality signals of up to 160 GBd in a 2-slot AXIe module.

For applications beyond 128 GBd, the M8199B AWG is the ideal solution where it provides high-speed and precise testing of various optical systems, and it provides stress signals to test next generator digital signal processor ASICs and new algorithm concepts. The flexibility of the waveform generator with high speeds, combined with excellent intrinsic jitter performances makes the M8199B a truly unique and versatile instrument for Intensity-Modulation/Direct-Detect (IM/DD) optical applications.

The M8199B AWG also allows you to generate any arbitrary waveform that can be mathematically described and can be used for physics, chemistry, and general-purpose electronics research.

Key Features

The key features of using the M8199B Arbitrary Waveform Generator are:

- Provides up to eight synchronized channels at 256 GSa/s with a nominal 3dB-bandwidth of 75 GHz including sinc-rolloff
- Enables development of designs of higher-order QAM (such as 64 QAM) at 160 GBd and above
- Enables 400+ Gb/s per lane in IM/DD or 1.6+ Tb/s per carrier in coherent optical communications
- Integrated, ready-to-use instrument, works with M8008A clock module
- Operates with well-known software, including MATLAB, Keysight IQtools, and SCPI programming interfaced based on M8070B
- Built-in frequency and phase response calibration for clean output signals

Figure 6 displays the front panel of the M8199B AWG module:

Figure 6   Front panel of the M8199B AWG module

The M8199B module occupies two slots of the 5-slot M9505A AXIe chassis. It must be installed in the slot immediately above the M8008A Clock Generator module. The M8008A module must be installed in slot 1; therefore, the M8199B module must be installed in slots 2 and 3 of the AXIe chassis.

If the M9537A AXIe Embedded Controller is also being used, the Controller module must be installed in slot 1, followed by the M8008A module in slot 2 and M8199B module in slots 3 and 4, respectively.

CAUTION	This device is ESD-sensitive when operated. The electrostatic discharge to any part of the module or chassis may cause timing alignment issues of the channels, which can be mitigated by toggling the sample rate. Therefore, take necessary anti-static precautions, such as wearing a grounded wrist strap, to minimize the possibility of electrostatic damage.

Figure 7 displays a typical configuration of M8199B AWG along with the M8008A clock generator.

Figure 7   Typical configuration of the M8199B AWG with M8008A Clock Gen.

For details on M8100 series modules, visit: www.keysight.com/find/M8100

For more information on controlling the AWG(s) modules using M8070B, refer to:

· For information on remote programming the M8199B modules, refer to the M8000 Series Programming Guide. on page 105
· Controlling M8199A AWG from the M8070B User Interface on page 83
· Controlling M8199B AWG from the M8070B User Interface on page 96

Introduction to AXIe Chassis

M9505A AXIe Chassis

The M9505A AXIe Chassis is a modular instrument chassis that supports complex and high density testing. The chassis provides slots for installing multiple AXIe based instrument modules such as the M8041A, M8051A, M8062A, M8009A, M8008A, M8199A and M8199B modules. Besides providing a frame for the installation of these instrument modules, the M9505A AXIe Chassis also provides power, a cooling system, a PCIe Gen2 local data bus, a Gigabit LAN interconnect, and a cabled USB (USB option required) and PCIe connection for external host computer connectivity.

> **NOTE**   The USB connection is recommended when using a laptop or desktop PC as an external controller. The PCIe connection is recommended for use with a desktop PC as an external controller only.

Refer to the *Keysight M9505A AXIe Chassis Startup Guide* to get detailed information about the AXIe chassis.

Figure 8   Base model of the M9505A AXIe Chassis

AXIe Embedded System Module (USB ESM)

The bottom slot of the AXIe chassis is reserved for the Embedded System Module (ESM) which is factory-installed. The ESM has a USB 2.0 interface as well as a PCIe x8, Gen1 and Gen2 compliant interface to connect an external host computer to the chassis. The following figure shows the PCIe Port and USB Port in ESM.
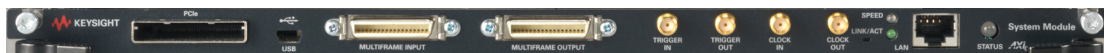
Figure 9   USB ESM module compatible with M9505A AXIe Chassis

The ESM:
- runs the chassis embedded operating system which manages all internal tasks and communications.
- tracks inserted modules and manages power requirements.
- monitors chassis temperature and controls variable-speed chassis fans.
- monitors module sensors and reports component failures to a system log.
- acts as a Gigabit Ethernet switch; forwards frames along the backplane.
- connects an external host computer to the chassis.
- synchronizes timing across all modules through the Keysight Trigger Bus, using an internal or external clock source.
- LAN connector on AXIe ESM is not used. Only use LAN connection on the host computer.
- Either the PCIe (desktop only) or USB (desktop or laptop) port can be used in this ESM but not both simultaneously. When you use the PCIe port, the USB port is automatically disabled until the PCIe port is no longer in use.

M9506A AXIe Chassis

The Keysight M9506A AXIe chassis is a modular instrument chassis fully compatible with the AXIe Wide PCIe specification. It allows multiple application-specific instrument modules to share a common chassis frame, power supply, cooling system, PCI Express (PCIe) x16 Generation (Gen) 3 backplane, Gigabit LAN hub, local bus for module-to-module signaling, and host PC connections. The full rack chassis provides five general purpose peripheral slots that accept 1U AXIe instrument modules.

Additional features include:

- Up to 300 W per slot power
- Five AXIe Wide compliant slots
- PCIe x16 Gen 3 Backplane allows module to module communication
- Default PCIe configuration merges both cable ports to one Gen 3 x16 PCIe Cable Port.
- Open AXIe Zone 3 for custom use (cable access, analog backplane, and so on.)
- Thunderbolt™ 3 Connection Port[1]
- Cascaded PCIe for multiple chassis systems
- Parallel and Star Triggering
- Push-pull fan system for quieter operation

The chassis includes a half-height Embedded System Module (ESM) that manages chassis functions. The ESM provides all ATCA (Advanced Telecommunications Computing Architecture) shelf manager functions, plus these AXIe extensions:

- Host PC connectivity (Gen 3 PCIe x8/x16, Thunderbolt 3, Ethernet)
- Sources timing signals (CLK100, SYNC, and FCLK)
- Routes STRIG (Star Trigger) to instruments through the backplane
- Two bi-directional trigger access ports route trigger signals through to the backplane parallel trigger bus and star triggers (STRIG) to each slot
- Provides backplane PCIe and Ethernet communication between modules

Other than a power button/status light (on the ESM), all monitoring, control, and communication with the chassis requires a host PC. This can be an embedded PC specifically designed for use in an AXIe chassis (such as the Keysight M9537A) or remote (a rackmount, desktop, or laptop) PC.

The Gen 3 PCIe Cable Interface ports provides up to a 8 GB/s (theoretical) for Gen 3 x8 and 16 GB/s (theoretical) for Gen 3 x16. The Thunderbolt 3 port provides a Gen 3 x4 link with up to 4 GB/s (theoretical) bandwidth.

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1   Thunderbolt™ is the brand name of an interface standard developed by Intel (in conjunction with Apple) that allows connection of external peripherals to a computer. Thunderbolt 3 specification provides Gen 3 PCI Express (PCIe), DisplayPort, and DC power in one USB-C compatible cable; only PCIe is supported on the M9506A. Charging devices such as laptop computers over Thunderbolt 3 is not supported on the M9506A.
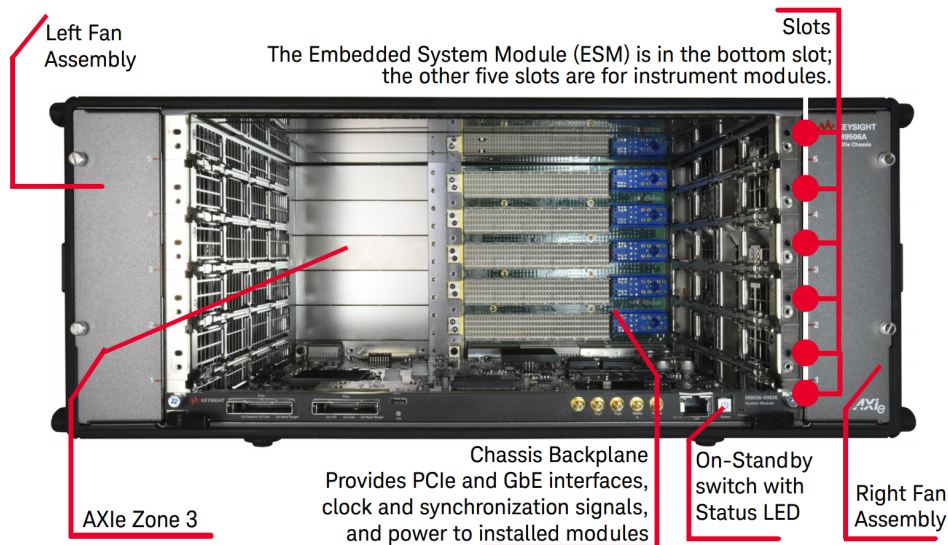
Figure 10

Refer to the *Keysight M9506A 5-Slot AXIe Chassis Startup Guide* to get detailed information about the AXIe chassis.

Host Computer

A host computer is used to:

- host all the software components of the instrument modules needed to control, configure, and use the modules.
- communicate with the ESM of the M9505A AXIe Chassis to allow you to monitor and control the chassis.

A host computer can be:

- the M9537A AXIe Embedded Controller module.
- a laptop with a USB port or with PCIe port.
- a desktop PC with a USB port or x8 or wider PCIe slot for the cabled PCIe adapter card.

M9537A AXIe Embedded Controller Module

The M9537A AXIe Embedded Controller is a one slot module that you can install in the M9505A AXIe Chassis like any other instrument module. This module acts as a host computer when installed in the M9505A AXIe Chassis. It is always installed in slot 1 of the M9505A AXIe Chassis.

The following figure displays this module.

Figure 11   M9537A AXIe Embedded Controller Module compatible with M9505A

This module may be installed in any slot of the M9514A AXIe chassis except for Slot 7 which is reserved for the ASM. However, to eliminate interference with the local bus used for E-Keying (if your AXIe modules use E-Keying), you should install the controller in one of the outside slots; for example, 1 or 14 first, then 2 or 13, and so on.

The ESM:

- runs the chassis embedded operating system which manages all internal tasks and communications.
- tracks inserted modules and manages power requirements.
- monitors chassis temperature and controls variable- speed chassis fans.
- monitors module sensors and reports component failures to a system log.
- acts as a Gigabit Ethernet switch; forwards frames along the backplane.
- connects an external host computer to the chassis.
- synchronizes timing across all modules through the Keysight Trigger Bus, using an internal or external clock source.

LAN connector on AXIe ESM is not used. Only use LAN connection on the host computer.

Either the PCIe (desktop only) or USB (desktop or laptop) port can be used in this ESM but not both simultaneously. When you use the PCIe port, the USB port is automatically disabled until the PCIe port is no longer in use.

Introduction to the M8070B software

The M8070B system software is required to control the M8100 series AWG modules (M8198A, M8199A, M8199B) and M8008A clock generator modules. It provides a user-friendly experience that can be used with standard or touchscreen enabled computers. It is fully supported by the Microsoft Windows 10 (Version 1607, Anniversary Update or newer) operating systems. The M8070B software also supports an off-line version, that does not require any license to operate.

The M8070B user interface provides an interactive graphical display in multiple windows containing controls, that enable you to perform the tasks. The GUI components include menus, tool bars, dialog boxes, toggle buttons, standard windows buttons, drop-down lists, sliders, and many more which are further discussed in this manual.

NOTE	Verify your account permissions. Ensure that you have full administrative privileges (run as Administrator) before you install or upgrade the M8070B system software on a PC running Windows 10. Not doing so may result in an installation failure. Contact your system administrator to provide you the administrative rights.

ESD Protection

CAUTION	Electrostatic discharge (ESD) can damage the circuits of the components on M8100 series AWG modules. Avoid applying static discharges to the front-panel connectors. Before connecting any coaxial cable to the connectors, momentarily short the center and outer conductors of the cable together. Avoid touching the front-panel connectors without first touching the frame of the instrument. Be sure the instrument and all connected devices (DUT, and so on) are properly earth-grounded (to a common ground) to prevent buildup of static charge and electrical over-stress. Take necessary anti-static precautions, such as wearing a grounded wrist strap, to minimize the possibility of electrostatic damage.

Electrostatic discharge (ESD) can damage or destroy electronic components. All work on electronic assemblies should be performed at a static-safe work station. The following list and figure shows an example of a static-safe work station using two types of ESD protection. Purchase acceptable ESD accessories from your local supplier.

- Conductive table-mat and wrist-strap combination.
- Conductive floor-mat and heel-strap combination.
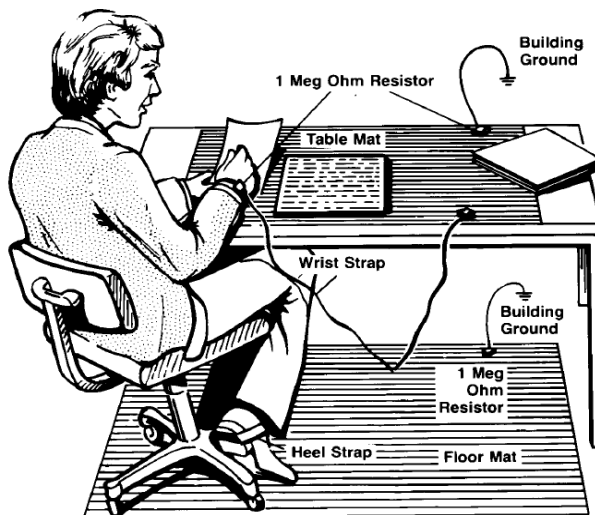
Figure 12   Illustration of a static-safe work station

Both types, when used together, provide a significant level of ESD protection. Of the two, only the table-mat and wrist-strap combination provides adequate ESD protection when used alone. To ensure user safety, the static-safe accessories must provide at least 1 MW of isolation from ground.

WARNING   These techniques for a static-safe work station should not be used when working on circuitry with a voltage potential greater than 500 volts.

Discharging Cables

Loose cables are like a capacitor and can hold electrostatic charges. The free end of a cable touching surfaces that have voltage levels will cause product damage. Before connecting any cable to product connector, short the center and outer conductors of the cable together to ground momentarily.

You should use the cable discharger provided with the initial product shipment and shown in the following figures.

Figure 13   3D illustration of Cable discharger shipped with hardware (top view)

Figure 14   3D illustration of Cable discharger shipped with hardware (lateral view)

While discharging a cable, make sure to ground the box appropriately, via the "GND" connector of the box, to the ground connector of the AXIe chassis as shown in the figure.
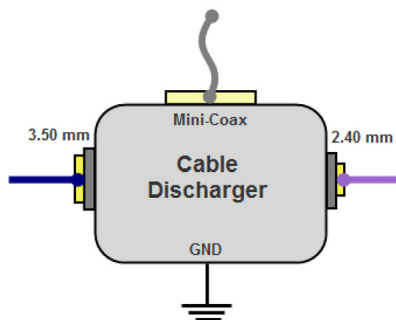
Figure 15   Illustration of Ground connection using Cable Discharger

That is either directly using the accessories provided with the discharger like the grounding cable, or via an ESD mat, which is connected to the ground connector of the AXIe chassis.

Discharge your cables using the matching connector; for example 2.40 mm (also for 1.85 mm), 3.50 mm (also for 2.92 mm) and Mini-Coax. You may stick the cable discharger box to your instrument/AXIe chassis e.g. using the fastener tape provided.

Fixture made of plastic can store charges, and probing powered devices can subject inputs to damaging voltage and power levels. Poor AC power supply connected to product or DUT may create AC transients, insufficient grounding, floating neutral lines which cause damaging currents to flow into or out of the instrument.

For more information about electrostatic discharge, contact the Electrostatic Discharge Association www.esda.org.

Document History

Table 3   Document History

Edition	Description
Edition 1.0, December 2023	New document supporting M8199A/B AWGs. Requires M8070B system software version 10.1.
Edition 2.0, January 2024	Supports M8198A AWG Release 1.0.

Related Documents

Table 4   Related Documents

Document Part No.	Document Title
M8100-91B10	M8100 Series AWG Start Here
M8100-91B20	M8100 Series Getting Started Guide
M8100-91B30	M8100 Series Tips for Preventing Damage
M8100-91B50	M8100 Series Programming Guide
M8100-91B60	IQTools User Guide

Abbreviations used in this Document

Table 5   Abbreviations

Abbreviation	Extended Form
AXIe	AdvancedTCA Extensions for Instrumentation and Test
AWG	Arbitrary Waveform Generator
BER	Bit Error Ratio
CDR	Clock Data Recovery
CTLE	Continuous-Time Linear Equalizer
DUT	Device Under Test
ESD	Electrostatic Discharge
ESM	Embedded System Module

Abbreviation	Extended Form
GB	Gigabyte
GUI	Graphical User Interface
J-BERT	Jitter-Bit Error Ratio Tester
LED	Light-Emitting Diode
MB	Megabyte
MIPI	Mobile Industry Processor Interface
PC	Personal Computer
PCIe	Peripheral Component Interconnect Express
PLL	Phase Locked Loop
PRBS	Pseudorandom Binary Sequence
PXI	PCI eXtensions for Instrumentation
R & D	Research & Development
SAS	Serial Attached SCSI
SATA	Serial Advanced Technology Attachment
SCPI	Standard Commands for Programmable Instruments
SMA	SubMiniature Version A
SSC	Spread Spectrum Clock
TCP	Transmission Control Protocol
USB	Universal Serial Bus
VCO	Voltage Controlled Oscillator

2 Quick tour of the M8070B User Interface

KEYSIGHT
TECHNOLOGIES

Launching M8070B User Interface

To launch the M8070B user interface, do the following:

1   Go to **Start** menu > **Keysight M8070B** > **Keysight M8070B**.

Figure 16   Launching M8070B software from Start menu
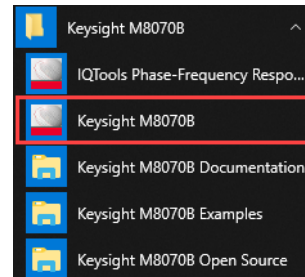
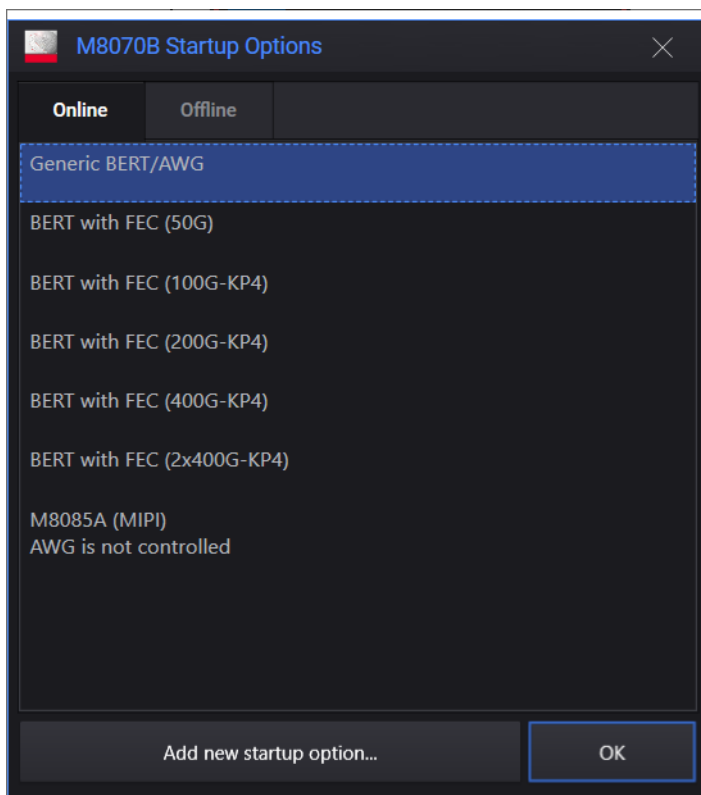The **M8070B Startup Options** dialog box appears.

