Keysight J-BERT M8020A High-Performance BERT and M8030A Multi-Channel BERT

KEYSIGHT

GETTING STARTED GUIDE

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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.

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 installation 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 Symbol

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.
	The UKCA (UK Conformity Assessed) marking is a new UK product marking that is used for goods being placed on the market in Great Britain (England, Wales and Scotland). It covers most goods which previously required the CE marking.
	This symbol on all primary and secondary packaging indicates compliance to China standard GB 18455-2001.
	Indicates that antistatic precautions should be taken.
	CSA is the Canadian certification mark to demonstrate compliance with the Safety requirements.
	CE compliance marking to the EU Safety and EMC Directives. ISM GRP-1A classification according to the international EMC standard. ICES/NMB-001 compliance marking to the Canadian EMC standard.
	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.
	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.

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

This guide provides high-level information for an initial setup of the Keysight J-BERT M8020A High-Performance BERT and M8030A Multi-Channel BERT. This guide focuses on setting up "bundled" systems such as the M8020A-BU1, M8020A-BU2, M8030A-BU1 and M8030A-BU2.

The M8020A-BU1 system has the M8000 module(s), M9537A AXIe Embedded Host Computer, M8070B software plus license, and module licenses pre-installed.

The M8030A-BU1 system has the M8000 module(s), M9514A AXIe Embedded Host Computer, M8070B software plus license, and module licenses pre-installed.

The M8020A-BU2 and M8030A-BU2 bundled systems has the M8000 module(s) and their licenses pre-installed but will require host computer connection and M8070B software plus license installation. These procedures are located in this guide.

NOTE **Network licenses are not pre-installed on any system. If you plan to use the M8020A or M8030A system over a network, you must perform the network license installation procedures in this guide.**

If you ordered a system that requires onsite installation of individual M8000 modules or the M9537A AXIe Embedded Host Computer into the M9505A or M9514A AXIe Chassis, refer to the *Keysight M8020A and M8030A Installation Guide* for detailed module-level installation instructions.

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Keysight J-BERT M8020A High-Performance BERT and M8030A Multi-Channel BERT

Getting Started Guide

1 Introduction

This chapter introduces you to Keysight's J-BERT M8020A High-performance BERT and M8030A Multi-Channel BERT. It also introduces you to the concept of using a host computer to communicate with the M8020A and M8030A.

KEYSIGHT TECHNOLOGIES

M8020A Modules

The M8020A 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 M8020A supports the following modules.

- M8041A high-performance BERT generator-analyzer-clock 8/16 Gb/s
- M8051A high-performance BERT generator-analyzer 8/16 Gb/s
- M8061A multiplexer 2:1 with de-emphasis 32 Gb/s
- M8062A 32Gb/s Front-end for J-BERT M8020A High-Performance BERT

The M8041A module must be installed in slots 1 through 3 in the AXIe chassis unless the M9537A AXIe Embedded Controller is installed. The M9537A AXIe Embedded Controller must be installed in slot 1.

The following configurations are possible in an M9505A 5-slot chassis:

- **1 or 2-channel, 16 Gb/s -** (1) M8041A
- **3 or 4-channel, 16 Gb/s** - (1) M8041A + (1) M8051A
- **1-channel, 32 Gb/s (Pattern Generator only)** - (1) M8041A + (1) M8061A
- **1-channel, 32 Gb/s (Pattern Generator only or full BERT)** - (1) M8041A + (1) M8062A

Details on the features and hardware components of each of the above mentioned modules are further described in the sections, that follow in this chapter.

M9505A AXIe Chassis

The M9505A AXIe Chassis is a modular instrument chassis that supports complex and high density testing. The chassis provides five slots for installing multiple AXIe based instrument modules such as the M8041A, M8051A, M8061A, and M8062A. 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 USB 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.

NOTE PCIe connectivity between the M9505A AXIe Chassis and an external desktop PC controller is recommended when full channel plus large patterns need to be downloaded.

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

Figure 1 M9505A 5-slot 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.

Figure 2 AXIe ESM

The ESM:

- runs the chassis embedded operating system (Windows 7) 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.

Keysight 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 3 M9537A AXIe Embedded Controller Module

M8030A Modules

The M8030A supports the following modules.

- M8041A high-performance BERT generator-analyzer-clock 8/16 Gb/s
- M8051A high-performance BERT generator-analyzer 8/16 Gb/s
- M8192A Multi-channel synchronization module

The modules must be installed in the M9514A AXIe 14-slot chassis in the following way:

Table 3 M8030A Modules Arrangement

Slot Number	Module
# 1	M8030A-BU1 AXIe embedded controller. For M8030A-BU2 this slot is empty and covered with filler front-plane
# 2, 3 & 4	M8041A module
# 5 & 6	M8051A module
# 7	M9521A AXIe system module, always included in M8030A-BU1 or M8030A-BU2, must be in this slot
# 8 & 9	M8051A module
# 10 & 11	M8051A module
# 12 & 13	M8051A module
# 14	M8192A multi-channel synchronization module, always required in this slot

Details on the features and hardware components of each of the above mentioned modules are further described in this chapter.M9514A AXIe Chassis

The Keysight M9514A AXIe 14-slot chassis (one slot for the AXIe System Module plus 13 instrument module slots) is a modular instrument chassis fully compatible with the AXIe 1.0 Hardware specifications. It allows multiple application-specific instrument modules to share a common chassis frame, power supply, cooling system, PCI Express (PCIe) Gen 2 data bus, Gigabit LAN hub, local bus for module-to-module signaling, and host PC connections.

Multiple chassis may be interconnected for scalability. The chassis provides 13 general purpose peripheral slots that accept 1U AXIe instrument modules. Each module slot has a Gen 2 x4 link (maximum of 2 GB/s data rate per module) to the chassis primary data 'fabric' hub—a x8 PCIe switch and data bus.

The chassis requires a full module height AXIe System Module (ASM) such as the Keysight M9521A, to manage chassis functions.

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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.

