

Keysight M8192A

Multi-Channel Synchronization Module for M8190A AWG and M8030A Multi-Channel BERT

Data Sheet
Version 2.0



Features and benefits

- Synchronization of up to six M8190A modules (= 12 channels)
- One trigger input can trigger up to six M8190A modules with deterministic latency
- Skew repeatability of 2 ps between any two channels - independent of sample rate
- Skew calibration with 50 fs delay resolution between any two channels
- 1U AXIe module for high port density

Description

The Keysight Technologies, Inc. M8192A synchronization module is used in conjunction with two to six M8190A Arbitrary Waveform Generator modules to build a fully synchronous, phase coherent multi-channel generator system with up to 12 analog channels and 24 marker outputs.

When running in synchronous mode, all of the M8190A modules work with the same sample clock and start at the same time. One of the M8190A modules is designated as the “master” module. The common sample clock is derived either from the master module’s internal clock synthesizer or from an external sample clock that is connected to the master module’s sample clock input.

The skew between any two channels is guaranteed to be within ± 20 ps independent of the sample rate. Using the fine delay adjust capability of the M8190A with 50 fs resolution, the skew can be adjusted to less than 1 ps between any two channels. Once adjusted, the skew is maintained across loading new waveforms, changing sample rate and power cycles to better than 2 ps.

A common trigger input is available on the synchronization module to trigger all the connected M8190A modules simultaneously with deterministic latency. Triggered waveforms have the same inter-channel skew as continuous waveforms. To achieve the lowest possible trigger delay uncertainty, the trigger input can be synchronized externally to the SYNC CLK output.

Applications

Typical applications include:

- Phase coherent multi-channel I/Q signal generation with up to six I/Q pairs
- Phase coherent multi-channel IF/RF generation with up to 12 IF/RF signals
- Multi-lane serial applications
- Physics research

Configurations

The M8192A can be used to synchronize M8190A modules that are located within the same or different AXIe chassis. This allows very flexible configurations to address a variety of application requirements.

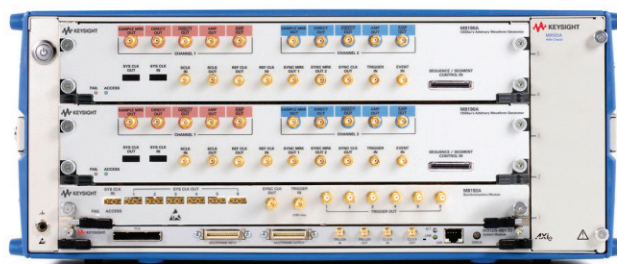
Trigger and clock connections are routed through special cables that are connected on the front panel between the M8192A module and the M8190A modules.

For all system configurations except the 13-slot chassis setup, an external PC or laptop with PCIe cable connection is required to control the setup. In case of multiple AXIe chassis configurations, a desktop PC with two or three PCIe adapters is required. With a 13-slot AXIe chassis, an embedded controller can be used with up to five M8190A modules.

The following configurations are possible:

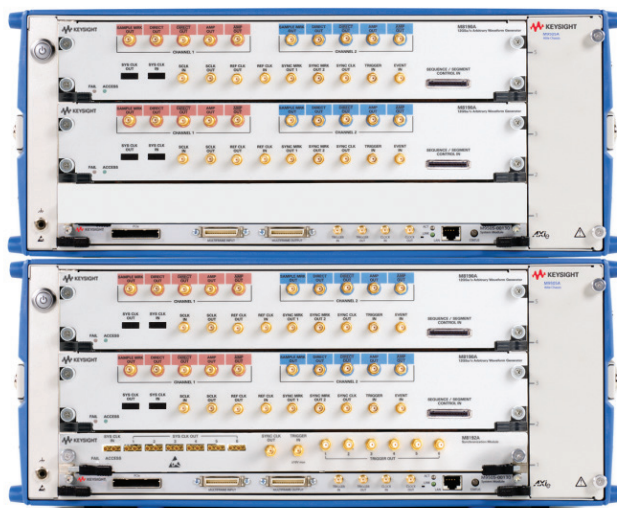
Up to 4 analog channels: One M9505A 5-slot AXIe chassis, one M8192A and two M8190A modules.

This configuration can also be ordered as a pre-configured M8190S Multichannel Arbitrary Waveform Generator System.