Figure 17   M8070B default startup options displayed in online mode

2   On the **M8070B Startup Options** dialog box, select one of the
    following tabs:
    · **Online**: Select this tab, if you are using the M8070B in online mode.
    · **Offline**: Select this tab, if you are using the M8070B in offline mode.
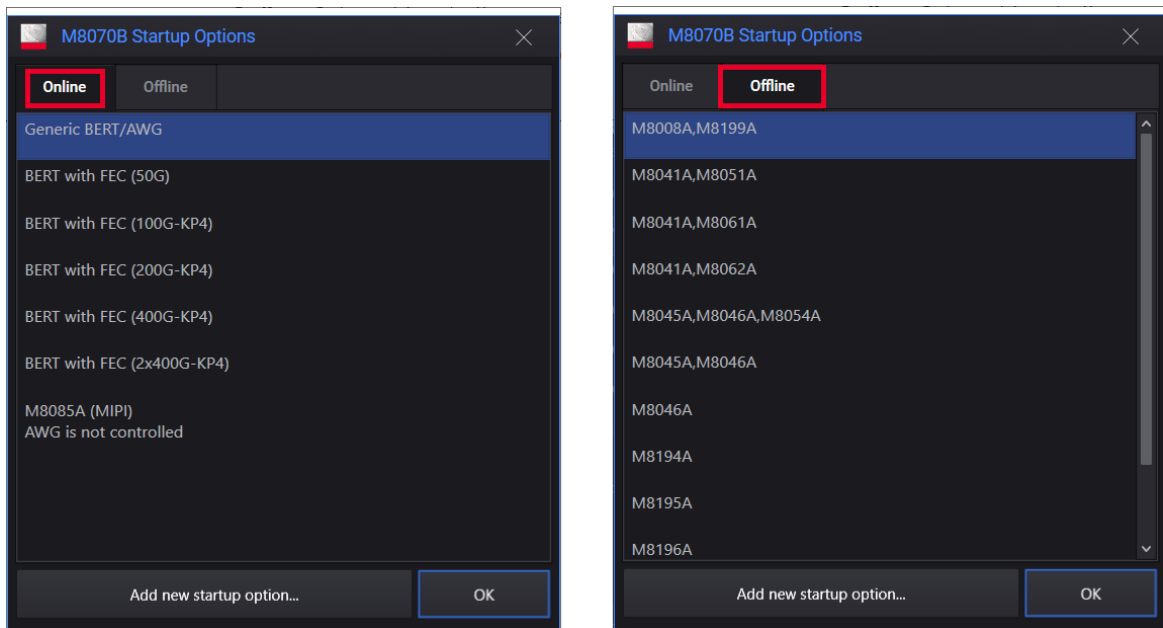
Figure 18   Online and offline startup options in M8070B software

3   To launch the M8070B in online mode, select **Generic BERT/AWG**, which opens the AWG with full support of all computer standard specific functionalities.

4   To launch the M8070B in offline mode, select one of the following launch options. Skip to step 5 if one or more of these startup options have not been added.

   · **M8008A, M8198A**: Launches the M8070B with M8008A and M8198A modules.

   · **M8008A, M8199A**: Launches the M8070B with M8008A and M8199A modules.

   · **M8008A, M8199B**: Launches the M8070B with M8008A and M8199B modules.

5   To add a new startup option, click **Add new startup options...** button on the **M8070B Startup Options** dialog box.

   The **New Startup Option** dialog box appears. Enter the required information.

Figure 19   Setting up a new startup option in M8070B SW

    a Type the name of the startup option in the **Startup Option Name** text box.

    b Select an option **Online** or **Offline Modules**.

    c In case of Offline Modules, type the module name(s) that you want to launch with M8070B. Note that if you are opting for starting M8008A along with one of the AWG modules, the M8008A module

must be prefixed to the required M8100 series AWG module in offline startup options. For example, M8008A, M8198A.

d   Select "Generic BERT/AWG" from the **Standard** drop-down list.

e   Select a workspace from the **Workspace** drop-down list. Initially only the default workspace is available. You can create a new workspace by clicking **Add New...** button.
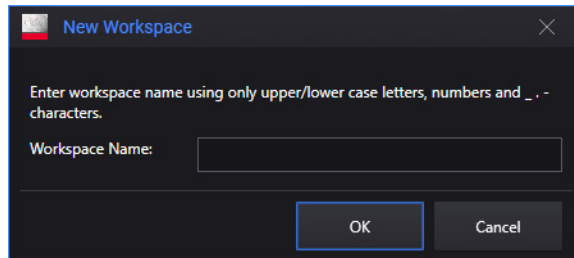
Figure 20   Window for creating a new workspace (as needed)

f   Select an option from the **Startup** Setting drop-down list. The following options are available:

  · **Select at startup**: Opens the **Recall Instrument State** dialog which allows you to load the M8070B user interface with the stored settings. For details on how to recall instrument state, refer to the *M8000 Series User Guide*.

  · **Factory Preset**: Launches the M8070B user interface with factory default settings.

  · **Last Used**: Launches the M8070B user interface with the last used settings.

g   Select or clear the **Do not control real-time scope** check box for the respective setting.

h   Select or clear the **Do not control AWG (M8194A,M8195A,M8196A)** check box for the respective setting.

6   Click **OK**.

The M8070B splash screen appears:

Figure 21   Startup splash screen for M8070B software

Starting M8070B on the command line

- When no additional command line arguments are given, M8070B starts in Generic BERT/AWG mode.

Messages while launching M8070B GUI

Whenever there is a change in the M8070B software version, the following message appears:
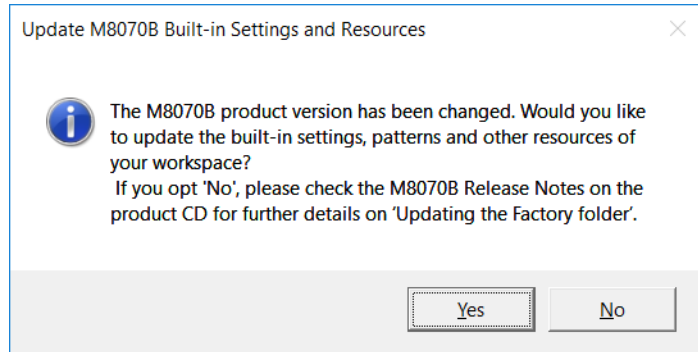
Figure 22   Version change prompt when launching M8070B SW

This message box prompts the user to update the workspace as there is an update in the software version.

· Clicking "Yes" will update the workspace.
· Clicking "No" will do nothing and you will have to manually update the workspace. For details on how to update the workspace, refer the "M8070B Release Notes".

Whenever, an old workspace data (M8070A) is detected, the following message will appear:
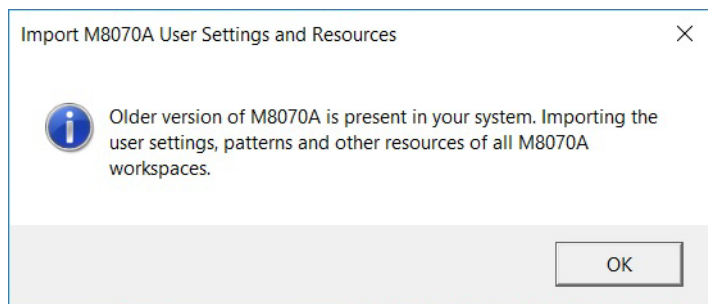
Figure 23   Prompt when the old (M8070A) workspace data is detected

- Clicking "OK" will import the user settings, patterns and other resources of M8070A workspace to M8070B workspace.

Load Setting

Before the M8070B software is launched, a **Load Setting** dialog will appear which allows you to choose the type of settings in M8070B software you wish to load.
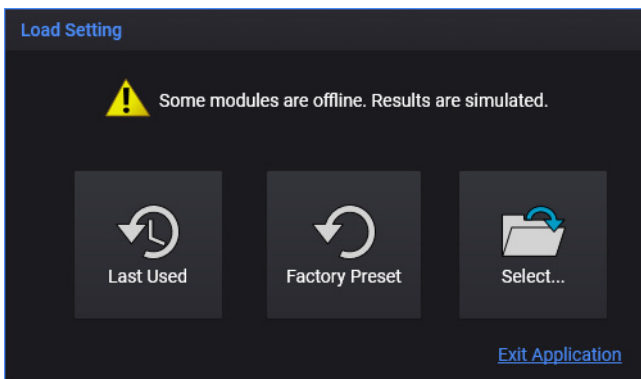
Figure 24   Appearance of the Load Setting dialog

The **Load Setting** dialog provides the following settings:

- **Last Used**: Launches the M8070B user interface with those settings that were configured/set in the previous instance of the software.
- **Factory Preset**: Launches the M8070B user interface with factory default settings.
- **Select...**: Opens the **Recall Instrument State** dialog which allows you to load the M8070B user interface with settings you may have saved. For details about "Recalling Instrument State", refer to the *M8000 Series User Guide*.
- **Exit Application**: Terminates the M8070B application.

NOTE	The **Load Setting** dialog appears each time the M8070B software is launched.

NOTE

A warning message will appear on the top of **Load Setting** dialog if the modules are offline. In this case, the results are simulated.

Once the settings are loaded, the M8070B software launches.

The following figure shows the appearance of M8070B user interface when M8008A clock module and M8198A AWG are connected.

Figure 25   Default view of the M8070B SW for the M8008A, M8198A startup option

The following figure shows the appearance of M8070B user interface when M8008A clock module and M8199A AWG are connected.
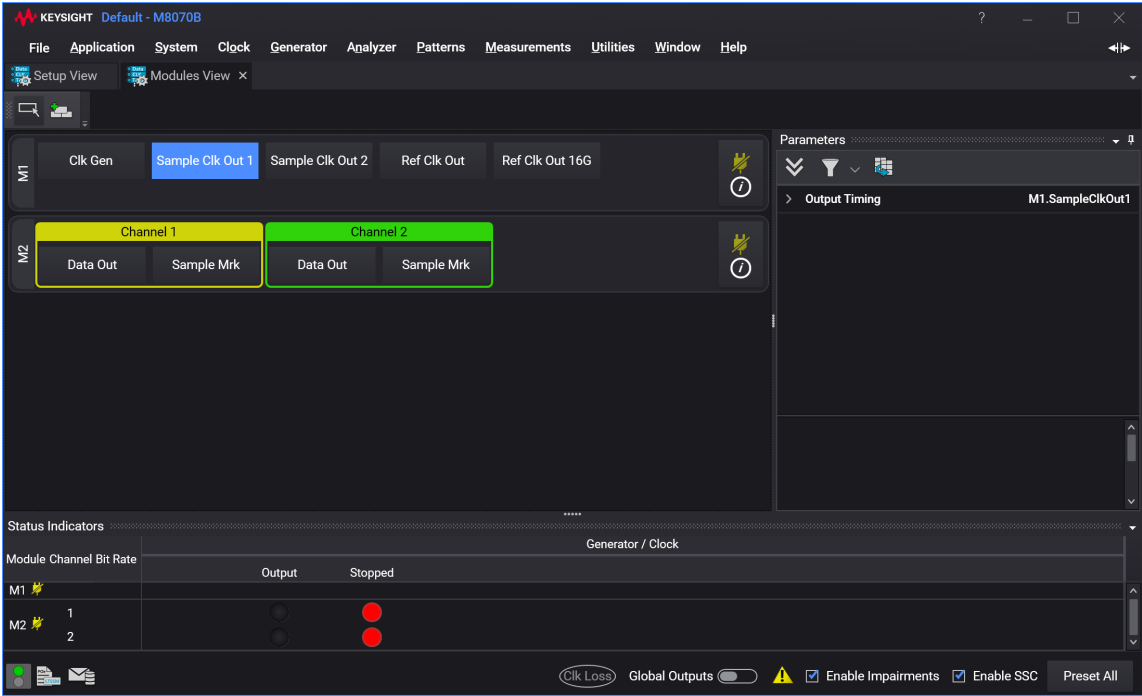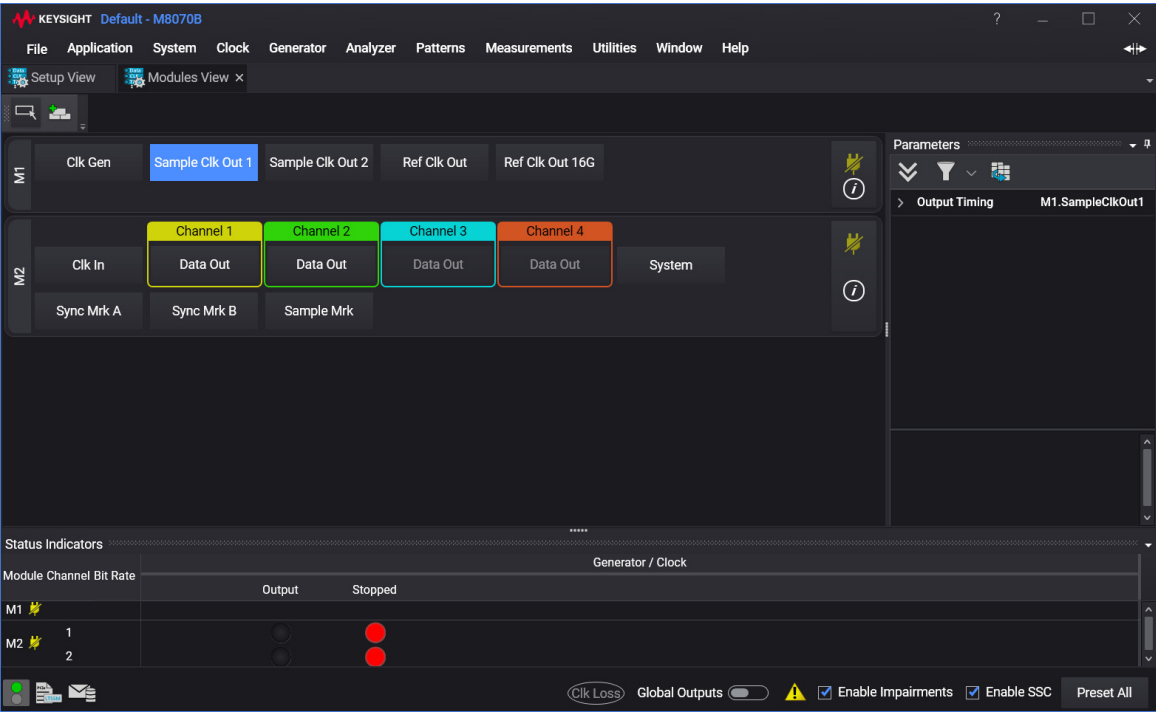
Figure 26   Default view of the M8070B SW for the M8008A, M8199A startup option

The following figure shows the appearance of M8070B user interface when M8008A clock module and M8199B AWG are connected.
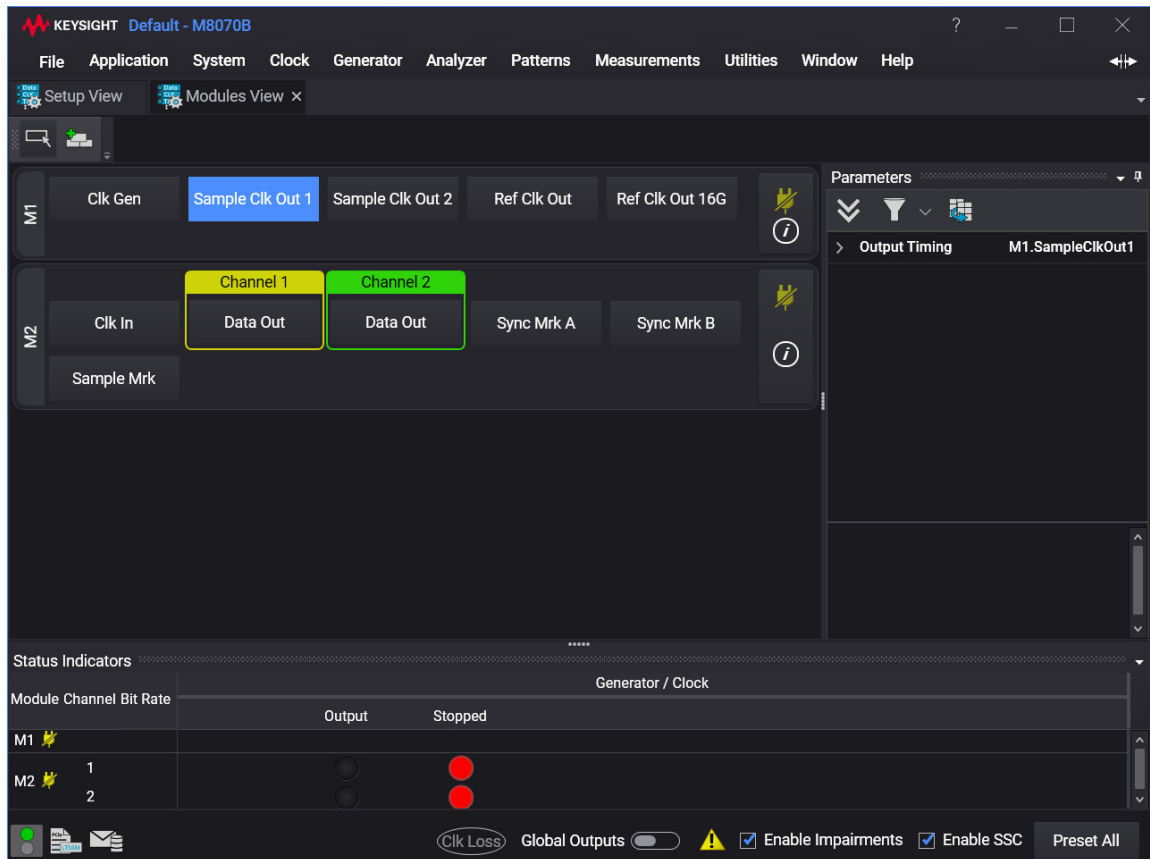
Figure 27   Default view of the M8070B SW for the M8008A, M8199B startup option

Get Module Information

You can get the module information that is connected to the M8198A/M8199A/M8199B by clicking the [i] icon present at the right side of each module. If properly connected, the module information will be shown as depicted in the following figure:

256 GSa/s Arbitrary Waveform Generator
Address   : **OFFLINE::211::INSTR**
Product Number   : M8199B
Serial Number   : DE5250000003
Hardware Revision : 0
Firmware Version : 1.0.150.2
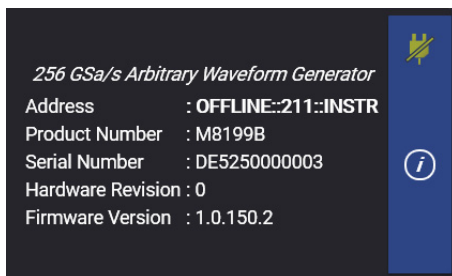
Figure 28   Information pertaining to the module

It provides the following information about the module:

- **Address** – The Address of module, for example, USB-PXI0::11::0::INSTR or OFFLINE::211::INSTR
- **Product Number** - Product no. of the module, such as M8198A/M8199B/M8199A
- **Serial Number** - Serial no. of the module, such as DE5250000003
- **Hardware Revision** - Hardware revision of module, such as, 0
- **Firmware Version** - Firmware revision of module, such as, 1.0.150.2

However, if you unable to get the module information, we suggest you to restart the M8070B software.