NOTE PCIe connectivity between the M9514A AXIe Chassis and an external desktop PC controller is recommended when full channel plus large patterns need to be downloaded.

Refer to the *Keysight M9514A AXIe Chassis Startup Guide* to get detailed information about the AXIe chassis.

Figure 4 M9514A 14-slot chassis

AXIe System Module (ASM)

The AXIe System Module (ASM) is installed in the system slot of the M9514A (slot 7). It provides the system communication and synchronization functions required in an AXIe chassis including:

- Trigger bus and clock routing.
- Managing clocks, including internal or external reference sources.
- Gigabit LAN switching with front panel RJ45 LAN connections.
- AXIe Fabric 1 switching (Gen 2 x4 lanes to each module slot).

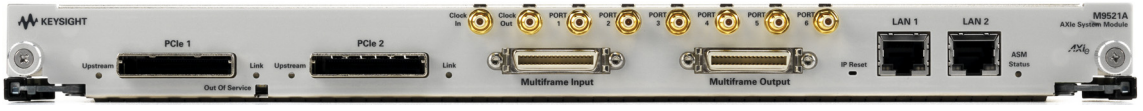


Figure 5 AXIe System Module

Keysight M9537A AXIe Embedded Controller Module

The M9537A AXIe Embedded Controller is a one slot module that you can install in the M9505A/M9514A AXIe Chassis like any other instrument module. This module acts as a host computer when installed in the M9505A/M9514A AXIe Chassis. It is always installed in slot 1 of the M9505A AXIe Chassis. It 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; e.g., either in slot 1 or slot 14.

The following figure displays this module.

Figure 6 M9537A AXIe Embedded Controller Module

The AXIe Embedded Controller:

- runs the chassis embedded operating system (Windows 7) 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 AXIe Embedded Controller 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.

NOTE

It is recommended to use the PCIe interface when more than 4 BERT channels are used in M8030A Multi-Channel BERT. By doing so, you can maintain enough communication speed between desktop and modules.

J-BERT M8041A High-Performance BERT Generator-Analyzer-Clock Module

The M8041A is an instrument module that can be installed into the M9505A 5-slot AXIe Chassis. This module occupies three slots.

The M8041A is a two channel bit error ratio tester with built-in clock and data generator for performing compliance and characterization measurements.

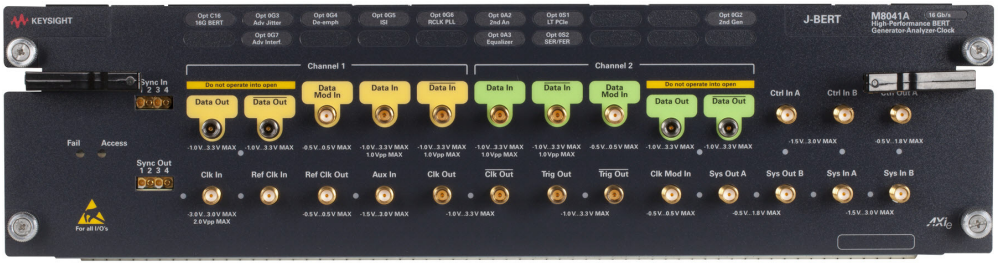


Figure 7 M8041A module

M8041A Features

- Two channel pattern generator (option 0G2) and two channel error detector (option 0A2)
- Data rate from 150 Mb/s to 16.2 Gb/s (option G16 or C16) for pattern generation and error detection
- Built in jitter injection (option 0G3)
- Adjustable ISI offered for M8041A and M8051A (option 0G5), software 2.0 and serial number >= DE55300500
- Built in 8 tap de-emphasis (option 0G4)
- Built in receiver equalization (CTLE, option 0A3)
- Built in reference clock multiplier for pattern generator (option 0G6)
- Simultaneous common mode and differential mode level interference (option 0G7)
- Interactive link training (option 0S1, Software 1.5)
- Four universal control inputs with adjustable threshold
- Three universal control outputs with adjustable levels
- 2 Gb pattern memory per channel (requires software 1.5)

Refer to the *M8000 Series Online Help* installed and integrated into the M8070B software to learn about how to use this module.

M8041A Module Components

The following figure displays the front panel of the M8041A module with its various components labeled.

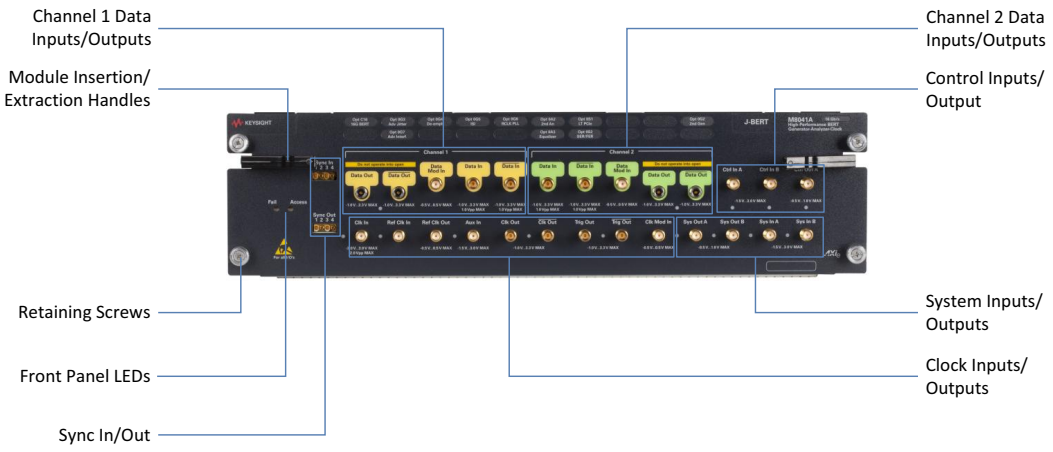


Figure 8 M8041A front panel view

As displayed in Figure 8 on page -21, the M8041A module has the following components.