Up to 8 analog channels: Two M9505A 5-slot AXIe chassis, one M8192A and three or four M8190A modules.

This configuration can also be ordered as a pre-configured M8190S Multichannel Arbitrary Waveform Generator System.



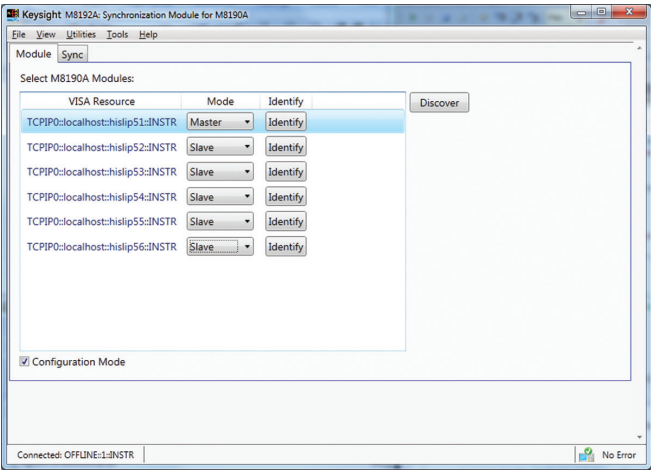
Software

Up to 12 analog channels: Three M9505A 5-slot AXIe chassis, one M8192A and five or six M8190A modules.

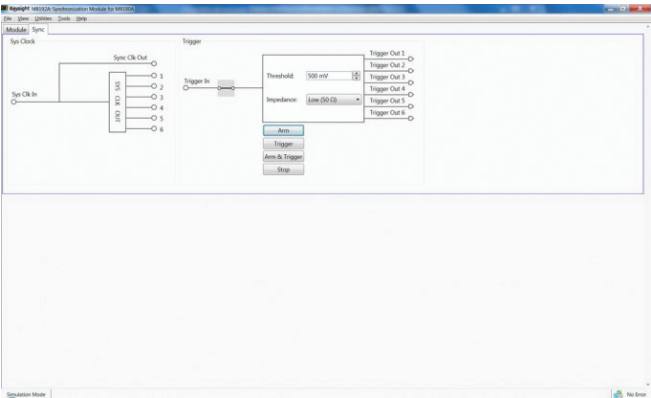


The M8192A module has its own firmware and SFP (Soft Front Panel) - similar to the M8190A modules - that allows you to control the trigger mode, trigger level and common start/stop of the multi-module setup. The SFP can be used to configure the entire synchronous system.

The firmware also offers a remote programming interface based on an IVI driver or SCPI commands.



Configuration screen of M8192A SFP



Clock and trigger distribution screen

Ordering Information

Product #	Description
M8192A	Synchronization Module for up to six M8190A AWG modules. Please note that two clock cables and two trigger cables are included. For more than two modules, the corresponding number of clock cables and trigger cables needs to be ordered separately.
M8192A-801	Clock Cable for the Synchronization Module (M8192A) (required for configurations with three or more M8190A modules)
M8192A-802	Trigger Cable for the Synchronization Module (M8192A) (required for configurations with three or more M8190A modules)
System bundles	
M8190S	Multichannel Arbitrary Waveform Generator System - two multi-channel selections are available
4-channel system	Consists of one M9505A 5-slot AXIe chassis (M8190S-B04), one M8192A synchronization module and two M8190A AWG modules, including the required number of clock and trigger cables (PCIe connectivity accessories will be added automatically)
8-channel system	Consists of two M9505A 5-slot AXIe chassis (M8190S-B08), one M8192A synchronization module and four M8190A AWG modules, including the required number of clock and trigger cables (PCIe connectivity accessories will be added automatically)
M8030A	Multi-Channel BERT System with up to 10 x 16 Gb/s
M8051A-802	Clock crossover distribution cable for M8051A (re-order product number for M8041-61614)