In the offline mode, the [icon] icon will appear in the M8070B GUI.

The M8070B user interface consists of various other GUI elements, which are described in detail in the *M8000 series User Guide*.

Viewing the modules in M8070B software

Overview

The M8070B system software provides the following types of views:

- Module View
- System View
- Impairment Setup View
- Group View
- Setup View

This document shall cover the various features pertaining to the Modules View that enable control of the M8100-series AWGs and the M8008A Clock Generator modules. Refer to the *M8000 Series User Guide* to understand the use and functionality of the rest of the views listed above.

In addition, on installing the **Advanced Measurement Package**, the following instruments can be controlled from M8070B System Software:

- N1076A/77A
- N1076B/78A
- Real-Time Oscilloscope

Description on the **Advanced Measurement Package** and steps to control the above instruments are explained in the *M8000 Series Advanced Measurement Package User Guide*.

NOTE	The Advanced Measurement Package requires license for its activation. For details on license, see Keysight License Manager on page 113.

NOTE	Verify your account permissions. Ensure that you have full administrative privileges (run as Administrator) before you install or upgrade the M8070B system software on a PC running Windows 10. Not doing so may result in an installation failure. Contact your system administrator to provide you the administrative rights.

About the Modules View

The **Modules View** is a graphical representation of the input/output ports that are present on the front panel of the modules, configured into the M8100-series AWGs. These modules have a different set of input/output ports depending upon their functionality, such as for generators or clock. Each module consists of two channels (channel 1 and channel 2) depending upon the licenses, you have ordered. Each channel contains Data Out (Generator) ports.

The modules are identified as M1, M2, M3 and so on in the GUI.

You can use the **Modules View** to configure the properties of a single port or a group (combination of multiple ports). For details, refer to Creating Groups in the Module View on page 62.

Launching Modules View

By default, the **Module View** is launched whenever you launch the M8070B user interface. However, if it is not available or is closed, you still can launch it from the main menu by clicking **System** > **Module View**.

The following figure shows the appearance of **Module View** when M8008A (M1) and M8199B (M2) modules are connected:
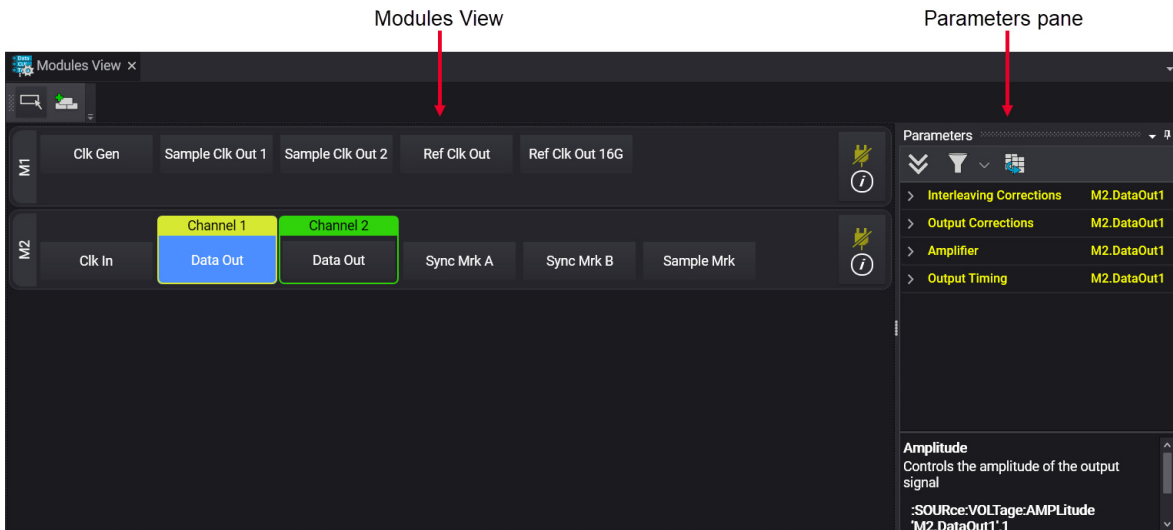
Figure 29   Default appearance of Modules View in the M8070B SW

The left side shows the connected modules and the right side shows the **Parameters** pane. Each module has input and output ports which can be configured through the **Parameters** window. For details on inputs and output ports, refer to Input and Output Ports on page 54. When you click the port, the respective configurable parameters are displayed in the **Parameters** window. For details, refer to Parameters pane on page 55.

The following figure shows an example of **Modules View** when M8008A (M1) and M8198A (M2) modules are connected:

Figure 30   Modules View for M8008A, M8198A startup option

The following figure shows an example of **Modules View** when M8008A (M1) and M8199A (M2) modules are connected:

Figure 31   Modules View for M8008A,M8199A startup option

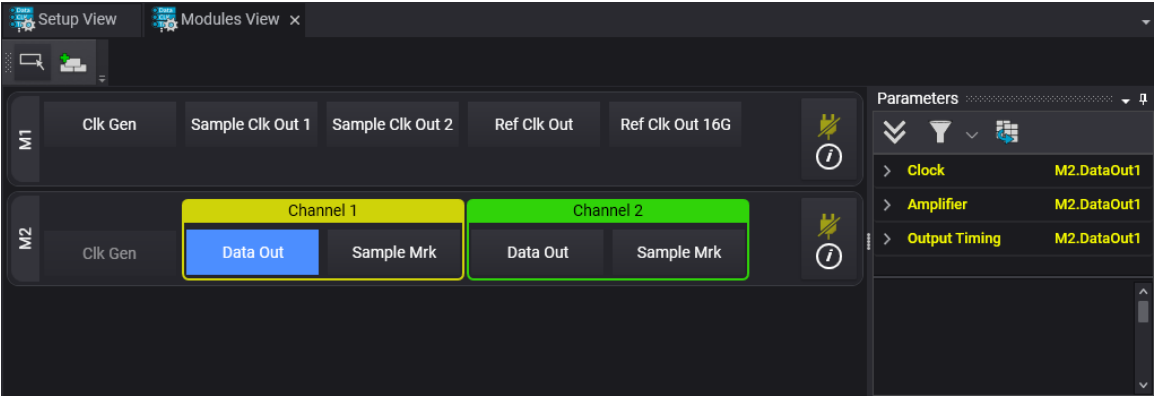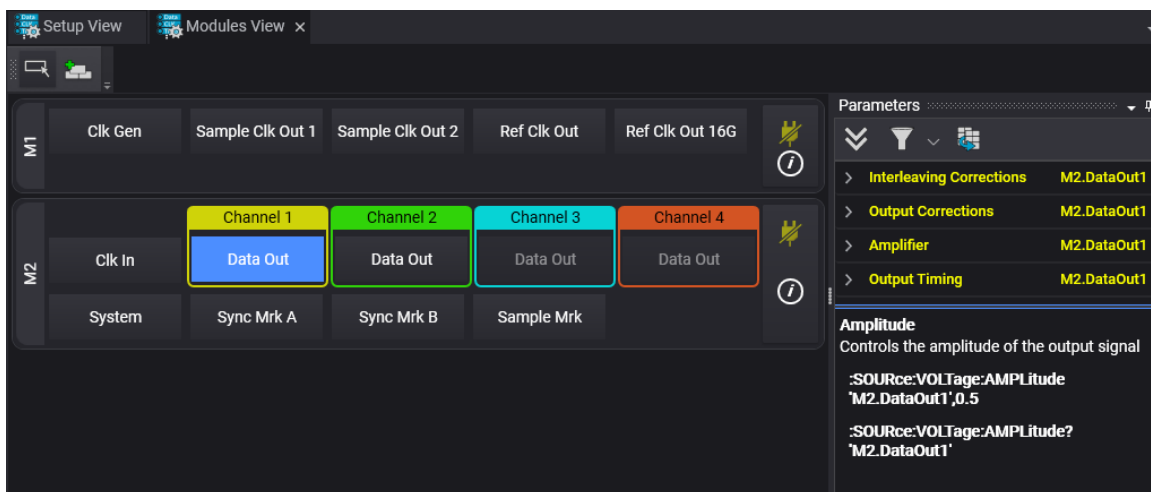The following figure shows an example of **Modules View** when M8008A (M1) and M8199B (M2) modules are connected:
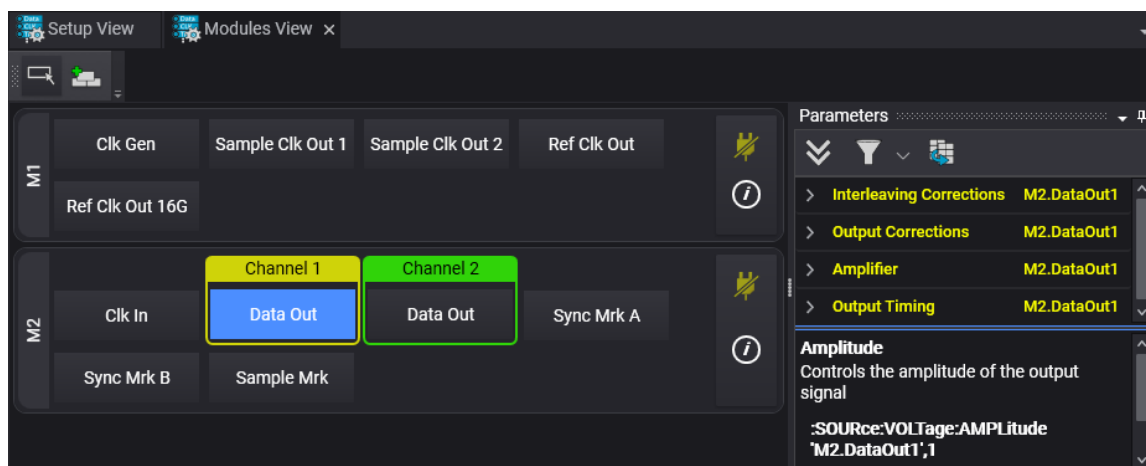

Figure 32   Modules View for M8008A,M8199B startup option

Input and Output Ports

M8008A Module

The M8008A module has the following ports on its front panel:

- **Clk Gen** – Clock can be generated from the internal oscillator or an external source.
- **Sample Clk Out 1** – This port provides a reference clock for a DUT. It provides a differential clock with adjustable amplitude, offset and termination.
- **Sample Clk Out 2** – This port provides the clock signal for AWG modules.
- **Ref Clk Out** – This port provides a reference clock to lock with other instruments in the test setup. It provides clock frequency 10 MHz or 100 MHz.
- **Ref Clk Out 16G** – This port provides a clock between 8 and 16 GHz, relative to symbol rate. It can be used as clock input or as trigger input for a precision time base of a DCA. Clean clock only.

M8198A / M8199A / M8199B / Modules

The M8198A AWG modules have the following input and output ports:

- **Clk In**: Sampling clock input from the M8008A Clock Generator.
- **Data Out (Ch1 / Ch2)**: Differential AWG data output per channel.
- **Sample Mrk (Ch1 / Ch2)**: Differential sample marker output per channel.

The M8199A AWG modules have the following input and output ports:

- **Clk In**: Sampling clock input from the M8008A Clock Generator.
- **Data Out (Ch1 / Ch2 / Ch3 / Ch4)**: Differential AWG data output per channel.
- **System**:
- **Sync Mark A / B**:
- **Sample Mrk**: Differential sample marker output per channel.

The M8199B AWG modules have the following input and output ports:

- **Clk In**: Sampling clock input from the M8008A Clock Generator.
- **Data Out (Ch1 / Ch2)**: Differential AWG data output per channel.
- **System**:
- **Sync Mark A / B**:
- **Sample Mrk**: Differential sample marker output per channel.

Selecting Single/Multiple Ports

You can select either single or multiple ports by pressing the toggle button, available on the top of the main window. It provides the following modes selection:

Single Selection Mode - allows you to select only one port at a time from the connected modules.

Multiple Selection Mode - allows you to select multiple ports from the connected modules.

Parameters pane

The **Parameters** pane displays the functional blocks of the selected port/port groups. Each functional block has a set of parameters. The **Parameters** pane also allows you to configure the parameters of the selected port/port groups.

If you try to set a parameter which conflicts with other parameter or in other words is dependent on other parameter, a **Auto Correct Confirmation** dialog appears. For details, see Auto Correction Confirmation Dialog on page 61.

The **Parameters** pane is shown in the following figure:
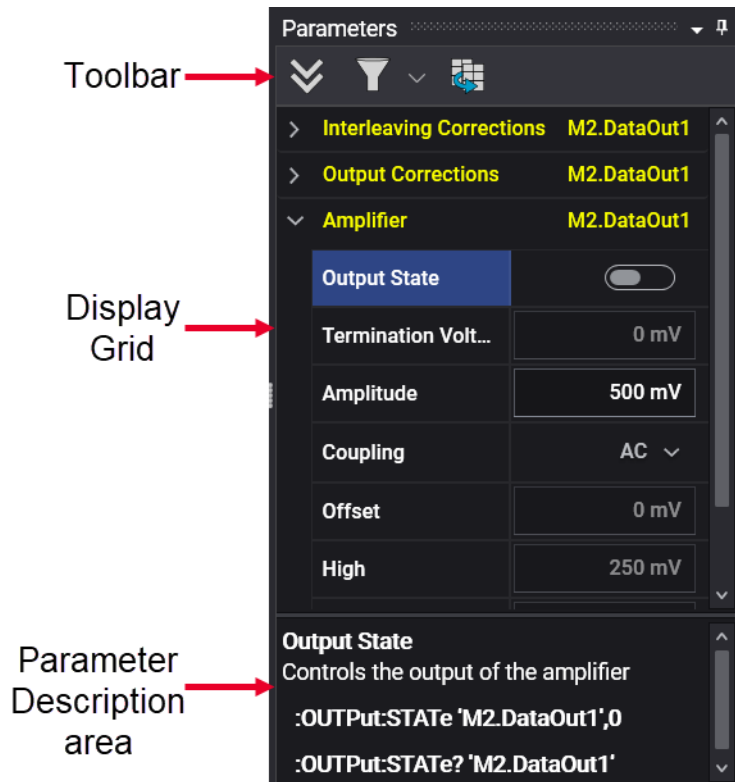
Figure 33   Various areas in the "Parameters" pane of the M8070B SW

The **Parameters** pane has the following sections:

- Tool bar
- Display Grid
- Parameters Description area

The **Parameters** pane tool bar includes the following icons:

- ⌄⌄ Expand/Collapse All Group: Click this icon to expand or collapse the functional blocks.

- ▼⌄ Show Search Option: Allows you to filter and customize your results by using the following options:

- By Location
- By Functional Block
- By Property

- Copying Parameter pane: Creates a replica of **Parameters** pane to enhance the usability. It allows you to work on two different instances of the application. The changes you make in one pane display immediately in the other pane. The icon present on the copied parameter pane loads all properties of the module. The following figure shows the copied **Parameters** pane.
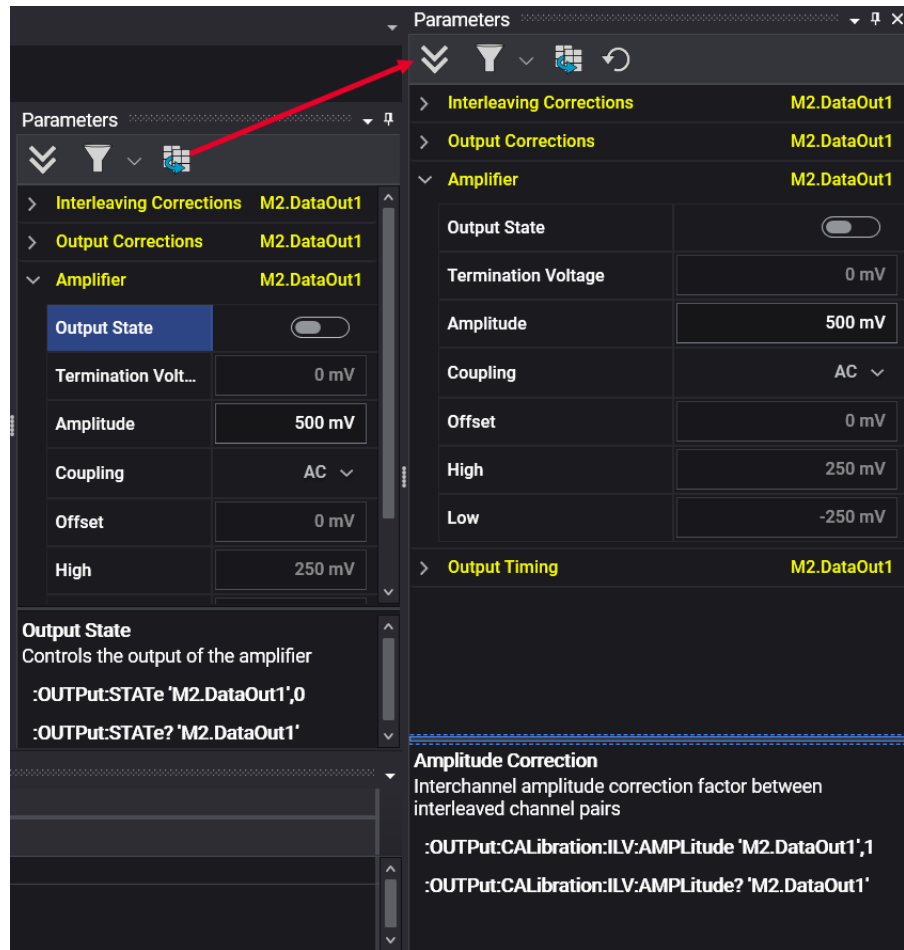
Figure 34   Replicated "Parameters" pane for enhanced usability

Once copied, enabling the auto hide feature docks the copied parameters pane to the right edge of the main user interface. The copied parameters pane pops-up once you click it.

The following figure shows the copied parameters pane docked to the right edge of the main user interface.
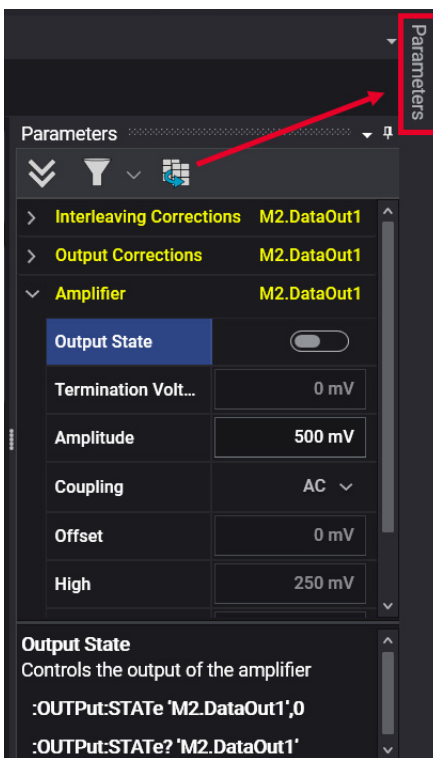
Figure 35   Docked "Parameters" pane in the M8070B SW

- **Display Grid**: Displays the parameters of the selected port/port groups within a grid. The left column contains the parameter names; the right column contains the parameter values.