Table 4 Insertion/Extraction and Retaining

Component	Description
Retaining screws	The screws on both ends of the module are used to retain the module tightly inside the M9505A AXIe Chassis slot once you have fully placed it inside the chassis. To remove the module, you first need to loosen these screws ensuring that these screws disengage completely.
Module Insertion/Extraction Handles	The handles on both sides of the module to insert or eject the module from the slot of the M9505A AXIe Chassis.

Table 5 Front Panel LEDs

Connector Name	Active when...	Color
Fail	power-up fault condition	red
Access	power-up ready state	green
Data In x	input is overloaded	red
Data Out x	output is overloaded	red
Data Mod In x	input is active	green
Ctrl In A/Ctrl In B	logic level is detected	green
Ctrl Out A	output is active	green
Clk In	signal is detected	green
Ref Clk In	signal is detected	green
Ref Clk Out	output is active	green
Aux In	not used	n/a
Clk Out	output is active	green
Trig Out	output is active	green
Clk Mod In	input is active	green
Sys Out A/Sys Out B	output is active	green
Sys Ctrl In A/Sys Ctrl In B	logic level is detected	green

M8041A Front Panel Connector Inputs/Outputs

CAUTION The inputs of the M8041A module are sensitive to static electricity. Therefore, take necessary anti-static precautions, such as wearing a grounded wrist strap, to minimize the possibility of electrostatic damage.

Table 6 Channel x Data Inputs/Outputs

Component	Description
Data Out and /Data Out	Differential data outputs (3.5 mm, female).
Data In and /Data In	Differential data inputs (3.5 mm, female).
Data Mod In	Accepts an external source for data out delay modulation (SMA, female).

Table 7 Clock Inputs/Outputs

Component	Description
Clk In	External clock input in the range of 8.1 to 16.2 GHz. This input is used as a direct clock for all channels in forwarded clock applications (SMA, female).
Ref Clk In	Reference clock input for applications that provide a host reference clock in the range of 10 MHz to 16 GHz. The clock signal may be SSC modulated and is used as the reference for the system clock of all Tx and Rx channels. A SSC tolerant PLL is used to multiply the reference clock to the system clock (SMA, female).
Ref Clk Out	The reference clock output is used to provide a 10 MHz or 100 MHz reference clock to the DUT or other test equipment (SMA, female).
Clk Out and /Clk Out	Differential clock output (3.5 mm, female).
Trig Out and /Trig Out	This output is used to send a trigger signal to another connected device, such as an oscilloscope (3.5 mm, female). It can also be used as a sub rate clock.
Clk Mod In	Input for delay modulation of the Trig Out and Clk Out channel. Both outputs are always affected (SMA, female).

Table 8 Sync In/Sync Out

Component	Description
Sync In	This input is used to synchronize two or more modules to a common system clock. It is connected to the Sync Out of the other module.
Sync Out	This output is used to synchronize two or more modules to a common system clock. It is connected to the Sync In of the other module.

Table 9 System Inputs/Outputs

Component	Description
Sys Out A/Sys Out B	System level control outputs used to signal events to the DUT or external instruments (SMA, female).
Sys In A/Sys In B	System level control inputs used to generate sequencer events (SMA, female).

Table 10 Control Inputs/Output

Component	Description
Ctrl In A/Ctrl In B	The module has two control inputs at the font panel each. Functionality of each input can be selected as: sequence trigger, error add, and pattern capture event.
Ctrl Out A	The module has one control output at the front panel with the following functionality (SMA, female): **Error Output** This signal can be used to trigger an external instrument to help in error analysis. If an error occurs, a single RZ pulse is generated. Continuous errors will result in a clock signal.

J-BERT M8051A High-Performance BERT Generator-Analyzer Module

The M8051A is an instrument module that can be installed into the M9505A 5- slot AXIe Chassis. This module occupies two slots and requires the M8041A module for proper operation.

NOTE

The three or four channel configuration requires a cable (provided with the M8051A) that connects the M8041A SYNC OUT to the M8051A SYNC IN to synchronize the two modules to a common system clock. Refer to the M8020A Installation Guide for instructions.

The M8051A is a two channel pattern generator and two channel error detector for performing compliance and characterization measurements.

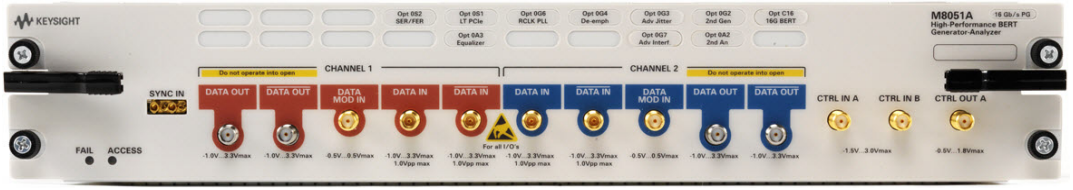


Figure 9 M8051A module

M8051A Features

The main M8051A features are the same as the M8041A features. Refer to M8041A Features on page 20.

M8051A Module Components

The following figure displays the front panel of the M8051A module with its various components labeled.

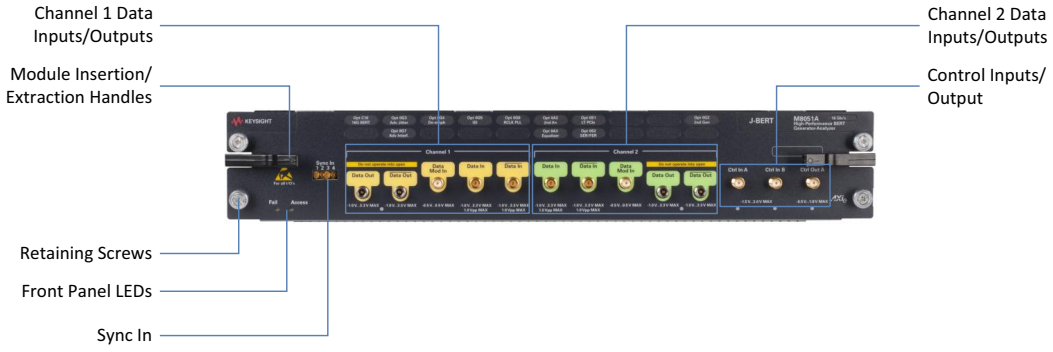


Figure 10 M8051A front panel view

As displayed in Figure 10 on page -26, the M8051A module has the following components.