For M8190A options and ordering information, please see the M8190A data sheet

Specifications for M8190A

Sys Clock Input (from master M8190A module)	
Connector and cable type	Proprietary multi-coax (M8192A-801)
Clock rate	1 GHz - 12 GHz (configured in master M8190A module)
Sys Clock Output (to slave M8190A modules)	
Connector and cable type	Proprietary multi-coax (M8192A-801)
Sync Clock Output	
Frequency	
14 Bit mode	Sample clock output frequency of M8190A divided by 48
12 Bit mode	Sample clock output frequency of M8190A divided by 64
Interpolation mode	Sample clock output frequency of M8190A divided by (24 * interpolation factor)
Output amplitude	1.0 V _{pp} (nom) into 50 Ω
Impedance	50 Ω (nom), AC coupled
Connector type	SMA
Trigger Input	
Input range	-5 V to +5 V
Threshold	
Range	-5 V to +5 V
Resolution	100 mV
Sensitivity	200 mV
Polarity	positive
Input impedance	Selectable 1 kΩ or 50 Ω (nom)
Max toggle frequency	Sync clock output frequency divided by 5
Minimum pulse width	
Asynchronous timing between Trigger Input and Sync Clock Output	1.1 * sync clock output period
Synchronous timing between Trigger Input and Sync Clock Output	1.0 * sync clock output period
Connector type	SMA
Trigger Output (to slave M8190A modules)	
Connector and cable type	Proprietary coax (M8192A-802)
Initial skew	
Between any two channels in a multi-channel setup	
Accuracy	+/- 20 ps (without system level calibration)
Repeatability	2 ps (after changes of sample rate or power cycle)
Delay resolution for skew calibration	50 fs (see M8190A data sheet)

Specifications for M8030A

Sys Clock Input (from master M8041A module)	
Connector and cable type	Proprietary multi-coax (M8041-61614)
Sys Clock Output (to slave M8051A modules)	
Connector and cable type	Proprietary multi-coax (M8041-61614)
Initial skew	
Between any two channels in a multi-channel setup	
Accuracy	+/- 20 ps (without system level calibration)
Repeatability	2 ps (after changes of sample rate or power cycle)
Delay resolution for skew calibration	50 fs (see M8190A data sheet)

Timing Characteristics

The M8192A can operate synchronously or asynchronously. Synchronous operation must be selected to achieve minimum delay uncertainty between Trigger Input and Direct Out or Marker Out. For synchronous operation Trigger Input must be synchronous to the Sync Clock Output.

Characteristics	Description
Setup time Trigger Input to rising edge of Sync Clock Output	+ 3.4 ns (typ)
Hold time Rising edge of Sync Clock Output to Trigger Input	- 1.1 ns (typ)
Delay in 12 bit mode Trigger Input (M8192A) to Direct Out (M8190A)	10240 external sample clock cycles + 0.5 internal ¹ sample clock cycles + 8.5 ns (meas)
Delay in 14 bit mode Trigger Input (M8192A) to Direct Out (M8190A)	7680 external sample clock cycles + 0.5 internal ¹ sample clock cycles + 8.5 ns (meas)
Delay in interpolation mode Trigger Input (M8192A) to Direct Out (M8190A)	Interpolation factor * 3840 external sample clock cycles + 4.5 internal ¹ sample clock cycles + 8.5 ns (meas)
Delay uncertainty (asynchronous mode)	1 sync clock output cycle ²
Delay uncertainty (synchronous mode)	10 ps (typ)

1. For the definition of the internal sample clock, refer to the data sheet of the M8190A section 'Sample clock input'

2. Refer to Sync clock output specifications for the ratio between Sample clock output frequency and Sync clock output frequency

General

Characteristics	Description
Power consumption	60 W
Operating temperature	0 °C to +40 °C
Operating altitude	up to 2000m
Operating humidity	5% to 80% relative humidity, non-condensing
Storage temperature	-40 °C to +70 °C
Interface to controlling PC	PCIe (see AXIe chassis specification)
Form factor	1-slot AXIe module
Dimensions (W x H x D)	351 x 29 x 310 mm
Weight	3.1 kg
Safety designed to	IEC61010-1, UL61010, CSA22.2 61010.1 tested
Warm-up time	30 min
Calibration interval	2 years recommended
Warranty	3 years standard
Cooling requirements	When operating the M8192A, choose a location that provides at least 80 mm of clearance at rear, and at least 30 mm or clearance at each side