  In addition, it also allows you to set the parameters of the selected port/port groups.

  The naming convention used for the port/port group is explained with the help of following example:

  M1.DataIn1

  Where,

  - M1 stands for Module1
  - DataIn stands for DataIn port
  - 1 for channel 1

The functional blocks use the different color schemes to represent different channels. You can set the color schemes of each channel from the Setting window. For details on Preferences window, refer to the *M8000 series User Guide*.

·   **Parameter Description area**: Provides the description and related SCPI of the currently selected parameter.

The following figure shows the **Parameter Description area** providing the description and the related SCPI when the termination voltage parameter is selected.
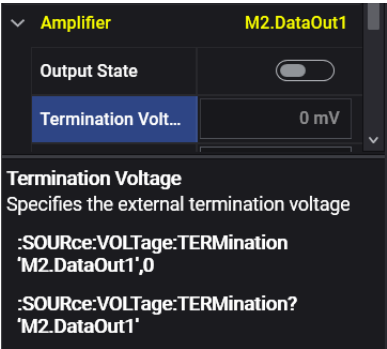
Figure 36   Description / SCPI command info displayed for selected parameter

·   **Copy-Paste Parameters Settings**: The **Parameter pane** allows you to copy all parameter's settings of one location to the another similar location within the same module. This helps to keeps the similar parameter settings for same locations across different channels.
For example, if you want to the copy the parameter's setting of DataOut of channel 1 to DataOut of channel 2, simply right-click DataOut of channel 1, click **Copy** and then right-click DataOut of channel 2, and click **Paste**.

The following figure illustrates how copy-paste of one location to another similar location within a module is done:
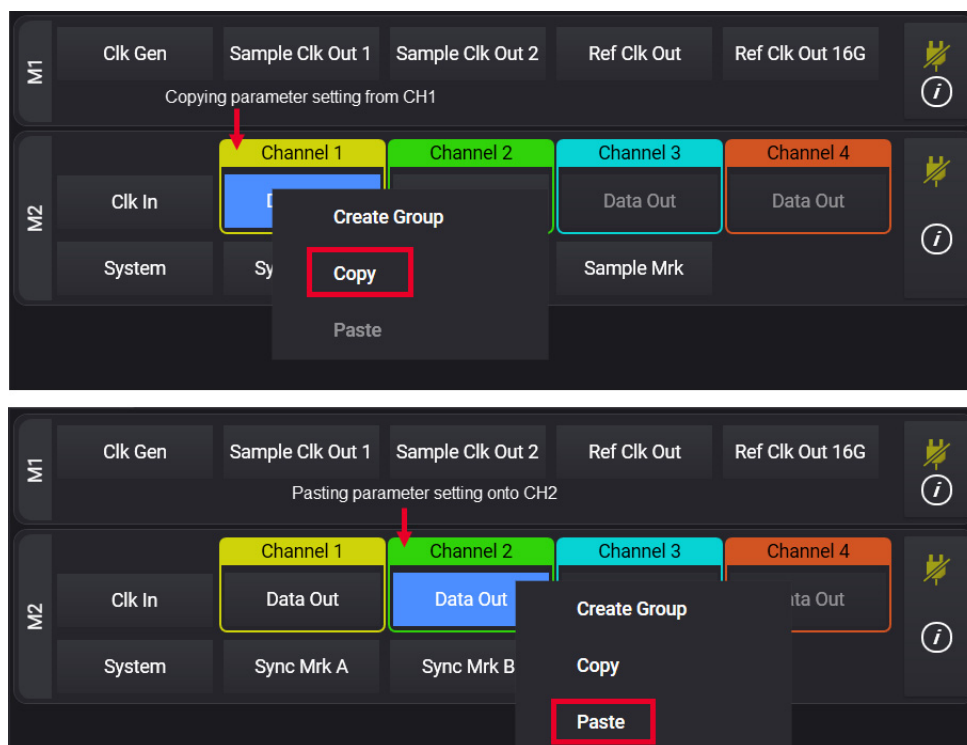
Figure 37   Copying and pasting Parameter settings from one CH to another

Auto Correction Confirmation Dialog

There are several parameters in the M8070B GUI which are interdependent on the settings of other parameters.

An **Auto Correct Confirmation** dialog appears if you try to set a parameter which conflicts with other parameter or in other words is dependent on the settings of other parameter. This dialog display the conflicts encountered and also provides the recommended setting to overcome those conflicts. If you click **Apply** button, the recommended settings will be applied on the M8070B GUI. However, if you click **Discard** button, the previous settings will be applied. The following figure shows an **Auto Correct Confirmation** dialog which is displayed when a user tries to set a ClkGen frequency and it conflicts with ClkOut Output Timing Divider.
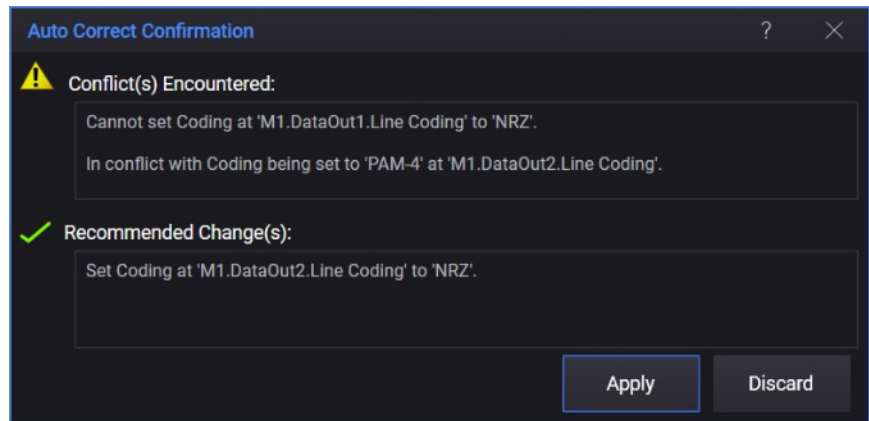
Figure 38   Information displayed on the "Auto Correct Confirmation" dialog

Creating Groups in the Module View

The **Module View** allows you to create a group of available ports and simultaneously allows you to configure their parameters.

To create a group:

· Switch to **Multiple Selection Mode** by pressing ⬚ **Single Selection Mode** icon.
· From your keyboard, hold the Ctrl key and select the ports from the modules. You need to select at least two ports in order to create a group.
· Right-click on the selected ports and click **Create Group** option or

alternatively you can select the ports and click ▦ **Create Group of Selection** icon. A **Create New Group** dialog will appear as shown in the following figure:
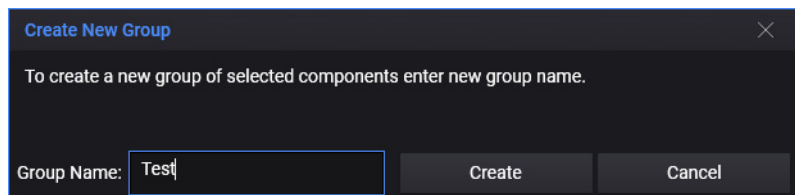
Figure 39   Creating new group in the M8070B SW

• Provide a group name and press **Create**.

A new group will be created in the **Group View**. For more information about the Groups View, refer to the *M8000 Series User Guide*.

3   Using M8070B
Utilities to Manage
AWGs

KEYSIGHT
TECHNOLOGIES

Overview

The M8070B system software provides the following utilities:

- SCPI Recorder
- Self Test Utility
- Licenses Window
- Settings Window
- Logger Window
- SCPI Server Information
- Plug-in Manager Window

In addition, the M8070B system software also provides the following utilities. These will be only available on installing the **Advanced Measurement Package** plugin:

- Script Editor
- DUT Control Interface
- SCPI Editor
- Self Test Utility

For details, on the utilities provided by **Advance Measurement Package**, please refer to *M8000 Series Advanced Measurement Package User Guide*.

NOTE	Please note that the Advanced Measurement Package requires license for its activation. For details on license, see Keysight License Manager on page 113.

For more information regarding the functionality of these utilities, refer to the *M8000 Series User Guide*.

Installing Instrument Drivers in the M8070B System Software

The M8070B system software supports instrument drivers. To use these drivers, it is necessary to install the instrument drivers in the M8070B software. The M8070B software comes with a **Manage Instrument Drivers** utility to simplify all the tasks related to instrument driver management.

This section describes how to use the **Manage Instrument Drivers** utility to install, remove, and update the instrument drivers in the M8070B system software.

Prerequisites for Instrument Driver Installation

· The latest version of M8070B software which is available either on CD or can be downloaded from Keysight web page.

· Instrument driver file which can be downloaded from Keysight web page.

NOTE	Verify your account permissions. Ensure that you have full administrative privileges (run as Administrator) before you install or upgrade the M8050A instrument drivers on a PC running Windows 10. Not doing so may result in an installation failure. Contact your system administrator to provide you the administrative rights.

Locate Documentation

After installing the M8070B software, you will find the required documentation from the Start menu. Select **Keysight M8070B > Keysight M8070B Documentation**.

For module related documents, navigate to:

```
C:\Program Files\Keysight\M8070B\Modules\
%ModuleDriverName%\doc
```

where <ModuleDriverName> is the name of the folder corresponding to the module driver of interest.

You can also visit www.keysight.com/find/m8000 to find the latest versions of related manuals.

How to install an Instrument Driver

The **Manage Instrument Drivers** window enables you to install a instrument driver. To do so, perform the following steps:

1   Download the required instrument driver file from the Keysight web page.

2   Click the 🔲 **Install module driver from file** icon. A standard Window's **Open** dialog appears.

3   Locate the instrument driver file (*.M8KM) which you want to install and click **Open**.

On the successful installation of the instrument driver, a message similar to the following appears:
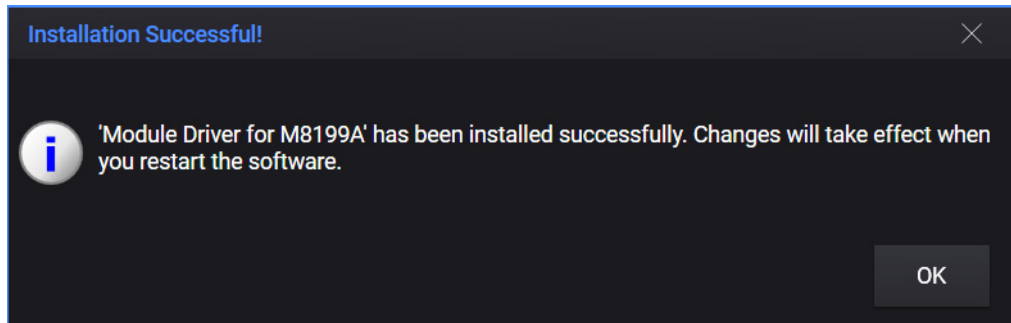
Figure 40   Information displayed after successful installation of module drivers

4   Restart the software. Once you restart the software, the instrument driver state will change to Loaded. Refer to the *M8000 Series User Guide* for information about Instrument States.

NOTE   Ensure to restart the M8070B software for the changes to take effect.

How to remove an Instrument Driver

The **Manage Instrument Drivers** window enables you to uninstall an instrument driver. To do so, perform the following steps:

1   Select the instrument driver from the list.

2   Click on the 🔴 **Uninstall selected module driver** icon or right-click on the selected instrument driver and select **Uninstall Plugin**. The **Uninstall Instrument Driver** dialog appears.
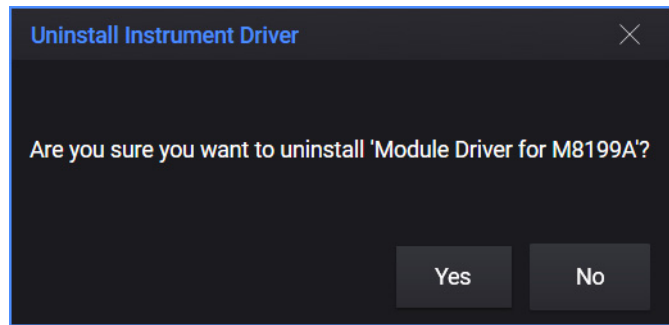
Figure 41   Prompt prior to removing module driver

3   Click **Yes**. If the state of the instrument driver is Installed, it will be immediately removed from the software.

4   However, if the instrument driver is currently in use (**Loaded** or **Not Loaded**), you will receive the following message.
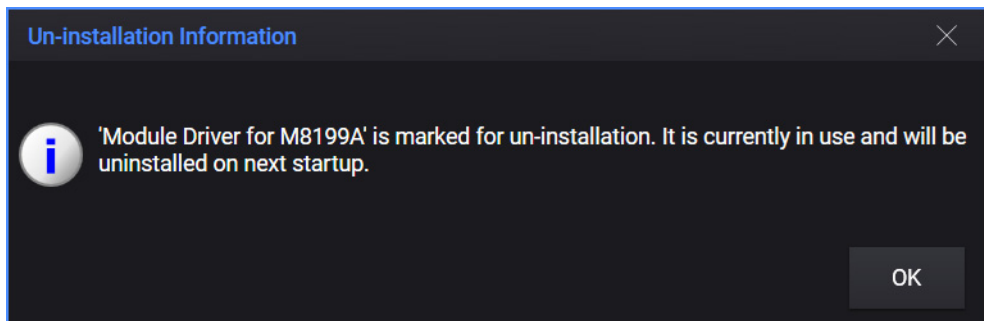
Figure 42   Information displayed after selected module driver is removed

5   Restart the M8070B software. The instrument driver will be removed during the next software startup.

How to update an Instrument Driver

The **Manage Instrument Drivers** window also enables you to update an already installed instrument driver. Perform the following steps to update the instrument driver with its higher version:

1   Download the latest instrument driver file from Keysight web page.

2   Click the 🔲 **Install module driver from file** icon. A standard Window's **Open** dialog appears.

3   Locate the instrument driver file (*.M8KM) you want to update and click **Open**. You will see the following message:

Upgrade instrument driver   ✕

Module Driver for M8199A: Version 1.3.35.2 is already installed, update to version 1.4.7.2?

                                                          Yes   No
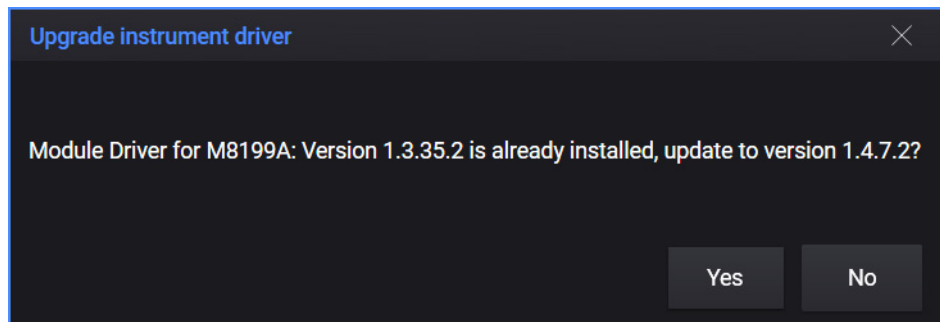
Figure 43   Prompt when initiating module driver upgrade

4   Click **Yes**. If the state of instrument driver is **Installed**, then it will be immediately updated, and the following message will appear:

Installation Successful!   ✕

ℹ 'Module Driver for M8199A' has been installed successfully. Changes take effect after restarting the software.

                                                                   OK
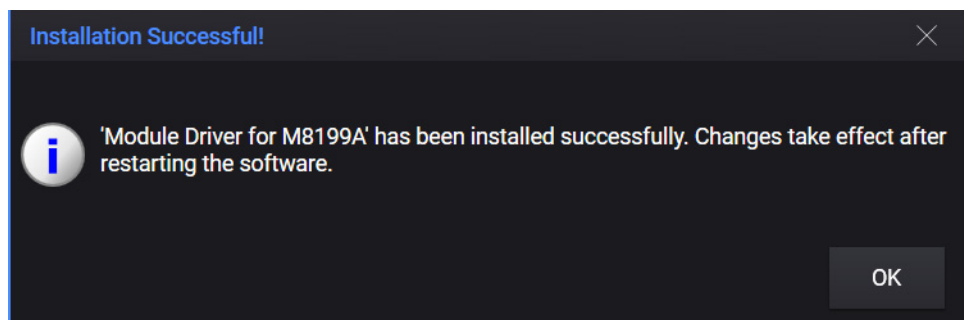
Figure 44   Information displayed after the module driver has been updated

5   Click **OK**. The previous instrument driver automatically removed and replaced with the new version of that instrument driver.

For the installation procedure, see How to install an Instrument Driver on page 68.

NOTE	Make sure that you restart the M8070B software for the changes to take effect.

The **Manage Instrument Drivers** window does not directly allow you to downgrade an installed instrument driver to a previous (lower) version. If you try to do so, it will give the following error message:
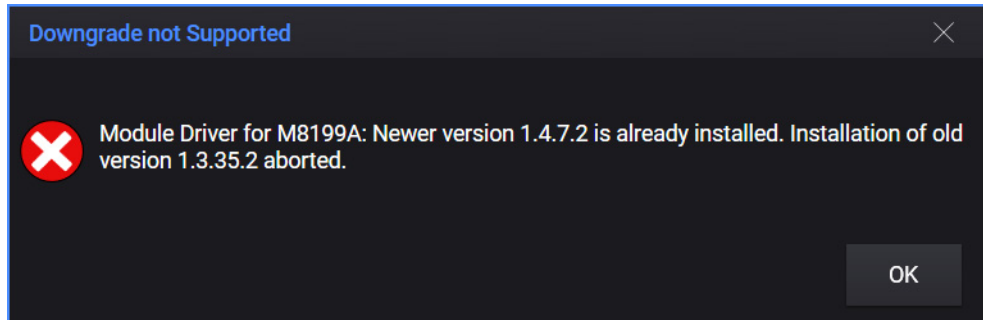
Figure 45   Error prompt when attempting to downgrade the driver version

In this case, you must first remove the instrument driver and then install the required previous (lower) version of that instrument driver again.