Table 11 Insertion/Extraction and Retaining

Component	Description
Retaining screws	The screws on both ends of the module are used to retain the module tightly inside the M9505A AXIe Chassis slot once you have fully placed it inside the chassis. To remove the module, you first need to loosen these screws ensuring that these screws disengage completely.
Module Insertion/Extraction Handles	The handles on both sides of the module to insert or eject the module from the slot of the M9505A AXIe Chassis.

Table 12 Front Panel LEDs

Connector Name	Active when...	Color
Fail	power-up fault condition	red
Access	power-up ready state	green
Data In x	input is overloaded	red

Connector Name	Active when...	Color
Data Out x	output is overloaded	red
Data Mod In x	input is active	green
Ctrl In A/Ctrl In B	logic level is detected	green

M8051A Front Panel Connector Inputs/Outputs

CAUTION The inputs of the M8051A module are sensitive to static electricity. Therefore, take necessary anti-static precautions, such as wearing a grounded wrist strap, to minimize the possibility of electrostatic damage.

Table 13 Channel x Data Inputs/Outputs

Component	Description
Data Out and /Data Out	Differential data outputs (3.5 mm, female).
Data In and /Data In	Differential data inputs (3.5 mm, female).
Data Mod In	Accepts an external source for data out delay modulation (SMA, female).

Table 14 Sync In

Component	Description
Sync In	This input is used to synchronize two or more modules to a common system clock. It is connected to the Sync Out of the other module or to the clock distribution module if more than two modules are installed. The sync cable is required if M8051A is connected with M8041A module.

Table 15 Control Inputs/Output

Component	Description
Ctrl In A/Ctrl In B	The module has two control inputs at the font panel each. Functionality of each input can be selected as: sequence trigger, error add, and pattern capture event.
Ctrl Out A	The module has one control output at the front panel with the following functionality (SMA, female): **Error Output** This signal can be used to trigger an external instrument to help in error analysis. If an error occurs, a single RZ pulse is generated with the width of half a vector length. Continuous errors will result in a clock signal.

M8061A 32 Gb/s Multiplexer with De-emphasis Module

NOTE **Currently, the M8061A module is only supported by M8020A High-Performance BERT and not by M8030A Multi-Channel BERT.**

The M8061A is an instrument module that can be installed into the M9502A 2- slot or M9505A 5- slot AXIe Chassis. This module occupies two slots.

The M8061A is used to characterize serial interfaces of up to 32 Gb/s. The M8061A provides four calibrated de-emphasis taps, which can be extended to eight taps, built-in superposition of level interference, and Clock/2 jitter injection.

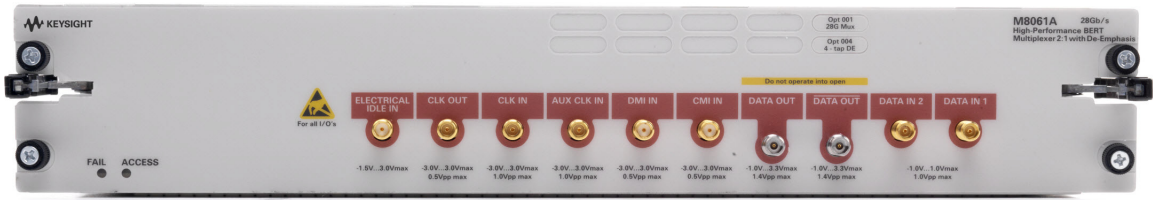


Figure 11 M8061A module

M8061A Features

- Expands data rate of M8041A and M8051A pattern generators up to 32 Gb/s enabling accurate and complete receiver stress testing
- Integrated and calibrated 4-tap de-emphasis, expandable to 8 taps
- Internal superposition of interference for common- mode and differential mode
- Transparent to jitter generated by the J-BERT M8020A, Clock/2 jitter can be added
- Electrical idle
- Control from M8020A user interface via USB

Refer to the *M8000 Series Online Help* installed and integrated into the M8070B software to learn about how to use this module.

NOTE Phase-matched cables, such as the Keysight M8061A-804, must be used when connecting the M8041A data outputs to the M8061A data inputs (32 Gb/s configuration). In addition, use a bandpass filter from the M8041A CLK OUT to the M8061A AUX CLK IN, such as the M8061A-802 (11.4 to 15.6 GHz) or M8061A-803 (11.1 to 17.5 GHz).

NOTE When using a bandpass filter from the M8041A CLK OUT to the M8061A AUX CLK IN, delay the M8041A DATA OUT 1 and DATA OUT 2 jitter by 600 ps.

M8061A Module Components

The following figure displays the front panel of the M8061A module with its various components labeled.

Figure 12 M8061A module components

As displayed in Figure 12 on page -30, the M8061A module has the following components.

Table 16 Insertion/Extraction and Retaining

Component	Description
Retaining screws	The screws on both ends of the module are used to retain the module tightly inside the M9505A AXIe Chassis slot once you have fully placed it inside the chassis. To remove the module, you first need to loosen these screws ensuring that these screws disengage completely.
Module Insertion/Extraction Handles	The handles on both sides of the module to insert or eject the module from the slot of the M9505A AXIe Chassis.

Table 17 Front Panel LEDs

Connector Name	Active when...	Color
Fail	power-up fault condition	red
Access	power-up ready state	green

M8061A Front Panel Connector Inputs/Outputs

CAUTION The inputs of the M8061A module are sensitive to static electricity. Therefore, take necessary anti-static precautions, such as wearing a grounded wrist strap, to minimize the possibility of electrostatic damage.

Table 18 Electrical Idle Input

Component	Description
Electrical Idle In	This input is used to enable/disable the output signal by an external control signal. If the input level is above the threshold level the module enters electrical idle. Normal operation resumes when the input level is below the threshold (SMA, female).