Definitions

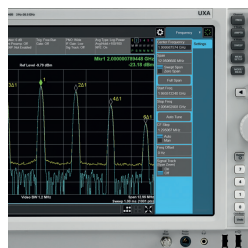
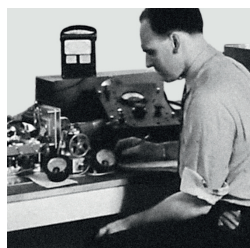
Specification (spec)	The warranted performance of a calibrated instrument that has been stored for a minimum of 2 hours within the operating temperature range of 0 °C to 40 °C and after a 45-minute warm up period. Within ± 10 °C after autocal. All specifications include measurement uncertainty and were created in compliance with ISO-17025 methods. Data published in this document are specifications (spec) only where specifically indicated.
Typical (typ)	The characteristic performance, which 80% or more of manufactured instruments will meet. This data is not warranted, does not include measurement uncertainty, and is valid only at room temperature (approximately 23 °C).
Nominal (nom)	The mean or average characteristic performance, or the value of an attribute that is determined by design such as a connector type, physical dimension, or operating speed. This data is not warranted and is measured at room temperature (approximately 23 °C).
Measured (meas)	An attribute measured during development for purposes of communicating the expected performance. This data is not warranted and is measured at room temperature (approximately 23 °C).
Accuracy	Represents the traceable accuracy of a specified parameter. Includes measurement error and timebase error, and calibration source uncertainty.

Software

Operating systems	Supported operating system is – Microsoft Windows XP 32 bit – Microsoft Windows Vista 32 bit – Microsoft Windows Vista 64 bit – Microsoft Windows 7 32 bit – Microsoft Windows 7 64 bit
Soft front panel	A graphical user interface (GUI or soft front panel) is offered to control all functionality to the instrument. It contains screens for controlling clock, outputs, marker, trigger, sequencer, importing waveforms and creating standard waveforms.
SCPI language	Remote control via SCPI
IVI-driver	An IVI-COM driver as well as IVI-C driver will be provided
LabView-driver	A LabView driver will be provided

From Hewlett-Packard through Agilent to Keysight

For more than 75 years, we've been helping you unlock measurement insights. Our unique combination of hardware, software and people can help you reach your next breakthrough. **Unlocking measurement insights since 1939.**



1939

THE FUTURE

myKeysight

myKeysight

www.keysight.com/find/mykeysight

A personalized view into the information most relevant to you.

Three-Year Warranty

www.keysight.com/find/ThreeYearWarranty

Keysight's commitment to superior product quality and lower total cost of ownership. The only test and measurement company with three-year warranty standard on all instruments, worldwide.

Keysight Assurance Plans

www.keysight.com/find/AssurancePlans

Up to ten years of protection and no budgetary surprises to ensure your instruments are operating to specification, so you can rely on accurate measurements.

Keysight Infoline

www.keysight.com/find/service

Keysight Infoline

Keysight's insight to best in class information management. Free access to your Keysight equipment company reports and e-library.

Keysight Channel Partners

www.keysight.com/find/channelpartners

Get the best of both worlds: Keysight's measurement expertise and product breadth, combined with channel partner convenience.

www.keysight.com/find/ad

For more information on Keysight Technologies' products, applications or services, please contact your local Keysight office. The complete list is available at: www.keysight.com/find/contactus

Americas

Canada	(877) 894 4414
Brazil	55 11 3351 7010
Mexico	001 800 254 2440
United States	(800) 829 4444

Asia Pacific

Australia	1 800 629 485
China	800 810 0189
Hong Kong	800 938 693
India	1 800 11 2626
Japan	0120 (421) 345
Korea	080 769 0800
Malaysia	1 800 888 848
Singapore	1 800 375 8100
Taiwan	0800 047 866
Other AP Countries	(65) 6375 8100

Europe & Middle East

Austria	0800 001122
Belgium	0800 58580
Finland	0800 523252
France	0805 980333
Germany	0800 6270999
Ireland	1800 832700
Israel	1 809 343051
Italy	800 599100
Luxembourg	+32 800 58580
Netherlands	0800 0233200
Russia	8800 5009286
Spain	800 000154
Sweden	0200 882255
Switzerland	0800 805353
	Opt. 1 (DE)
	Opt. 2 (FR)
	Opt. 3 (IT)
United Kingdom	0800 0260637

For other unlisted countries:
www.keysight.com/find/contactus
(BP-09-28-15)



www.keysight.com/go/quality

Keysight Technologies, Inc.
DEKRA Certified ISO 9001:2008
Quality Management System



Unlocking Measurement Insights

This information is subject to change without notice.
© Keysight Technologies, 2013 - 2015
Published in USA, December 21, 2015
5991-2863EN
www.keysight.com