How to Access an Installed Instrument Driver through M8070B User Interface

Perform the following steps to access an installed instrument driver through the M8070B user interface:

1   Click **Start** menu and go to **All Programs > Keysight M8070B** and click **Keysight M8070B**.

2   Select the instrument driver from **M8070B Startup Options** dialog box.

3   Click **OK**.

The instrument driver user interface appears in the M8070B software.
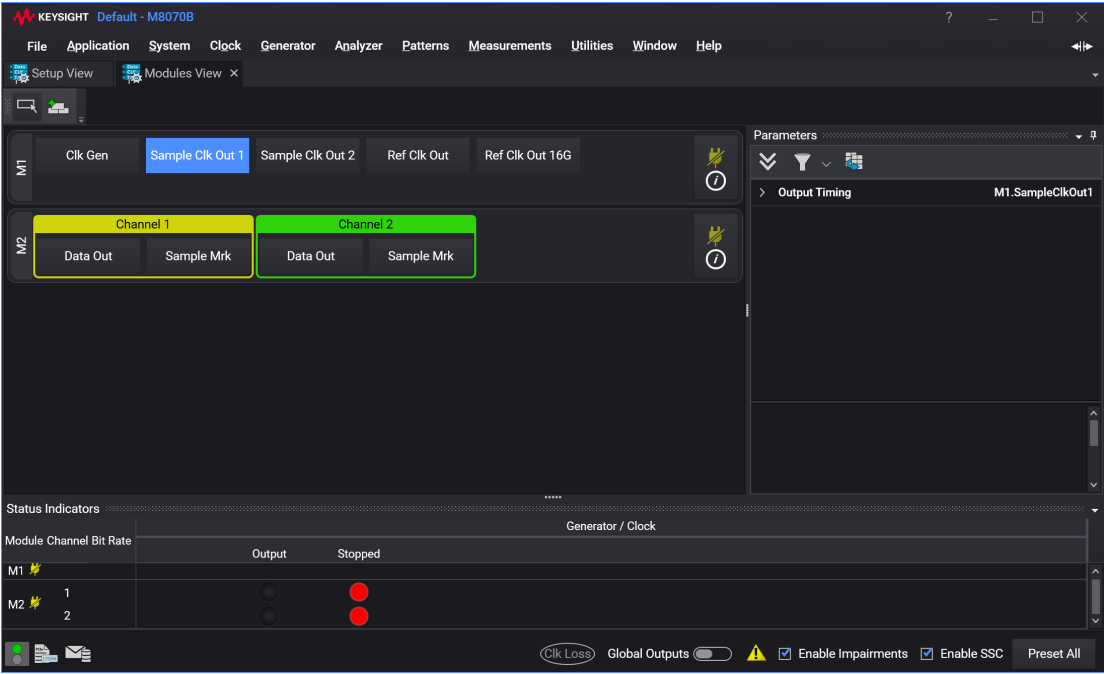
Figure 46   Default appearance of modules in the M8070B SW

4   # Controlling AWGs using the M8070B software

KEYSIGHT
TECHNOLOGIES

Overview

The M8070B system software allows you to control the M8100-series AWGs along with the M8008A clock modules. Once an AWG module is installed into an AXIe chassis, it can be accessed via the M8070B software. Ensure that you have latest version of M8070B software installed in your system.

Visit the respective URL for product specifications pertaining to AWGs:

· M8198A AWG — www.keysight.com/find/M8198A

· M8199A AWG — www.keysight.com/find/M8199A

· M8199B AWG — www.keysight.com/find/M8199B

Visit the following URL to download the IQTools software: www.keysight.com/find/IQTools

Controlling M8198A AWG from the M8070B User Interface

The M8198A AWG is controlled by the M8070B software system. Ensure that you have M8070B software version 10.5 or later installed on your system. Also, ensure that you have installed the M8198A module driver in the M8070B software. The module driver file can be downloaded from Keysight web page www.keysight.com.

For complete details on how to install, update or remove module drivers, refer to the Installing Instrument Drivers in the M8070B System Software on page 67.

For information on M8198A remote programming, refer to the M8100 Series Programming Guide.

For complete details on M8198A Arbitrary Waveform Generator, visit www.keysight.com/find/M8198A.

Once the M8198A AWG module is installed into an AXIe chassis, it can be accessed via the M8070B software. Follow the given steps to access the module driver user interface from M8070B Software:

1   In Windows, click **Start › Keysight M8070B › Keysight M8070B**.

2   Select the package driver (for example; M8198A) from the **M8070B Startup Options** dialog box. For details on the **M8070B Startup Options** dialog box, refer to Launching M8070B User Interface on page 38.

3   Click **OK**. The M8070B software user interface should now appear on your screen.

M8198A AWG and M8008 Clock Generator in Module View

Once the M8198A and M8008A integration is done, you will see the module's entry in the **Module View**.

The following figure shows the **Module View** of M8198A and M8008A:
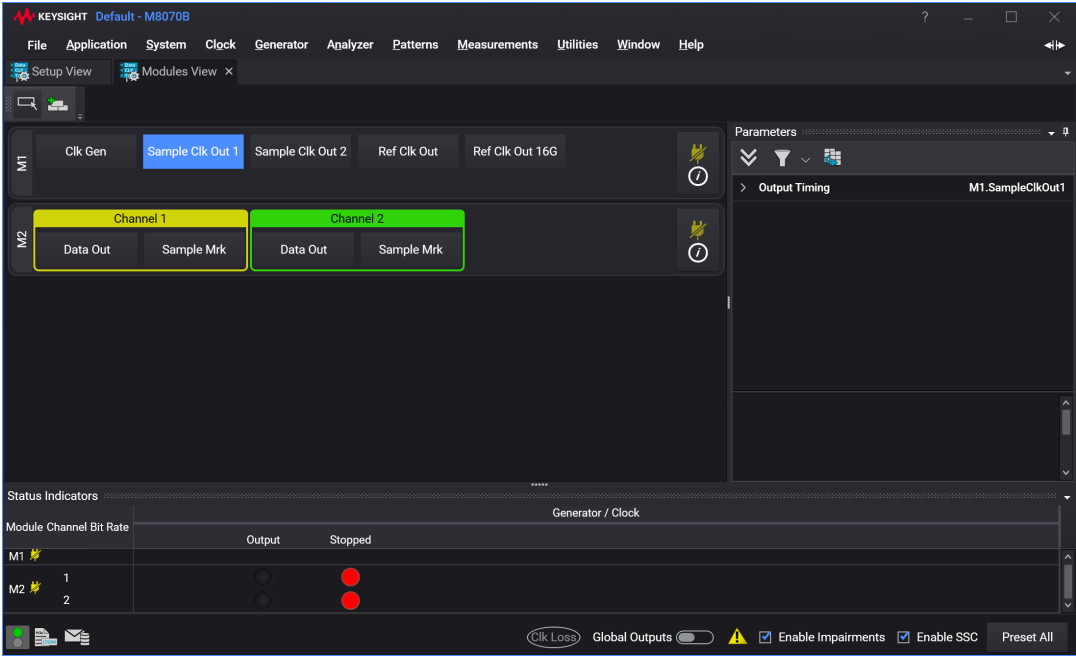
Figure 47   Default Modules view of M8198A and M8008A modules

M8198A and M8008A Parameters Configuration

The following figure shows parameters provided by M8198A AWG.
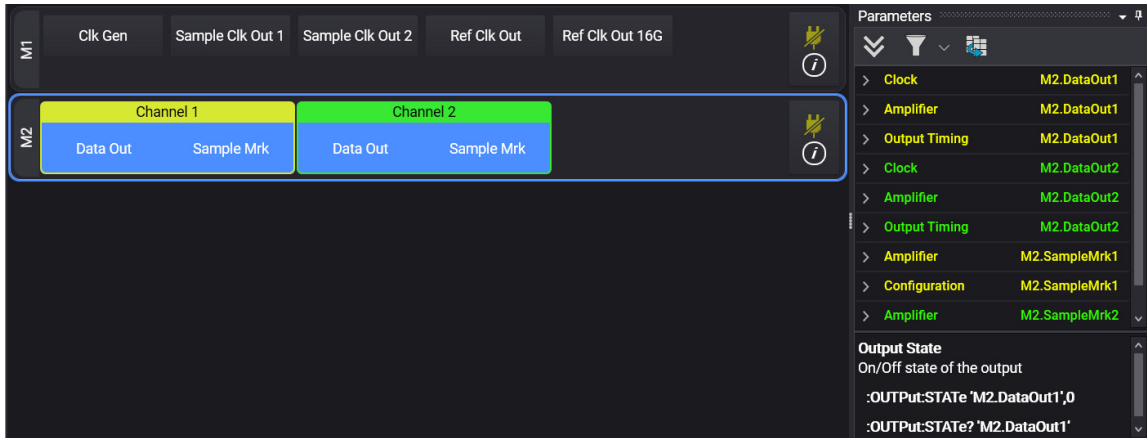
Figure 48   M8198A AWG parameters supported in M8070B SW

M8198A AWG Parameters

The M8198A AWG has a Clk In port each for Channel 1 & 2 along with Data Out and Sample Mrk ports for Channels 1 & 2, respectively. You can use the **Parameters** pane to configure the ports in Channel 1 & 2.

· **CH 1 Clk In / CH 2 Clk In** – The Clk In port has the following options:
  ▪ **Sample Rate** – Sets the sample frequency of the output DAC for the currently selected reference clock (such as M8008A Clock module) and its range.
· **Data Out (Channel 1/2)** – The Data Out port has the following options:
  ▪ **Clock**
    · **Sample Rate** – The sampling rate of the Channel (units in Samples/second).
  ▪ **Amplifier** – The Amplifier function has the following options:
    · **Output State** – Enables or disables the state of the output.
    · **Coupling** – Sets the AC or DC coupled connection to DUT.
    · **Amplitude** – Sets the amplitude of the output signal.
    · **Offset** – Sets the offset voltage of the output signal.

- **High** – Sets the high voltage level of the output signal.
- **Low** – Sets the low voltage level of the output signal.
    - **Output Timing**
        - **Delay** – Sets the channel-specific delay on the output signal.
- **Sample Mrk** – The Sample Mrk function has the following options:
    - **Amplifier** – The Amplifier function has the following options:
        - **Output State** – Enables or disables the state of the output.
        - **Termination Voltage** – Sets the external termination voltage.
        - **Amplitude** – Sets the amplitude of the output signal.
        - **Offset** – Sets the offset voltage of the output signal.
        - **High** – Sets the high voltage level of the output signal.
        - **Low** – Sets the low voltage level of the output signal.
    - **Configuration** – The Configuration function has the following options:
        - **Divider** – Sets the divider for subrate clock generation.
        - **Subrate Frequency** – Automatically configured based on the sample rate of the corresponding Data Out and divider value. For example, if Sample rate for Data Out on Channel 1 is set to 128 GSa/s and the Divider value is configured to 16, the Subrate Frequency is calculated as:

            Subrate Frequency = Sample Rate / Divider

For information on remote programming of these M8198A parameters, refer to the *M8100 Series Programming Guide*.

M8008A Clock Generator Parameters

The M8008A clock module has the Clk Gen, Sample Clk Out 1/2, Ref Clk Out and Ref Clk Out 16G ports. You can use the **Parameters** pane to configure these ports.

- **Clk Gen** – The Clk Gen port has the following synthesizer settings:
    - **Synthesizer**
        - **Source** - Select a triggering source.
            - Internal – An internal reference clock source is used.
            - Reference – An external 10 MHz or 100 MHz reference clock source is used.

- Direct – An external clock source is used whose direct frequency is in the range of:
  - 7.95 GHz to 16.25 GHz if M8008A module is used as standalone.
  - 12.5 GHz to 16.25 GHz if M8008A module is used along with M8198A AWG.

ii **Reference Frequency** – Set the reference clock source.

- For internal clock source, set reference frequency as AXIe 100 MHz or Internal 100 MHz
- For reference clock source, set reference frequency of the external clock source as 10 MHz or 100 MHz
- For direct clock source, the frequency of the external clock source measured at the Ref Clk Out port of the M8008A clock module is applied.

iii **Frequency** – Set the system frequency. Depending on the instrument configuration, it will be either frequency or sample rate. If M8008A is used standalone, it will be frequency on M8008A module. For the M8008A+M8198A configuration, it will set sample rate on M8198A.

iv **Period** – Set the system period. The period is the reciprocal value of the system frequency. This is provided as a convenience for those who prefer period instead of frequency.

- **Sample Clk Out 1** – Sets the frequency at Sample Clk Out 1 port in Hz.
  - **Output Timing**:
    - i **Frequency** – Sets the clock output frequency.
- **Sample Clk Out 2** – Sets the frequency at Sample Clk Out 2 port in Hz.
  - **Amplifier**:
    - i **Output State** – Enables power output state.
    - ii **Power** – Sets the power output in dBm.
  - **Output Timing**:
    - i **Frequency** – Sets the clock output frequency.
- **Ref Clk Out** – Sets the frequency 10 MHz or 100 MHz at Ref Clk Out.
  - **Output Timing**:
    - i **Frequency** – Sets the clock output frequency.
- **Ref Clk Out 16G** – Controls the output of Ref Clk Out 16G.

- **Output Timing**:
  - i **Output State** – Enables the output on the Ref Clk Out 16G port. Note that enabling / disabling Global Outputs does not affect this state.
  - ii **Divider** – Divides the output signal by the factor defined in this setting.
  - iii **Frequency** – Sets the clock output frequency on this port.

For information on M8008A remote programming using SCPI commands, refer to the *M8100 Series Programming Guide*.

Connecting M8008A Clock Source to M8198A AWG Module

NOTE	The unused output should be disabled on the M8070B software or terminated with 50 Ohms on the module hardware.

Following are the possible ways to connect a M8008A clock source to the M8198A AWG module(s):

Case 1   Connecting M8008A clock module to a single channel of the M8198A AWG module

In this case, an M8008A clock module, one M8198A AWG modules an M9505A AXIe chassis and the following cables are required:

- 3.5 mm, 50 cm M8199A-811 customer orderable sync cable (M8199-61620)
- 1.85 mm, 45 cm M8199A-810 replacement channel clock cable (M8199-61624)

Make the connections as described below:

1 Connect the M8008A Clock Generator Sync Out port with the M8198A AWG Sync In port using the sync cable (blue cable).
2 Connect the M8008A Clock Generator Sample Clock Out port with the M8198A AWG Clock In port for a Channel using clock cable (red cable).

Figure 56 shows how to connect M8008A clock generator module to a single channel of the M8198A AWG modules:
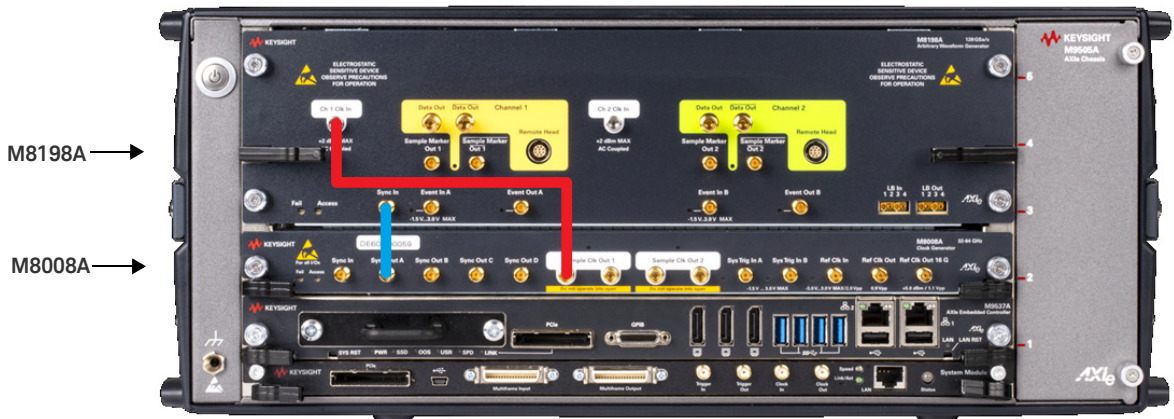
Figure 49   Connecting M8008A clock generator to a single channel of M8198A AWG

Case 2   Connecting M8008A clock module to two channels on an M8198A AWG modules

In this case, an M8008A clock module, one M8198A AWG module, an M9505A AXIe chassis and the following cables are required:

- 3.5 mm, 50 cm M8199A-811 customer orderable sync cable (M8199-61620)
- 1.85 mm, 45 cm M8199A-810 replacement channel clock cable (M8199-61624)

Make the connections as described below:

1   Connect the M8008A Clock Generator Sync Out port with the M8198A AWG Sync In port using the sync cable (blue cable).

2   Connect the M8008A Clock Generator Sample Clock Out ports with both M8198A AWG Clock In ports for each Channel using clock cable (red cable).

Figure 57 shows how to connect M8008A clock generator module to the two channels of an M8198A AWG module:
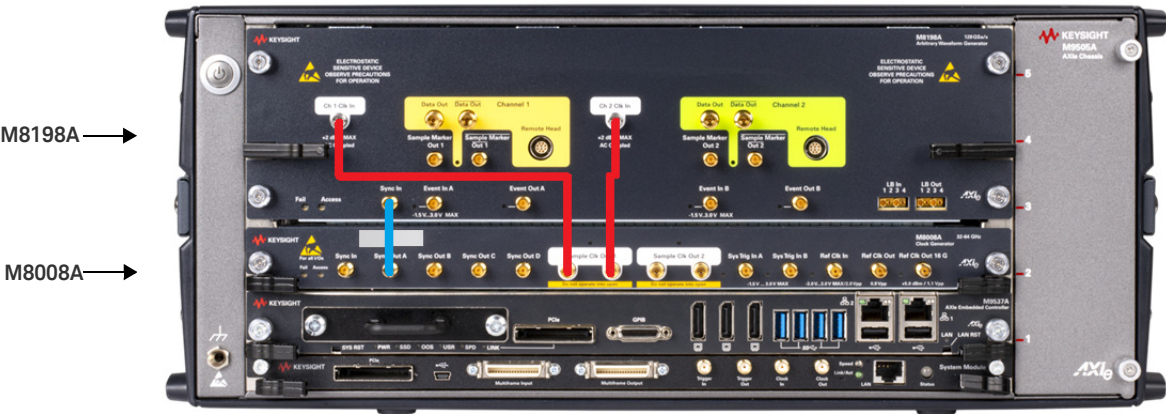
M8198A →

M8008A →

Figure 50   Connecting M8008A clock generator to two channels of M8198A AWG

| NOTE | Enable the Ref Clk Out port in the primary chassis using the web interface. For details, refer to *Keysight M9505A AXIe Chassis Startup Guide*. |

For information on remote programming of the M8198A modules, refer to the *M8100 Series Programming Guide*.

Controlling M8199A AWG from the M8070B User Interface

The M8199A AWG is controlled by the M8070B software system. Ensure that you have M8070B software version 7.5 or later installed on your system. Also, ensure that you have installed the M8199A module driver in the M8070B software. The module driver file can be downloaded from Keysight web page www.keysight.com.

For complete details on how to install, update or uninstall module drivers, refer to the Installing Instrument Drivers in the M8070B System Software on page 67.

For information on M8199A remote programming, refer to the *M8100 Series Programming Guide*.

For complete details on M8199A Arbitrary Waveform Generator, visit www.keysight.com/find/M8199A.

Once the M8199A AWG module is installed into an AXIe chassis, it can be accessed via the M8070B software. Follow the given steps to access the module driver user interface from M8070B Software:

1   In Windows, click **Start > Keysight M8070B > Keysight M8070B**.

2   Select the package driver (for example; M8199A) from the **M8070B Startup Options** dialog box. For details on the **M8070B Startup Options** dialog box, refer to Launching M8070B User Interface on page 38.

3   Click **OK**. The M8070B software user interface should now appear on your screen.

M8199A AWG and M8008 Clock Generator in Module View

Once the M8199A and M8008A integration is done, you will see the module's entry in the **Module View**.