Table 19 Clock Inputs/Output

Component	Description
Clk Out	Clock output port is used to provide a clock signal to a device.
Clk In	Clock input port is used to receive a clock signal from the M8041A module.
Aux Clk In	Auxiliary clock input port is used to receive an auxiliary clock signal from the M8041A module.

Table 20 DMI/CMI Inputs

Component	Description
DMI In	Differential mode interference input independent of ground (SMA, female).
CMI In	Common mode interference input relative to ground (SMA, female).

Table 21 Data Inputs/Outputs

Component	Description
Data Out and /Data Out	Differential or single-ended data output (2.4 mm, female).
Data In 1 and Data In 2	Single-ended data input (3.5 mm, female).

M8062A 32Gb/s Front-end for J-BERT M8020A High-Performance BERT

NOTE **Currently, the M8062A module is only supported by M8020A High-Performance BERT and not by M8030A Multi-Channel BERT.**

The M8062A extends the data rate of the J-BERT M8020A Bit Error Ratio Tester to the speeds required for testing devices with lane rates in the 25-28 Gb/s range. When combined with a two channel M8041A, the system provides data pattern generation and full-rate error analysis for users developing 100G class serial data link components and systems with lane rates up to 32.4 Gb/s.

Typical Applications:

- 100G Serdes development (CAUI-4)
- Optical Transceiver development for 100G-SR4, LR4, and ER4, 32G Fibre Channel
- Thunderbolt 20G
- Active Optical Cables

Figure 13 M8062A module

M8062A Features

- Extends maximum data rate of J-BERT M8020A up to 32.4 Gb/s
- Seamless control of pattern generator and error analyzer
- Integrated 8-tap de-emphasis
- Built in ISI generator for channel emulation
- Analyzer equalization eliminates errors resulting from closed eyes in loop back path

Refer to the *M8000 Series Online Help* installed and integrated into the M8070B software to learn about how to use this module.

NOTE **Phase-matched cables must be used when connecting the M8041A data and clock outputs to the M8062A data and clock inputs. The provided cable set, Keysight M8062-61643, meets this requirement.**

M8062A Module Components

The following figure displays the front panel of the M8062A module with its various components labeled.

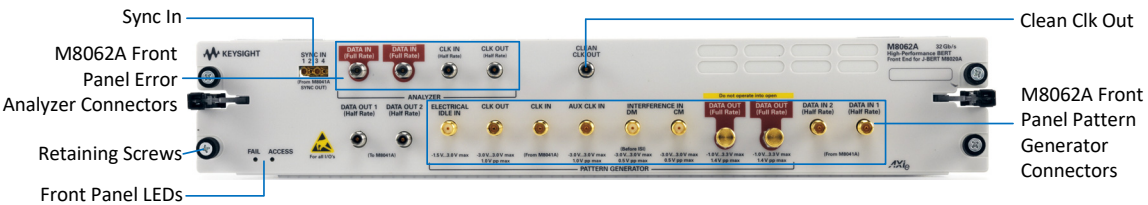


Figure 14 M8062A module components

As displayed in Figure 14 on page -34, the M8062A module has the following components.

CAUTION **The inputs and outputs of the M8062A module are sensitive to static electricity. Therefore, take necessary anti-static precautions, such as wearing a grounded wrist strap, to minimize the possibility of electrostatic damage.**

Table 22 Insertion/Extraction and Retaining

Component	Description
Retaining screws	The screws on both ends of the module are used to retain the module tightly inside the M9505A AXIe Chassis slot once you have fully placed it inside the chassis. To remove the module, you first need to loosen these screws ensuring that these screws disengage completely.
Module Insertion/Extraction Handles	The handles on both sides of the module to insert or eject the module from the slot of the M9505A AXIe Chassis.

Table 23 Front Panel LEDs

Connector Name	Active when...	Color
Fail	power-up fault condition	red
Access	power-up ready state	green

Table 24 Sync In/Clean Clk Out

Connector Name	Description
Sync In	This input is used to synchronize two or more modules to a common system clock. It is connected to the Sync Out of the other module. The sync cable is required if M8062A is connected with M8041A module.
Clean Clk Out	Half-rate, or divided, clock output with no applied jitter.

M8062A Front Panel Pattern Generator Connectors

Table 25 Electrical Idle Input

Component	Description
Electrical Idle In	This input is used to enable/disable the output signal by an external control signal. If the input level is above the threshold level the module enters electrical idle. Normal operation resumes when the input level is below the threshold (SMA, female).

Table 26 Pattern Generator Clock Inputs/Output

Component	Description
Clk Out	Half-rate Pattern Generator clock output. Carries the same jitter as the full-rate data output.
Clk In	Pattern Generator clock input (half-rate). Connect to clock output of M8041A.
Aux Clk In	Alternate Pattern Generator clock input (half-rate). Typically unused.

Table 27 DMI/CMI Inputs

Component	Description
DMI In	Differential Mode Interference input. Applies a single-ended, external interference source differentially to the data output (SMA, female).
CMI In	Common Mode Interference input. Applies a single-ended, external interference source to both the normal and complement data output signals (SMA, female).

Table 28 Pattern Generator Data Inputs/Outputs

Component	Description
Data Out and /Data Out	Differential or single-ended, full-rate data output to the device under test. Unused outputs must be terminated in 50-ohms. (2.4 mm, female).
Data In 1 and Data In 2	Single-ended, half-rate data inputs from the M8041A module (3.5 mm, female).

M8062A Front Panel Analyzer Connectors

Table 29 Error Analyzer Data Inputs/Outputs

Component	Description
Data In and /Data In	Differential or single-ended, full-rate data input from the device under test. Unused input should be terminated in 50-ohms. (2.4 mm, female).
Data Out 1 and Data Out 2	Single-ended, half-rate data outputs to the M8041A module (3.5 mm, female).

Table 30 Error Analyzer Clock Inputs/Output

Component	Description
Clk Out	Half-rate Error Analyzer clock output, synchronous with analyzer sampling.
Clk In	Half-rate, Error Analyzer clock input. Allows external clocking of the Error Analyzer.