The following figure shows the **Module View** of M8199A and M8008A:
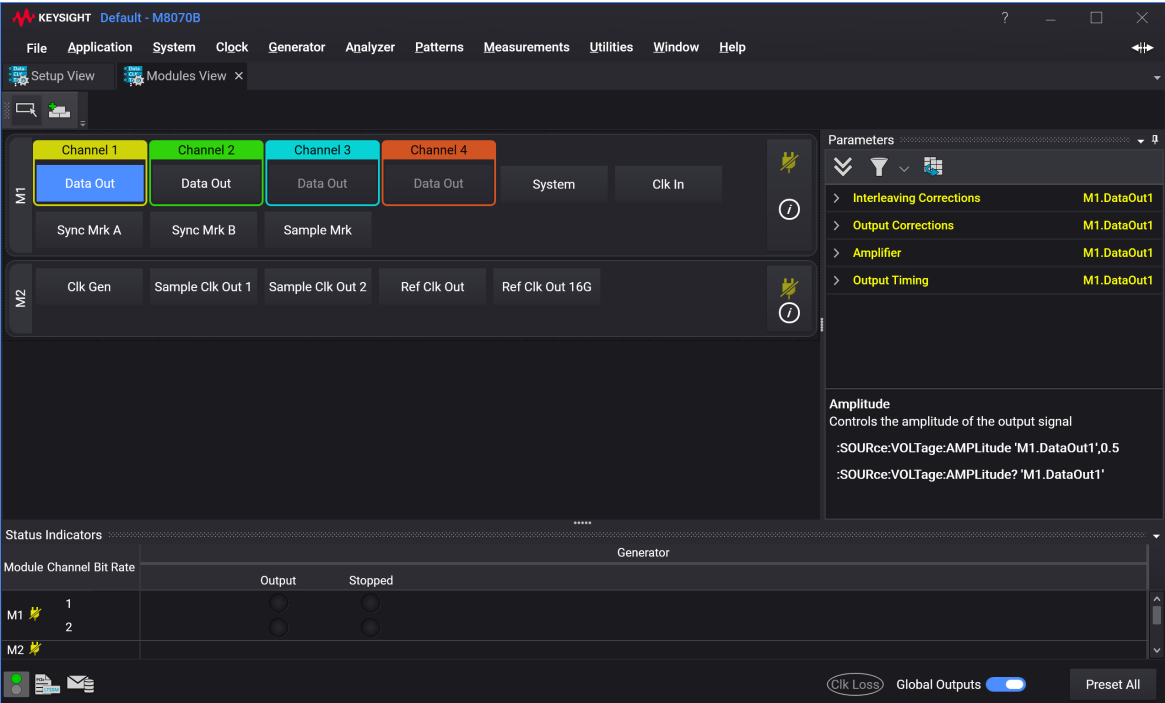
Figure 51   Module view of M8199A AWG and M8008A clock modules

M8199A and M8008A Parameters Configuration

The following figure shows parameters provided by M8199A and M8008A:
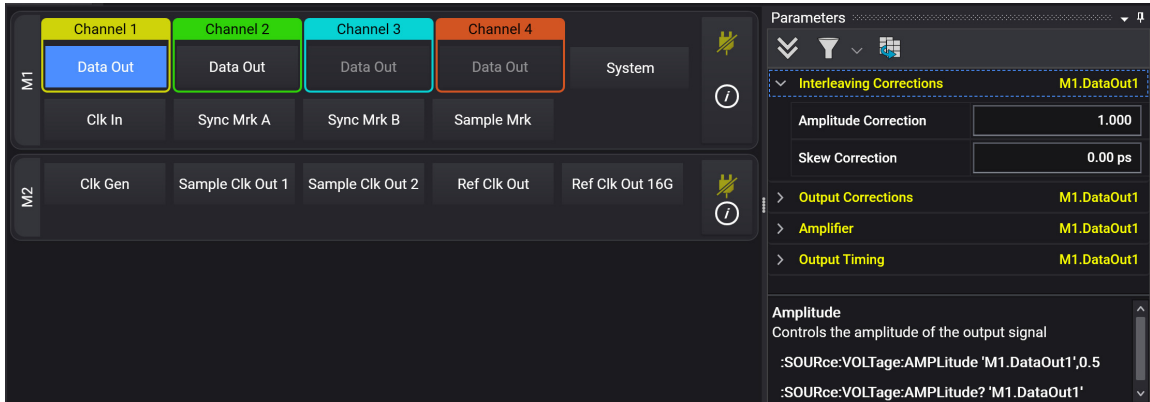
Figure 52   Parameters displayed for the selected port on M8199A module view

M8199A AWG Parameters

The M8199A AWG has the ClkGen, Data Out, Sync Mrk A/B and Sample Mrk ports. You can use the **Parameters** window to configure these ports.

· **Data Out (Channel 1/2/3/4)** – The Data Out port has the following options:

  ▪ **Interleaving Corrections**

    · **Amplitude Corrections** – Sets the amplitude correction factor between the two internally interleaved channels.

    · **Skew Corrections** – Sets the skew between the two internally interleaved channels.

  ▪ **Output Corrections**

    · **Peaking** – Adds a correction value to the peaking adjustment.

  ▪ **Amplifier** – The Amplifier function has the following options:

    · **Output State** – Enables or disables the state of the output.

    · **Termination Voltage** – Sets the external termination voltage of the output signal.

    · **Amplitude** – Sets the amplitude of the output signal.

    · **Coupling** – Sets the AC or DC coupled connection to DUT.

- **Offset** – Sets the offset voltage of the output signal.
- **High** – Sets the high voltage of the output signal.
- **Low** – Sets the low voltage of the output signal.
- **Output Timing**
  - **Delay** – Sets the channel-specific delay on the output signal.
- **System** – The System port has the following options:
  - **Combiner S/N** – Sets the serial number of attached passive combiner. An empty string indicates no combiner is attached.
  - **Interleaving Mode** – Enables or disables interleaving mode.
- **Clock In** - The Clock IN port has the following option:
  - **Sample Rate** – Sets the sample frequency of the output DAC for the currently selected reference clock and its range.
- **Sync Mrk A/B** – The Sync Mrk A/B function has the following options:
  - **Amplifier** – The Amplifier function has the following options:
    - **Output State** – Enables or disables the state of the output.
    - **Amplitude** – Sets the amplitude of the output signal.
    - **Offset** – Sets the offset voltage of the output signal.
    - **High** – Sets the high voltage of the output signal.
    - **Low** – Sets the low voltage of the output signal.
- **Sample Mrk** – The Sample Mrk function has the following options:
  - **Amplifier** – The Amplifier function has the following options:
    - **Output State** – Enables or disables the state of the output.
    - **Termination Voltage** – Sets the external termination voltage.
    - **Amplitude** – Sets the amplitude of the output signal.
    - **Offset** – Sets the offset voltage of the output signal.
    - **High** – Sets the high voltage of the output signal.
    - **Low** – Sets the low voltage of the output signal.

For information on M8199A remote programming, refer to the *M8000 Series Programming Guide*.

M8008A Clock Generator Parameters

The M8008A clock generator module has the Clk Gen, Sample Clk Out 1/2, Ref Clk Out and Ref Clk Out 16G ports. You can use the Parameters window to configure these ports.

· **Clk Gen** – The Clk Gen port has the following options:
  · **Source** - Selects the different trigger modes. Currently it supports internal and external reference clock.
  · **Reference Frequency** – Sets reference clock source as internal or AXIframe.
  · **Frequency** – Sets the system frequency. Depending on the instrument configuration, it will be either frequency or sample rate. If M8008A is used standalone, it will be frequency on M8008A module. In case of M8008A+M8199A configuration, it will set sample rate on M8199A.
  · **Period** – Sets the system period. The period is the reciprocal value of the system frequency. This is provided as a convenience for those who prefer period instead of frequency.
· **Sample Clk Out 1/2** – Sets the frequency at RefClockOut in Hz.
· **Ref Clk Out** – Sets the frequency 10 MHz or 100 MHz at RefClockOut.
· **Ref Clk Out 16G** – Controls the output of Ref Clk Out 16G.

For information on SCPI commands for remote programming of M8008A clock generator, refer to the *M8100 Series Programming Guide*.

Interleaving Option (M8199A-ILV)

The interleaving option (M8199A-ILV) consists of a total of four power combiners that are connected to the outputs of the M8199A. For mechanical stability, the power combiners are mounted in a metal housing that is screwed onto the front panel of the M8199A making the setup mechanically stable and this avoids phase induced instabilities of the signal. The interleaving option is attachable and detachable.

Using the interleaving technique, the sample rate of the AWG can be doubled, at the expense of cutting the number of channels in half. That is, a 4-channel M8199A can have two 256 GSa/s channels, while a 2-channel M8199A will have one 256 GSa/s channel with the ILV Option. The interleaving option supports always combining four channels at 128 GSa/s combined to two channels at 256 GSa/s.

The skew calibration between the channels is handled by the M8070B system software.

Connecting M8199A-ILV to the M8199A Instrument

Follow the given steps to connect M8199A-ILV assembly to M8199A instrument:

1   Remove the M8199A instrument from the AXIe Chassis.

2   Place M8199A instrument and M8199A-ILV on a flat surface (for example on a desk).

3   Move M8199A-ILV to the front panel of the M8199A instrument as in the following figure.
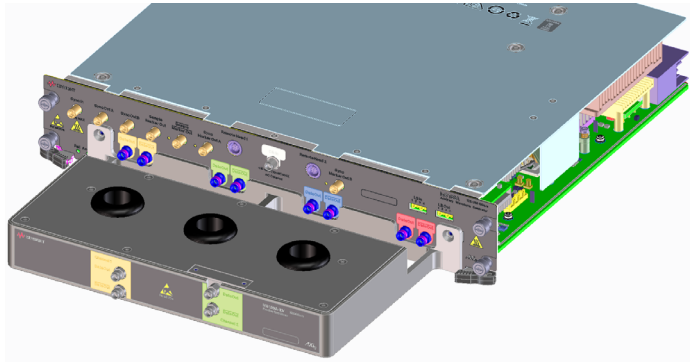
Figure 53   Moving M8199A-ILV to the front panel of M8199A

4   Fix it with 2x screw 0515-2741 and a long screwdriver Torx T20 or with screwdriver 8710-2904.

Figure 54   Fixing M8199A-ILV to M8199A using screws

5   Screw torque will be each screw 1.7 Nm.

6   Place the 8x connectors of the M8199A-ILV on the plugs available on the M8199A front panel.

7   Screw the nut of the connector by hand until you are sure that the nut runs in the thread.

8   Use the torque wrench (8710-1765) to fix the nut with the right torque (0.9 Nm) at all eight connectors of the M8199A-ILV. The required torque for 1.85 mm connectors is 0.9 Nm (8lb-inch).

Figure 55   Tightening the M8199A-ILV to the M8199A front panel

9   Mount the M8199A instrument together with M8199A-ILV back to the AXIe Chassis.

Connecting M8008A Clock Source to M8199A AWG Module

NOTE	The unused output should be disabled on the M8070B software or terminated with 50 Ohms on the module hardware.

Following are the possible ways to connect a M8008A clock source to the M8199A AWG module(s):

Case 1   **Connecting M8008A clock module to M8199A AWG module**

In this case, make the connections as described below:

1   Connect the 1.85 mm, 45 cm M8199A-810 replacement channel clock cable (M8199-61624) from Sample Clk Out of M8008A to Clk In of M8199A.

2   Connect the 3.5 mm, 50 cm M8199A-811 sync cable (M8199-61620) from Sync Out of M8008A to Sync In of M8199A.

Figure 56 shows how to connect the M8008A clock generator module to the M8199A AWG module:

Figure 56   Connecting M8008A clock generator to M8199A AWG module

Case 2   Connecting PSG to M8199A module

Keysight M8257D, Opt. 567, 1EU, UNY (referred to as PSG) is an alternative to the M8008A clock module that can be used as a clock source. In this case, connect the 1.85 mm, 45 cm M8199A-810 replacement channel clock cable (M8199-61624) from the PSG Output to Clk In of M8199A.

The output power needs to be set at the PSG for various sample clock frequencies. The output power level should start at 7 dBm at 50 GHz and should be increased linearly to 11 dBm at 60 GHz. This means, as we increase the frequency from 50 GHz to 60 GHz, there is a linear increase in the output power from 7 dBm to 11 dBm. Above 60 GHz, a power level of 11 dBm should be used.

The following table shows the required output power level at different frequencies:

Frequency (GHz)	Amplitude (dBm)
50	7
51	7.4
52	7.8
53	8.2
54	8.6
55	9
56	9.4
57	9.8
58	10.2
59	10.6
60	11
61	11
62	11
63	11
64	11

Case 3   Connecting M8008A clock module to two M8199A AWG modules

In this case, a M8008A clock module, two M8199A AWG modules, an M9505A AXIe chassis and the following cables are required:

- 3.5 mm, 50 cm M8199A-811 customer orderable sync cable (M8199-61620)
- 1.85 mm, 45 cm M8199A-810 replacement channel clock cable (M8199-61624)

Make the connections as described below:

1   Connect the M8008A Clock Generator Sync Out port with both the M8199A AWG Sync In ports using the sync cable (blue cable).

2   Connect the M8008A Clock Generator Sample Clock Out port with both the M8199A AWG Clock In ports using clock cable (red cable).

Figure 57 shows how to connect M8008A clock generator module to the two M8199A AWG modules:
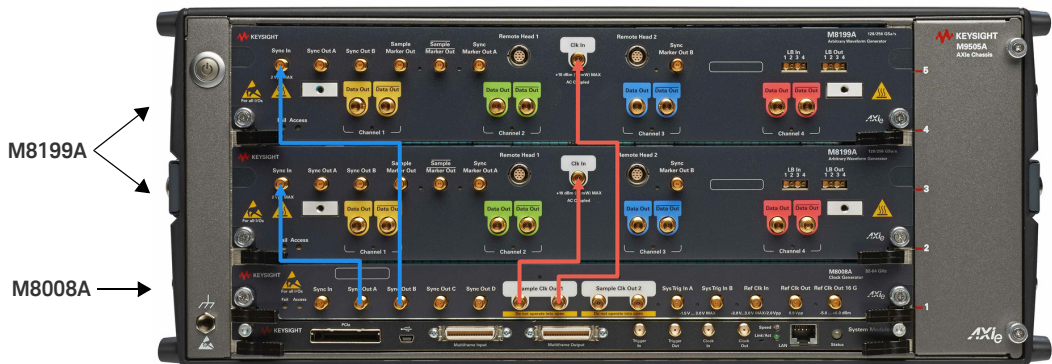
Figure 57   Connecting M8008A clock generator to two M8199A AWG modules

Case 4   Connecting M8008A clock module to four M8199A AWG modules

In this case, a M8008A clock module, four M8199A AWG modules, two M9505A AXIe chassis and the following cables are required:

- 3.5 mm, 50 cm M8199A-811 customer orderable sync cable (M8199-61620)
- 1.85 mm, 45 cm M8199A-810 replacement channel clock cable (M8199-61624)

Make the connections as described below:

1   Connect the M8008A Clock Generator Sync Out port with all the four M8199A AWG Sync In ports using sync cable (blue cable).

2   Connect the M8008A Clock Generator Sample Clock Out port with all the four M8199A AWG Clock In ports using clock cable (red cable).

Figure 58 shows how to connect M8008A clock generator module to the four M8199A AWG modules:
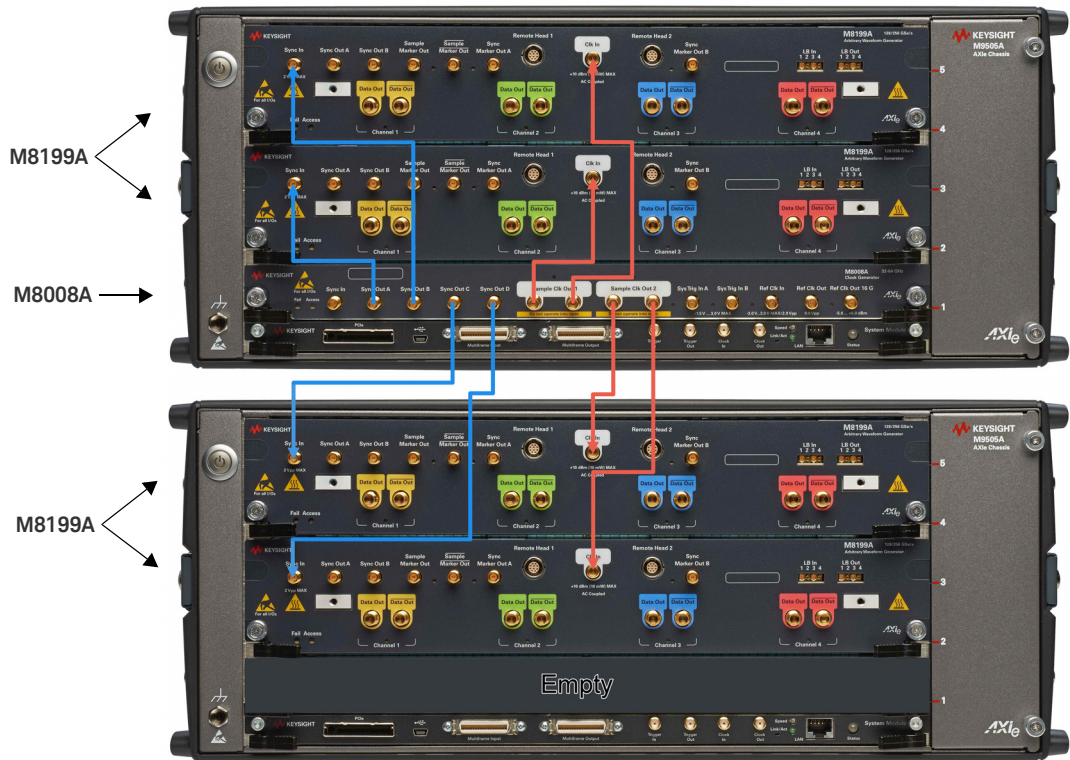

Figure 58   Connecting M8008A clock generator to four M8199A AWG modules

NOTE   Enable the Ref Clk Out port in the primary chassis using the web interface. For details, refer to *Keysight M9505A AXIe Chassis Startup Guide*.

For information on SCPI commands required for the remote programming of the M8199A modules, refer to the *M8000 Series Programming Guide*.

Enabling/Disabling the Interleaving Mode

There are two different interleaving (ILV) modes:

- **Non interleaved**: This mode is active when no combiner serial no. is registered, and no remote head is connected.
- **Interleaved**: This mode is active when a combiner serial no. is registered, or a remote head is connected. Interleaved mode is active when a remote head is connected even though no combiner serial no. is registered. The connection of a remote head is only checked at startup.

NOTE	The registered combiner serial no. is persistently stored on the module.

To enable the ILV, do the following:

1 Go to **Parameters** > **Interleaving** > **Combiner S/N**.
2 Enter the serial no. of the ILV option (Combiner) into the **Combiner S/N** text field.
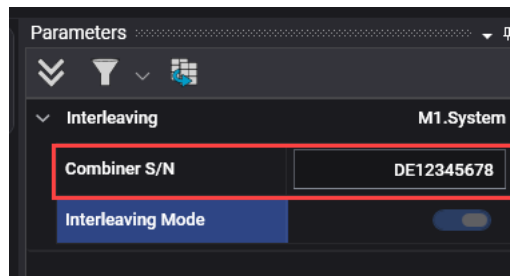

Figure 59

3 Restart the M8070B application. After the restart, the ILV mode will be enabled.

To disable the ILV, do the following:

1 Go to **Parameters** > **Interleaving** > **Combiner S/N**.
2 Delete the serial no. in the **Combiner S/N** text field and press **Enter**.
3 Restart the M8070B application. After the restart, the ILV mode will be disabled.