M8192A Multi-Channel Synchronization Module

The M8030A multi-channel BERT uses the M8192A synchronization module to synchronize the M8030A modules that are installed in the AXIe chassis. The clock connections are routed through special cables that are connected on the front panel between the M8192A module and the M8030A modules.

Figure 15 M8192A synchronization module

When running in synchronous mode, all of the M8030A modules work with the same sample clock and start at the same time. One of the M8030A modules (M8041A) is designated as the “primary” module. The common sample clock is derived either from the primary module’s internal clock synthesizer or from an external sample clock that is connected to the primary module’s sample clock input.

For further information, please check the Keysight website www.keysight.com/find/M8192A for the latest version of related documents and data sheet.

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.
- a desktop PC with a USB port or x8 or wider PCIe slot for the cabled PCIe adapter card.

Refer to the Computer Hardware and Software Requirements on page 42 for external host computer minimum requirements.

2 Basic Setup for M8020A

Step 1 - Unpack the Shipment

The M8020A-BU1 or M8020A-BU2 is shipped with the modules pre-installed in the M9505A AXIe Chassis.

Unpack and verify the shipment contents to check if you have received all the items that you ordered. The shipment contents can vary depending on the options that you ordered. Therefore, the shipping list delivered with the shipment should supersede these lists.

Table 31 Typical contents of an M8020A instrument shipment

Item	Description
M8020A-BU1 or M8020A-BU2	The M8020A that you ordered. All modules are pre-installed in the M9505A AXIe Chassis.
Accessories	The accessories will vary depending on the M8020A and the options that you ordered while purchasing the module. Accessories include standard items that are shipped with the M8020A as well as optional items that you ordered separately. (Please check the M8020A and M8061A/M8062A product data sheet for the latest list of default and optional accessories. Latest version can be downloaded from www.keysight.com/find/M8020A)
M8070B	CD-ROM with M8070B system software.
Start Here	Document which provides instructions to be followed before operating the J-BERT M8020A High-Performance BERT.
Tips for Preventing Damage to J-BERT M8020A High-Performance BERT	Document which provides tips for preventing damage to J-BERT M8020A High- Performance BERT.
Getting Started Guide	This document, *Keysight M8020A and M8030A Getting Started Guide*. (Please check the Keysight website: www.keysight.com/find/M8020A for the latest guide.)

Carefully inspect all items in the shipment for any damage.

Return the Damaged/Defective Item to Keysight for Repair/Replacement

If anything is missing, defective, or damaged,

1 Review the warranty information shipped with your product or check the warranty information on Keysight website.
   - To check the warranty information on your module, go to www.keysight.com/find/warranty and specify the module's model number (for example, M8041A) in the Product Number field, and specify the serial number from the top of the module in the Serial Number field.

2 Contact the nearest Keysight Sales Office. If you need assistance finding Keysight contact information, go to www.keysight.com/find/assist (worldwide contact information for repair and service).

Step 2 - Set up the M8020A

This step does not have to be performed while verifying the basic setup for power up and connectivity. However, you will need to decide on a benchtop or rack mounted usage of the M8020A after this basic verification. For the procedures on how to set up the M8020A, refer to the *M8020A Installation Guide*.

Step 3 - Set up the External Host Computer (not required for M8020A-BU1)

NOTE **Perform this step if you are using a laptop or desktop computer as the host computer.**

The host computer communicates with the ESM and instrument modules in the chassis and hosts all the software components needed to use the instrument modules.

Computer Hardware and Software Requirements

The following are the hardware and software requirements that should be met on the host computer before the installation of software components on this computer:

Hardware requirements

- Pentium® processor 1 GHz or equivalent
- 16 GB available RAM
- USB 3.0 connection
- PCIe 2.0/8x (only for highest data throughput and desktop PC)
- VGA resolution 1024 x 768
- 1.5 GB or more free hard disc space

Software requirements

- The following operating systems are supported:
  - Windows 7 (64 bit) SP1
  - Windows 8 (64 bit)
  - Windows 8.1 (64 bit)
- Keysight I/O libraries version 16.3 or higher

NOTE The M8070B software is required to control the M8020A.

NOTE PCIe connectivity between the M9505A AXIe Chassis and an external desktop PC controller is recommended when full channel plus large patterns need to be downloaded.

To connect via USB

If you are planning to use USB connectivity between the M9505A AXIe Chassis and host computer, then you can use a laptop or desktop computer with USB 3.0 support as the host computer.

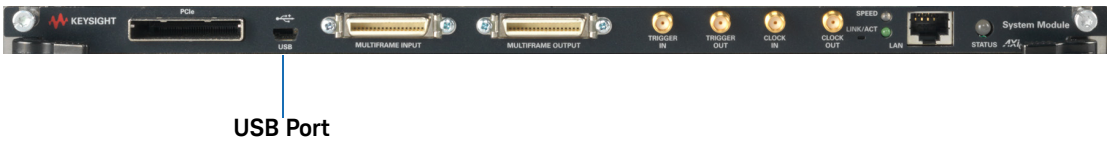


Figure 16 USB port on the font panel of the AXIe ESM

To connect via PCIe

In case of PCIe connectivity, the host computer can be a desktop PC with an available x8 or wider PCIe slot.

Review the Keysight recommended list of host computers at http://literature.cdn.keysight.com/litweb/pdf/5990-7632EN.pdf that are compatible with the Keysight M9505A AXIe Chassis.

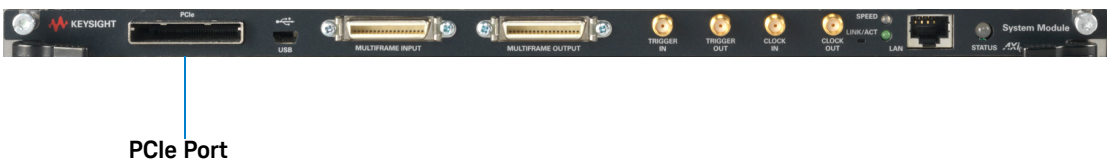


Figure 17 PCIe port on the front panel of the AXIe ESM

Step 4 - Connect the M9505A AXIe Chassis to a Power Supply

You can use an external power supply, typically AC power mains.

1 The instrument module uses the power supplied by the M9505A AXIe Chassis in which it is installed. The M9505A AXIe Chassis power cord comes with the chassis shipment. Insert the power cord into the inlet at the rear of the chassis.

2 Connect the cord to an appropriate AC power main.

3 Push the circuit breaker to the right, which is the ON position.

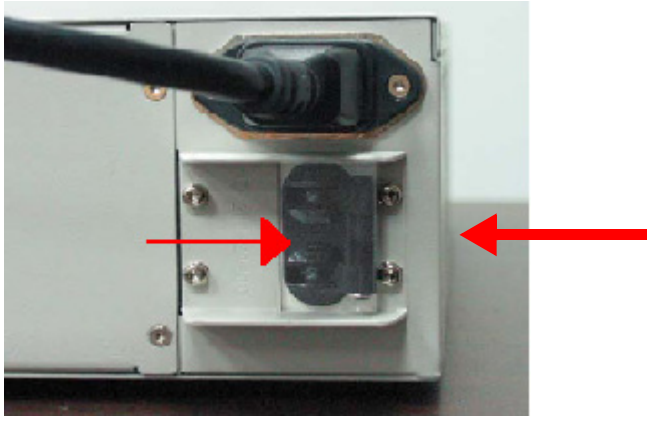


Figure 18 Chassis circuit breaker

Step 5 - Power Up (if connecting via PCIe)

Power up all the connected hardware components in the M9505A AXIe Chassis.

1 Press the ON/Standby button on the front panel of the chassis to power on the chassis.

Figure 19 Chassis ON/standby button

2 After powering up the chassis, wait until the Status LED of the ESM is solid green. This ensures that the PCIe channel in the chassis is ready for the successful connectivity of the chassis to the host computer.

3 Wait until the Access LED(s) of the module(s) in the chassis is/are solid green.

4 Power up the host computer. By this time, the Status LED of the ESM in the chassis and the Access LED(s) of the module(s) should have been steady green indicating a power ready status of the setup.

   The step to power up the host computer is not required if you are using the M9537A AXIe Embedded Controller module as the host computer because it gets powered on simultaneously with the chassis through the chassis backplane.

NOTE

If you plan to connect the J-BERT M8020A to a corporate LAN and the M9537A AXIe Embedded Controller is installed, you must use the Ethernet port available on the M9537A AXIe Embedded Controller or the LAN port on the external PC.

NOTE

To power down a chassis, first turn off the host computer and then power down the chassis using the On/Standby button on its front panel.

If you are using the M9537A AXIe Embedded Controller module as the host computer, ensure that you first shut down the controller by executing the Windows shutdown process.

Do not use the circuit breaker for routine chassis turn off.

The module(s) are turned off automatically with the chassis.

Step 6 - Verify Basic M8020A Operation

After powering ON the connected hardware components, you can verify if you have correctly set up the hardware if:

- a steady green status light is displayed on the ESM of the M9505A AXIe Chassis indicating that the chassis has powered up successfully.
- the Access LED on the front panel of the instrument module turns on indicating that the module is in a power- ready state.
- the Out of Service (OOS) LED on the front panel of the M9537A AXIe Embedded Controller turns off. (Applicable only when you are using M9537A AXIe Embedded Controller as the host computer).

If the chassis does not power up to a steady green Status light, or powers up to a steady red light, the chassis has detected a failure and requires service.

If the Fail LED on the front panel of the instrument module is steady red and does not turn off, it indicates a power fault condition. In such a situation, the instrument module may require repair/service.

Contact your Keysight representative to replace or service the chassis/module.

Step 7 - Install Keysight IO Libraries Suite (not required for M8020A-BU1)

IO Libraries Suite version 16.3 or later is required. Always use the latest version of the Keysight IO Libraries.

NOTE **Perform this step if you are setting up an M8020A-BU2 system or the host computer you are using as part of the M8020A system requires I/O library installation.**

1. Disconnect any devices connected to the host computer.
2. If open, close all applications on the host computer.
3. Insert the *Automation-Ready* CD in your CD-ROM drive or download and install the IO Libraries from www.keysight.com/find/iosuite.
4. Follow the instructions as prompted during the installation.
5. After installation, you will see the Keysight IO icon in the taskbar notification area of the host computer screen.

Step 8 - Install M8070B Software (not required for M8020A-BU1)

NOTE **Perform this step if you are setting up an M8020A-BU2 system or the host computer you are using as part of the M8020A system requires I/O library installation.**

The M8070B software does not require any license for its installation. However, it can only be used to perform some basic operations. For advance operations, you need to install the plugins in the M8070B software. For details, go to Step 9 - Install the Plugins on page 48. These plugins need a valid license for their activation. For details, go to Step 10 - Install the Licenses on page 49.

NOTE **A CD-ROM is shipped when ordering the M8070B (part of the M8020A configuration).**

To install the software

1 Insert the CD ROM into the host computer or download the latest M8070B software from www.keysight.com/find/M8020A.

2 Double-click the setup (.exe) file.
The InstallShield Wizard is displayed.

3 If displayed, click **Install** to continue or click **Next** if the system controller meets the minimum system configuration requirements displayed by the wizard.

4 When displayed, accept the license agreement and click **Next**.

5 Click **Install** to start the installation then follow any on-screen prompts/instructions.

6 In Windows click **Start** > **All Programs** > **M8070B Keysight** > **M8070B Keysight** to verify software installation. The Startup screen of the M8070B software should display.

NOTE

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

Step 9 - Install the Plugins

The basic functionality of the M8070B can be used without installing any license. However, for advanced features, you need to install the M8070B plugins. The plugin file (*.M8KP) can be downloaded from Keysight web page. The M8070B software supports the following plugins:

- Advanced Measurement Package
- Error Distribution Analysis Package

Please make sure that you have M8070B software version 6.0 or later installed on your system. The M8070B software comes with a **Plugin Manager** to simplify all the tasks related to plugin management. The **Plugin Manager** also allows you to install, uninstall and upgrade the plugins.