Controlling M8199B AWG from the M8070B User Interface

The M8199B AWG is controlled by the M8070B software system. Ensure that you have M8070B software version 9.5 or later installed on your system. Also, ensure that you have installed the M8199B module driver in the M8070B software. The module driver file can be downloaded from Keysight web page www.keysight.com.

For complete details on how to install, update or remove module drivers, refer to the Installing Instrument Drivers in the M8070B System Software on page 67.

For information on M8199B remote programming, refer to the *M8100 Series Programming Guide*.

For complete details on M8199B Arbitrary Waveform Generator, visit www.keysight.com/find/M8199B.

Once the M8199B AWG module is installed into an AXIe chassis, it can be accessed via the M8070B software. Follow the given steps to access the module driver user interface from M8070B Software:

1   Click **Start > Keysight M8070B > Keysight M8070B**.

2   Select the package driver (such as M8199B) from the **M8070B Startup Options** dialog box. For details on the **M8070B Startup Options** dialog box, refer to Launching M8070B User Interface on page 38.

3   Click **OK**. The M8070B software user interface should now appear on your screen.

M8199B AWG and M8008 Clock Generator in Modules View

Once the M8199B and M8008A integration is done, the module's entry is available in the **Modules View**.

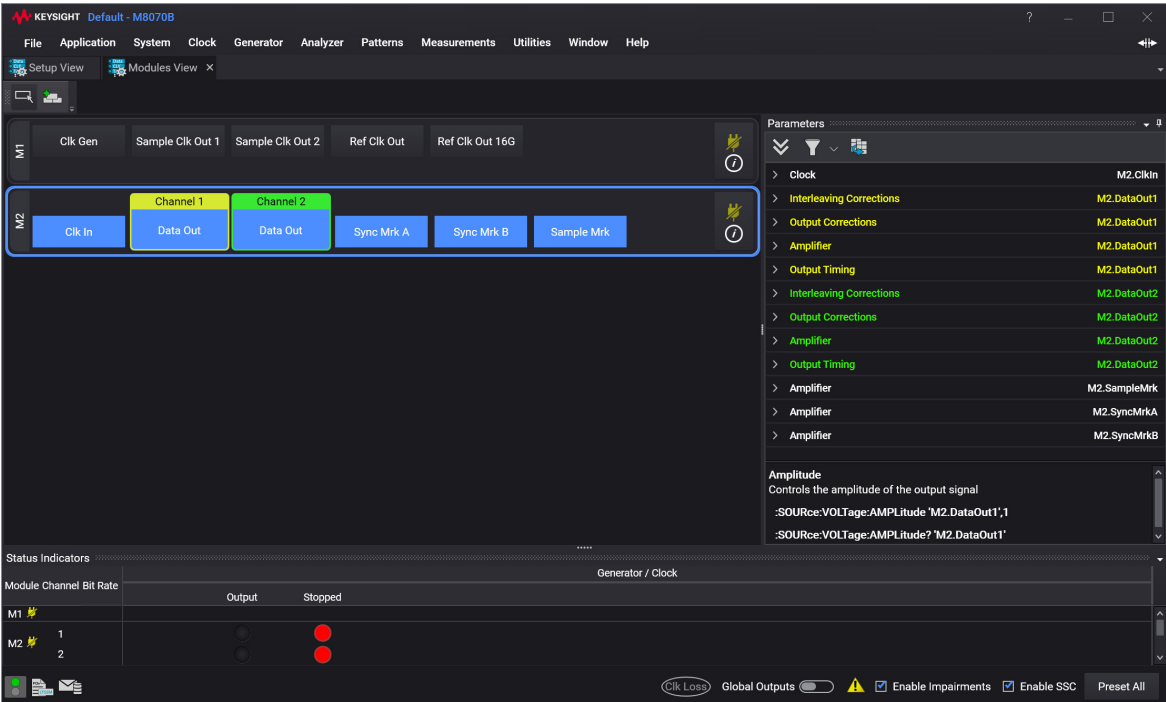Figure 60 shows the **Modules View** of M8199B and M8008A:

Modules view in M8070B software displaying M8199B and M8008A

M8199B and M8008A Parameters Configuration

M8199B AWG Module Parameters

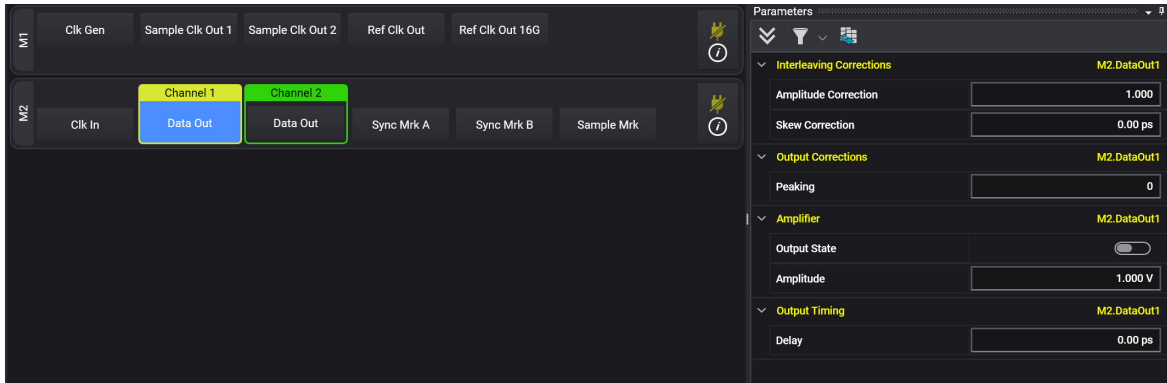Figure 61 shows parameters available to configure the M8199B modules:

Figure 61   Parameters available for the M8199B AWG

The M8199B AWG has the Clk In, Data Out, Sync Mrk A/B and Sample Mrk ports. You can use the **Parameters** window to configure these ports.

· **Clk In** – The Clk In port has the following options:
  · **Sample Rate** – Sets the sample frequency of the output DAC for the currently selected reference clock and its range.

· **Data Out (Channel 1/2)** – The **Data Out** port has the following options:
  · **Interleaving Corrections**
    · **Amplitude Correction** – Sets the amplitude correction factor between the two internally interleaved channels.
    · **Skew Correction** – Sets the skew between the two internally interleaved channels.
  · **Output Corrections**
    · **Peaking** – Adds a correction value to the peaking adjustment.
  · **Amplifier** – The Amplifier function has the following options:
    · **Output State** – Enables or disables the state on the output.
    · **Amplitude** – Sets the amplitude on the output signal.
  · **Output Timing**
    · **Delay** – Sets the channel-specific delay on the output signal.

· **Sync Mrk A/B** – The Sync Mrk A/B function has the following options:

· **Amplifier** – The Amplifier function has the following options:
  · **Output State** – Enables or disables the state on the output.
  · **Amplitude** – Sets the amplitude on the output signal.
  · **Offset** – Sets the offset voltage on the output signal.
  · **High** – Sets the high voltage on the output signal.
  · **Low** – Sets the low voltage on the output signal.
· **Sample Mrk** – The Sample Mrk function has the following options:
  · **Amplifier** – The Amplifier function has the following options:
    · **Output State** – Enables or disables the state on the output.
    · **Termination Voltage** – Sets the external termination voltage on the output signal.
    · **Amplitude** – Sets the amplitude on the output signal.
    · **Offset** – Sets the offset voltage on the output signal.
    · **High** – Sets the high voltage on the output signal.
    · **Low** – Sets the low voltage on the output signal.

The M8070B software allows you to program these parameters using SCPI commands. For information on M8199B remote programming using SCPI commands, refer to the *M8100 Series Programming Guide*.

M8008A Clock Module Parameters

Figure 62 shows parameters available to configure the M8008A modules:
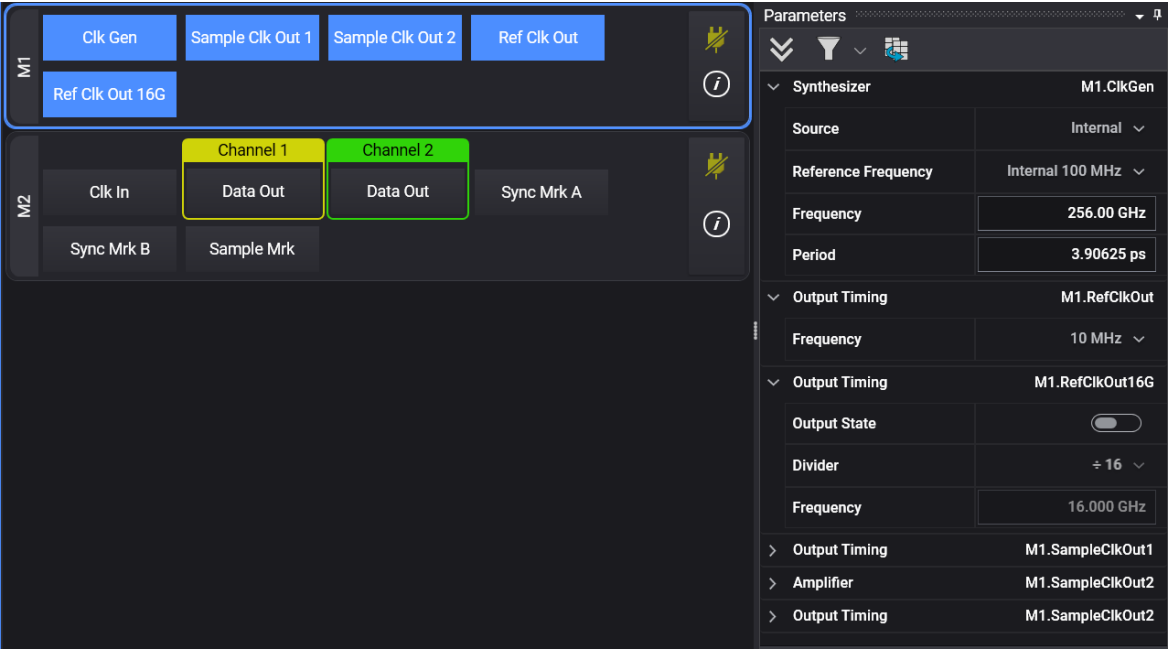

Figure 62   Parameters available for the M8008A clock module

The M8008A clock module has the Clk Gen, Sample Clk Out 1/2, Ref Clk Out and Ref Clk Out 16G ports. You can use the Parameters window to configure these ports.

· **Clk Gen** – The Clk Gen port has the following synthesizer settings:

   · Synthesizer

      i **Source** - Select a triggering source.

         · Internal – An internal reference clock source is used.

         · Reference – An external 10 MHz or 100 MHz reference clock source is used.

         · Direct – An external clock source is used whose direct frequency is in the range of:

- 7.95 GHz to 16.25 GHz if M8008A module is used as standalone.
- 12.5 GHz to 16.25 GHz if M8008A module is used along with M8199B AWG.

ii **Reference Frequency** – Set the reference clock source.

- For internal clock source, set reference frequency as *AXIe 100 MHz* or *Internal 100 MHz*
- For reference clock source, set reference frequency of the external clock source as *10 MHz* or *100 MHz*
- For direct clock source, the frequency of the external clock source measured at the REF CLK IN port of the M8008A clock module is applied.

iii **Frequency** – Set the system frequency. Depending on the instrument configuration, it will be either frequency or sample rate. If M8008A is used standalone, it will be frequency on M8008A module. For the M8008A+M8199B configuration, it will set sample rate on M8199B.

iv **Multiplier** – This setting is available when an external direct clock source is used. It multiplies or divides the output signal by the factor defined in this setting.

v **Period** – Set the system period. The period is the reciprocal value of the system frequency. This is provided as a convenience for those who prefer period instead of frequency.

- **Sample Clk Out 1** – Sets the frequency at Sample Clk Out 1 port in Hz.
  - Output Timing:
    - i **Frequency** – Sets the clock output frequency.
- **Sample Clk Out 2** – Sets the frequency at Sample Clk Out 2 port in Hz.
  - Amplifier:
    - i **Output State** – Enables power output state.
    - ii **Power** – Sets the power output in dBm.
  - Output Timing:
    - i **Frequency** – Sets the clock output frequency.
- **Ref Clk Out** – Sets the frequency 10 MHz or 100 MHz at Ref Clk Out.
  - Output Timing:
    - i **Frequency** – Sets the clock output frequency.
- **Ref Clk Out 16G** – Controls the output of Ref Clk Out 16G.

· Output Timing:

i **Output State** – Enables the output on the Ref Clk Out 16G port. Note that enabling / disabling Global Outputs does not affect this state.

ii **Divider** – Divides the output signal by the factor defined in this setting.

iii **Frequency** – Sets the clock output frequency on this port.

For information on M8008A remote programming using SCPI commands, refer to the *M8000 Series Programming Guide*.

Connecting M8008A Clock Source to M8199B AWG Module

NOTE	The unused output should be disabled on the M8070B software or terminated with 50 Ohms on the module hardware.

Following are the possible ways to connect a M8008A clock source to the M8199B AWG module(s):

Case 1 **Connecting M8008A clock module to M8199B AWG module**

In this case, make the connections as described below:

1 Connect the 1.85 mm, 45 cm M8199A-810 replacement channel clock cable (M8199-61624) from Sample Clk Out of M8008A to Clk In of M8199B.

2 Connect the 3.5 mm, 50 cm M8199A-811 sync cable (M8199-61620) from Sync Out of M8008A to Sync In of M8199B.

Figure 63 shows how to connect the M8008A clock generator module to the M8199B AWG module:

Figure 63   Connecting M8008A module to an M8199B AWG module

NOTE	If you connect more than one M8199B module, you must perform an additional user calibration using the IQtools user interface to ensure that the skew between modules is stable and corrected. For more information, refer to the *IQTools User Guide*.

Case 2   **Connecting M8008A clock module to two M8199B AWG modules**

In this case, an M8008A clock module, two M8199B AWG modules, an M9505A AXIe chassis and the following cables are required:

- 3.5 mm, 50 cm M8199A-811 customer orderable sync cable (M8199-61620)
- 1.85 mm, 45 cm M8199A-810 replacement channel clock cable (M8199-61624)

Make the connections as described below:

1   Connect the M8008A Clock Generator Sync Out port with both the M8199B AWG Sync In ports using the sync cable (blue cable).

2   Connect the M8008A Clock Generator Sample Clock Out port with both the M8199B AWG Clock In ports using clock cable (red cable).

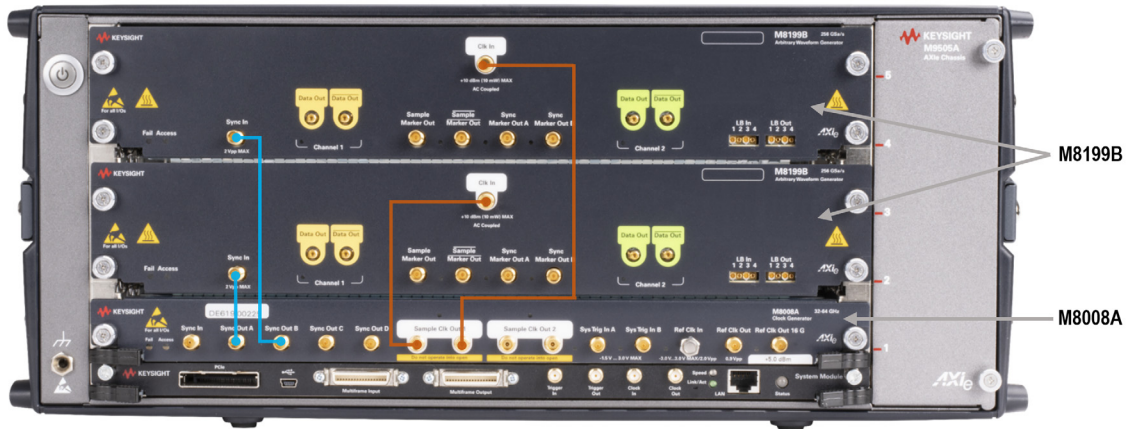Figure 64 shows how to connect M8008A clock generator module to the two M8199B AWG modules:

Figure 64   Connecting an M8008A module to two M8199B AWG modules

Case 3   **Connecting M8008A clock module to four M8199B AWG modules**

In this case, an M8008A clock module, four M8199B AWG modules, two M9505A AXIe chassis and the following cables are required:

- 3.5 mm, 50 cm M8199A-811 customer orderable sync cable (M8199-61620)
- 1.85 mm, 45 cm M8199A-810 replacement channel clock cable (M8199-61624)

Make the connections as described below:

1   Connect the M8008A Clock Generator Sync Out port with all the four M8199B AWG Sync In ports using sync cable (blue cable).

2   Connect the M8008A Clock Generator Sample Clock Out port with all the four M8199B AWG Clock In ports using clock cable (red cable).

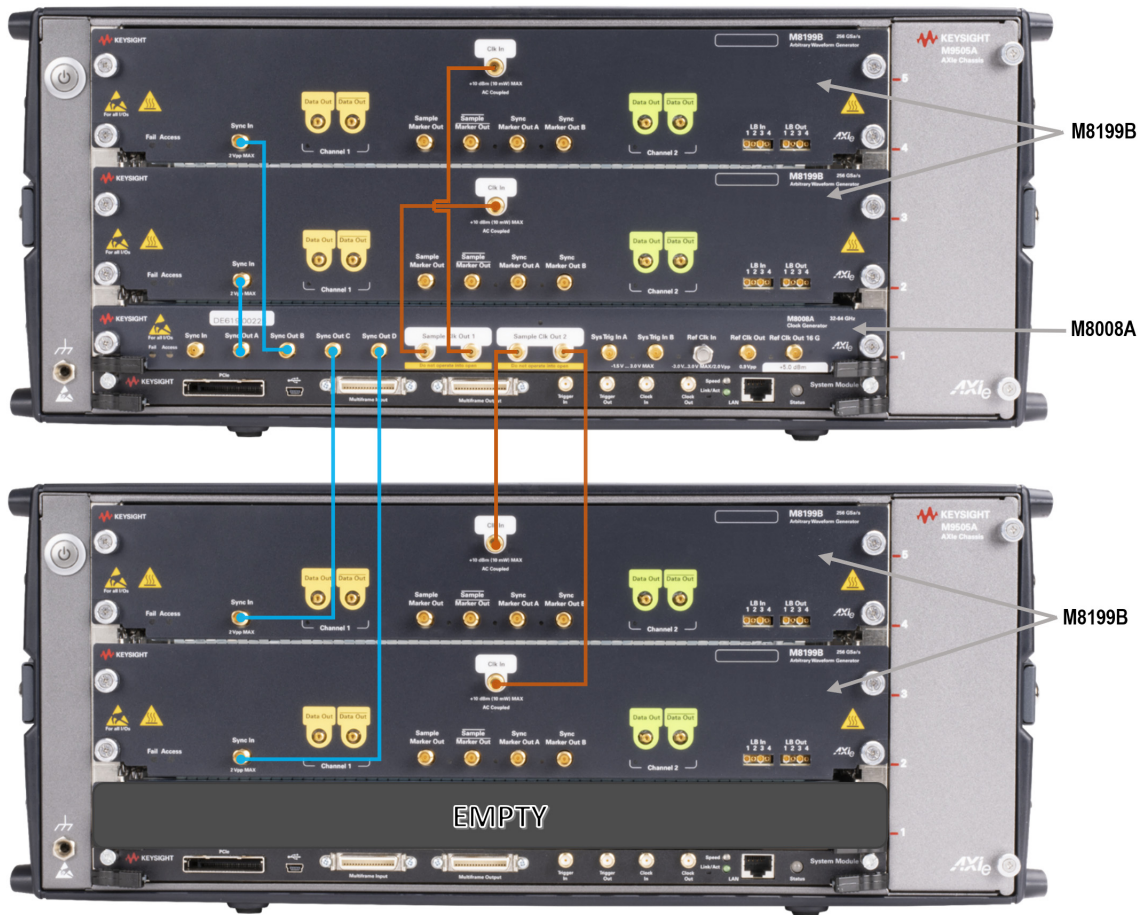Figure 65 shows how to connect M8008A clock generator module to the four M8199B AWG modules:

Figure 65   Connecting an M8008A modules to four M8199B AWG modules

> **NOTE**
>
> Enable the Ref Clk Out port in the primary chassis using the web interface. For details, refer to *Keysight M9505A AXIe Chassis Startup Guide*.

For information on remote programming the M8199B modules, refer to the *M8000 Series Programming Guide*.

5   Licenses

KEYSIGHT
TECHNOLOGIES

Overview

The basic functionality of the M8070B can be used without installing any license. However, for advanced operations, you need to install the M8070B plugins. For details on these plugins, refer to the *M8000 Series User Guide*.

In addition, the M8100 Series of AWGs, being modular products, includes different sets of modules hosted in an M9505A or M9514A AXIe chassis, respectively. Each module has its own licenses corresponding to specific features. Therefore, you need to install these licenses in your instrument in order to use these modules/features.

The licenses for the plugins and modules can be installed using the **Keysight License Manager**. See

License Types

The Keysight Licensing provides four types of licenses:

· **Node-locked** - A node-locked license permits the licensed software to run on only one machine. Each node-locked license is locked to an instrument or computer. Trial licenses are node-locked, subscription licenses. Trial licenses are issued for a particular instrument or computer and are provided free of charge for you to try out a Keysight product.

A trial license can be of the following two types:

  · **30 days free trial license** - The 30 days free trial license for the M8000 Series of BER Test Solutions can be downloaded using the following weblink:
  http://www.keysight.com/main/editorial.jspx?cc=IN&lc=eng&ckey=2624767&nid=-32914.1100508&id=2624767

  · **9 months DST license** - The DST license can only be ordered by rental companies and distributors.

· **USB portable** - A USB portable license is locked to a USB dongle (also called a USB key). Systems that run the licensed feature or product must have the license file resident on their hard disks, and have the dongle attached when they run the licensed feature or product.

Node-locked and USB portable licenses may be counted or uncounted. Counted licenses enable a specified number of a given capability. An uncounted license simply unlocks the licensed feature or application on the system where it is installed.

· **Transportable** - A transportable license is a type of node-locked license that can be unlocked from one client host and then locked to another client host, via a network-enabled process performed in conjunction with the Keysight Software Manager website.

· **Floating** - A floating license (network license) resides on a license server (a separate computer) that can be used on another computer or instrument.

Floating licenses can be borrowed for a specified number of days. Once you have borrowed a license, you can disconnect the licensed instrument or computer from the license server and continue to use the license offline for the duration of the borrow period. Some older floating licenses do not support borrowing.

Each license is either perpetual (permanent) or subscription (good for a limited amount of time).

These licenses can be installed using the Keysight License Manager. It helps you install licenses on your local machine (instrument or computer), or configure your local machine to use licenses from a remote license server. For details, see Keysight License Manager on page 113.

Module-Specific Licenses

Module-specific licenses are a specialized type of license that enables a specific module of a modular instrument (such as a PXI or AXIe module). The module-specific license resides on the controller and is bound to both the controller (typically a PC) and the module; the controller by means of the HostID, and the module itself by means of the module serial number which is embedded in the feature name for the license. Module-specific licenses may be time-perishable.

Licenses for M8100 Series AWGs

M8198A Arbitrary Waveform Generator module

Table 8 lists the license options required for the M8198A AWG modules.

Table 6   M8198A - Channel license

Product	Option	Description
M8198A-001	001	Arbitrary waveform generator module, 1 channel, 128 GSa/s, 3-slot AXIe module
M8198A-002	002	Arbitrary waveform generator module, 2 channel, 128 GSa/s, 3-slot AXIe module
M8198A-08G	08G	8 GSa sample memory per channel

Table 7   M8198A - Upgrade options

Product	Option	Description
M8198AU-U02	U02	Upgrade M8198A AWG from 1 to 2 channels, 128 GSa/s
M8198AU-U8G	U8G	Upgrade M8198A AWG from 1 GSa to 8 GSa memory per channel

M8199A Arbitrary Waveform Generator module

Table 8 lists the license options required for the M8199A AWG modules.

Table 8   M8199A - Channel selection

Product	Option	Description
M8199A-002	002	2 channel, 128/256 GSa/s AWG, 512 kSa per channel
M8199A-004	004	4 channel, 128/256 GSa/s AWG, 512 kSa per channel

M8199B Arbitrary Waveform Generator module

Table 9 and Table 10 list the license options required for the M8199B AWG modules.

Table 9   M8199B - Base licenses

Product	Option	Description
M8199B-S01	S01	1 channel, 224 GSa/s AWG
M8199B-S02	S02	2 channel, 224 GSa/s AWG
M8199B-001	001	1 channel, 256 GSa/s AWG
M8199B-002	002	2 channel, 256 GSa/s AWG

Table 10   M8199B - Upgrade licenses

Product	Option	Description
M8199B-256	256	Upgrade M8199B-S0X (224 GSa/s) to M8199B-00X (256 GSa/s)
M8199B-U02	U02	Upgrade M8199B 1 channel to 2 channel (either M8199B-S01 to M8199B-S02 or M8199B-001 to M8199B-002)

Keysight License Manager

Keysight License Manager is a software utility that enables end users to easily manage right-to-use licenses for software and hardware capabilities on Keysight instruments or systems. The graphical user interface (GUI) gives you a visual representation of the licenses installed on your Keysight Technologies systems and provides access to the following features:

· View the licenses installed on a system

· Install licenses for new capabilities

· Transport licenses from one controller to another

· Borrow the licenses

· Remove licenses for capabilities no longer needed

For detailed information on **Keysight License Manager**, refer to the *Keysight License Manager Help*. You can access the *Keysight License Manager Help* from the **Keysight License Manager** web page: http://www.keysight.com/find/LicenseManager

NOTE	Keysight License Manager 6 and Keysight License Manager 5 are installed on your system when you install M8070B system software.

There are two versions of Keysight License Manager, which can be used to manage the licenses:

1 **Keysight License Manager 6** - See Keysight License Manager 6 on page 114.

2 **Keysight License Manager 5** - See Keysight License Manager 5 on page 115.

Keysight License Manager 6

This license management application allows you to manage floating and USB portable licenses for a variety of software products and instruments.
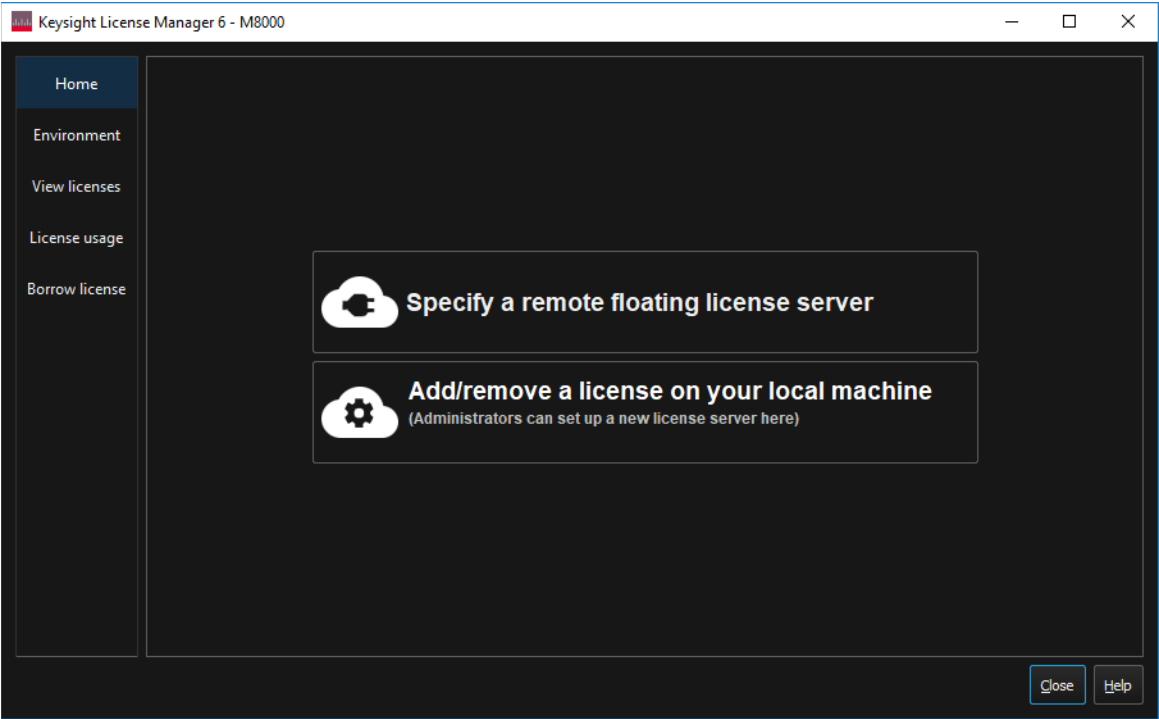

Figure 66   Default view of KLM 6

USB portable licenses:	Install, view, delete
Floating licenses:	Install, view, delete, borrow, and configure license server

You can use the Keysight License Manager 6 to configure remote license servers for sharing licenses across a network, or to configure a local license server (used with certain types of node-locked licenses) on the computer or instrument where your Keysight software is installed.

Although, the Keysight License Manager 6 is installed on your system when you install the M8070B software, however, you can download the it from Keysight License Manager 6.

Keysight License Manager 5

This license management application allows you to manage node-locked and transportable licenses for a variety of software products and instruments.
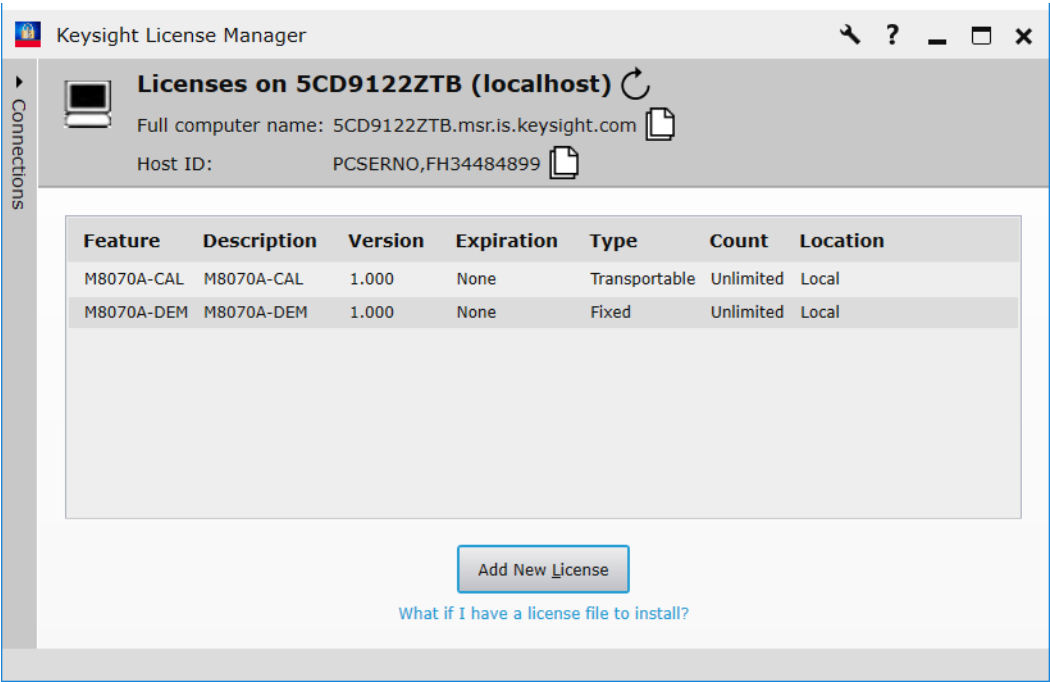

Figure 67   M8070B licenses displayed in KLM 5

Node-locked licenses:	Install, view, delete
Transportable licenses:	Install, view, delete, and transport

Although, the Keysight License Manager 5 is installed on your system when you install the M8070B software, however, you can download the it from Keysight License Manager 5.

Installing the Licenses

Adding License using Keysight License Manager 6

Adding a Floating License

1   On the license server machine, start **Keysight License Manager 6** from your computer's **Start** screen or **Start** menu.

2   Click **Add a license to your local machine**.

3   Select **Add a license to this floating license server**.

4   In the **Add (install) a license window**, click **Browse...** and browse to the location of your license file. You can repeat this as many times as needed to install all your licenses.

5   If you want the license server process to start automatically each time the server machine is restarted, make sure that **Automatically start license server after every reboot** is selected.
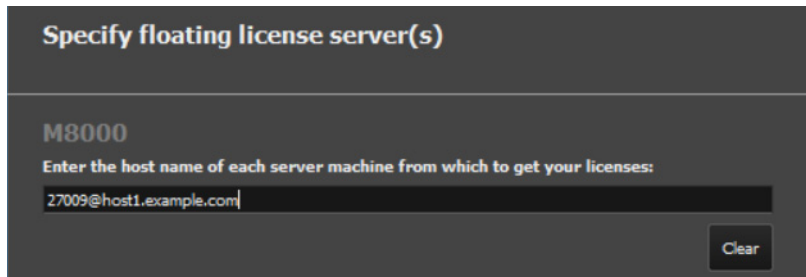
For more information, you can also refer the *Keysight Licensing Administrator's Guide*:
https://literature.cdn.keysight.com/litweb/pdf/5951-5739.pdf

Specify remote license servers

To tell your Keysight product where to get its floating (network) licenses, do the following.

1   From the **Keysight License Manager 6** home screen, click Specify remote license server(s).

2   If you did not run **License Manager** from a menu in a Keysight product, you will see a product selection dialog box. Select the product to be licensed from the drop-down list.

3   In the **License Setup Wizard** for <Product Name> dialog box, type in the port_number@host_name of each server. If you have more than one server, separate them with semicolons (;). For example:

Figure 68   Field to enter host name(s) in the License Setup Wizard

4   Once you've entered your server name(s), click **Next** to complete your setup.

Adding a USB License

Before adding a USB license, you must ensure that:

· Your Keysight product software is installed on this machine.

· You have a license file on this machine. If you don't have a license file, go to **Keysight Software Manager** to get one.

· If your license is locked to a dongle (USB key) rather than to a host ID:

  · The dongle driver is installed on this machine. To install:

    · Run Setup64.exe and accept the defaults.

    · Get the FLEXID10 USB Dongle Driver from http://www.keysight.com/find/LicensingUsbDriver.

    · Extract the .zip file to this machine.

  · The dongle is connected to a USB port on this machine.

To license a Keysight product for use on this machine, select the product from the drop-down menu. Once you have selected your product, browse to the license file, then click **Next** to add the license.

Counted node-locked or USB portable licenses require a license server process: your local machine is both server and client for this license type. If your local machine was not already running a license server process, that process will be started when you click **Next** to complete the operation. To make sure the server process starts automatically each time you reboot the machine, ensure that **Automatically start license server after every reboot** is selected.

For more information, you can also refer the *Keysight Licensing Administrator's Guide*:
https://literature.cdn.keysight.com/litweb/pdf/5951-5739.pdf

Adding License using Keysight License Manager 5

Adding a Node-Locked License

You can add a license to your system by installing a license (*.lic) file if you receive one from Keysight.

1   Select the 🔧 > **Install License File...** menu option. This displays a Windows file selection window.

2   Use the file window to browse to and select the license file (<filename>.lic) that you want to add.

3   Click **Open**. License Manager automatically installs the license file in the folder and notifies you with a pop-up that the license has been stored in your license directory. The license now appears on the main license view.

For more information, you can also refer the *Keysight Licensing Administrator's Guide*:
https://literature.cdn.keysight.com/litweb/pdf/5951-5739.pdf

Transporting a License

Transportable licenses are licenses that can be moved from one host controller to another using the **Keysight License Manager**.

1   Start the **Keysight License Manager** by double clicking the **Keysight License Notifier** icon or click **Start** > **(All) Programs** > **Keysight License Manager** > **Keysight License Manager**.

2   In the **Keysight License Manager**, click on **Help** > **Keysight License Manager Help** and perform the procedure in the **Transporting Licenses** help topic.

3   Additionally, you can also refer the *Keysight Licensing Administrator's Guide*: https://literature.cdn.keysight.com/litweb/pdf/5951-5739.pdf

Installing Temporary License (Trial License)

A temporary (trial) license can be of the following two types:

·   **30 days free trial license** - The 30 days free trial license for the M8000 Series of BER Test Solutions can be downloaded using the following weblink:
http://www.keysight.com/main/editorial.jspx?cc=IN&lc=eng&ckey=2624767&nid=-32914.1100508&id=2624767

·   **9 months DST license** - The DST license can only be ordered by rental companies and distributors.

The following procedure shows how to redeem and install a trial license on a dedicated host computer.

1   Locate the **Software License Entitlement Certificate**.

2   Follow the instructions on the **Software License Entitlement Certificate** to redeem your license.

3   You will receive a license file (in an email). The file has the suffix .lic.

4   Follow the instructions in the email to complete the installation of the license file.

5   In the M8070B software interface, verify that the license has been installed by selecting **Utilities** > **Licenses...** then viewing the license status in the **Installed** column.

6 Appendix

KEYSIGHT
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Basic Troubleshooting

Updating software components

Updated versions of the M8198A, M8199A and M8199B AWG module-specific software components are available on the Keysight website.

To download a software upgrade:

1   Go to http://www.keysight.com.
2   Click the **Technical Support** tab.
3   Click **Drivers and Software**.
4   Type the model number of the instrument module for which software update is needed and click **Find**. Model number is located on the front panel of the module.
5   Click the **Driver & Software** link on the module page.
6   Download the required software update from the list of available updates.

The chassis does not power up

If the chassis or a module does not appear to power up, check the following:

·   The circuit breakers at the rear of the chassis are set to the right, which is the **ON** position.
·   The AC power cords are connected to a working power source.
·   The electrical circuits are not overloaded. Check the combined power requirements of all equipment on the same circuit.
·   There are no empty slots in the chassis. Leaving slots empty can overheat the inserted modules, causing them to shut down.

Module is exceptionally hot

·   Check that the vent holes on the chassis are not blocked.
·   Check that a filler panel module or an instrument module is installed into empty slots on either side of an instrument module.

Contacting Keysight Technologies

To locate a sales or service office near you, go to www.keysight.com/find/contactus.

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KEYSIGHT
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www.keysight.com