NOTE Please note that the M8070B plugins requires a license for its activation.

For further details on how to install, update or uninstall plugins, please refer to the *M8000 Series User Guide* or *M8000 Series Plugins Getting Started Guide*.

Step 10 - Install the Licenses

NOTE Please note that the license installation procedure is same for M8020A and M8030A system. Therefore, if you want to install licenses for M8030A system, please refer to instructions provided in this section.

NOTE All M8020A-BU1 licenses have been pre-installed (except for a floating/networked license). All other system configurations require license installation as described in this step.

The usage of M8070B plugins is govern by Keysight Licensing. Keysight Licensing provides tools and processes for floating, USB portable, node-locked, and transportable licenses. 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.

Depending upon the license types, the following version of **Keysight License Manager** can be used to install the licenses:

- The node-locked and transportable licenses are installed by **Keysight License Manager 5**.
- The floating and USB probable licenses are installed by **Keysight License Manager 6**.

NOTE Please note that the Keysight License Manager 5 and Keysight License Manager 6 get installed on your system when you install M8070B system software.

For details on how to install these licenses, you can refer the following documents:

- M8000 Series User Guide (https://literature.cdn.keysight.com/litweb/pdf/M8000-91B08.pdf)
- Keysight Licensing Administrator's Guide (https://literature.cdn.keysight.com/litweb/pdf/5951-5739.pdf)

Installing Module Licenses (for upgrades only)

Installing module licenses is only necessary if you add module options onsite. Module licenses enable specific options in the modules of the M8020A system. Once a module license has been installed using the Keysight License Manager, the next time the M8070B software and M8020A hardware are started, the license is recognized by the M8070B software and compared to the module's serial number. If the PC Host ID and serial number match, the EEPROM in the module is programmed and the option is enabled. Even if the M8070B software license is transported to another host computer, the module option will remain enabled.

The following procedure shows how to redeem and install a module license.

1 Locate the Software License Entitlement Certificate (email or paper copy).
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.

Affix Option Label (optional)

Whenever the M8020A is upgraded with additional options, it is recommended that you affix the corresponding label(s) to the front panel of the module. The option labels provide a quick view of which options are installed in each module. Figure 20 on page -51 shows the option label sheet provided with your M8020A system.

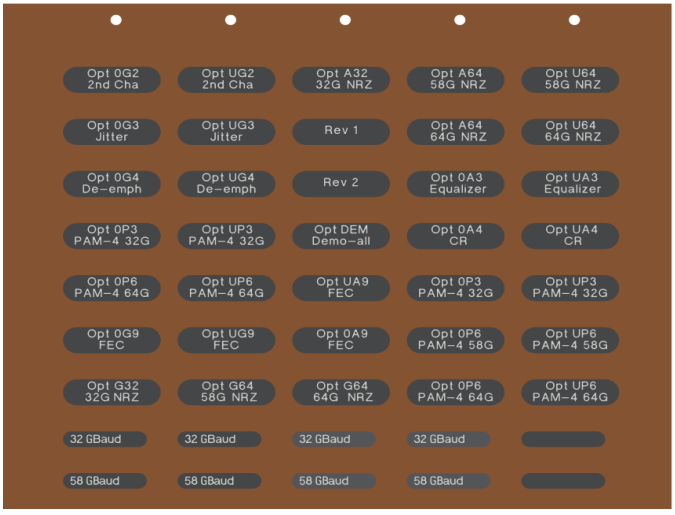


Figure 20 Option label sheet

1 Locate the option label sheet shown in Figure 20 on page -51.
2 Affix the option labels as shown in Figure 21 on page -51.

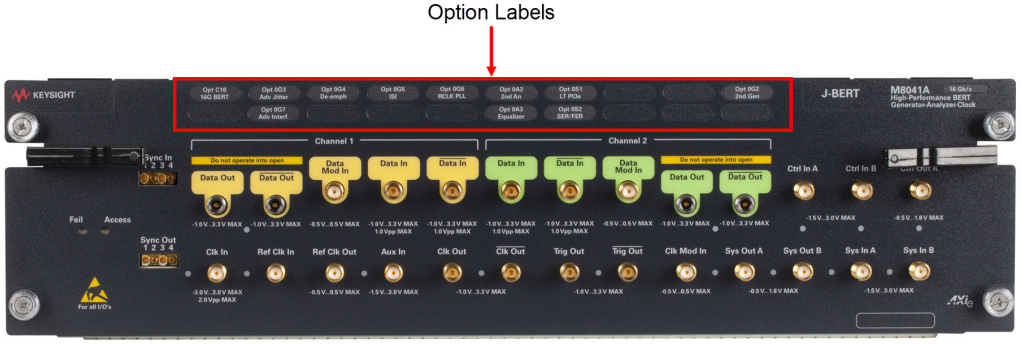


Figure 21 Affix option labels

Step 11 - Turning off the Chassis and Modules

Turn off the chassis and module in the following sequence:

1 Turn off the host computer. If you are using the Keysight AXIe Embedded Controller module as the host computer, ensure that you shut down the controller by executing the Windows shutdown process.

2 Turn off the chassis by pressing the chassis ON/STANDBY switch on the front panel of chassis. Do not use the circuit breaker for routine turn off. The module(s) are turned off automatically with the chassis.

Step 12 - Connecting the M8020A to the Device Under Test (DUT)

This section describes how you can connect the M8020A to a DUT.

NOTE The 32G, or three or four channel 16G configurations require a cable (provided with the M8051A or M8062A) that connects the M8041A SYNC OUT to the M8051A/62A SYNC IN. Refer to the M8020A Installation Guide for instructions.

NOTE If you are connecting M8020A over USB, make sure to disable the “Sleep Mode” of the external PC or laptop. Failing to do so may cause you to re-initialize the M8070B software.

Typical Test Setup Example

Figure 22 on page -53 is an example of a common test setup for testing a DUT.

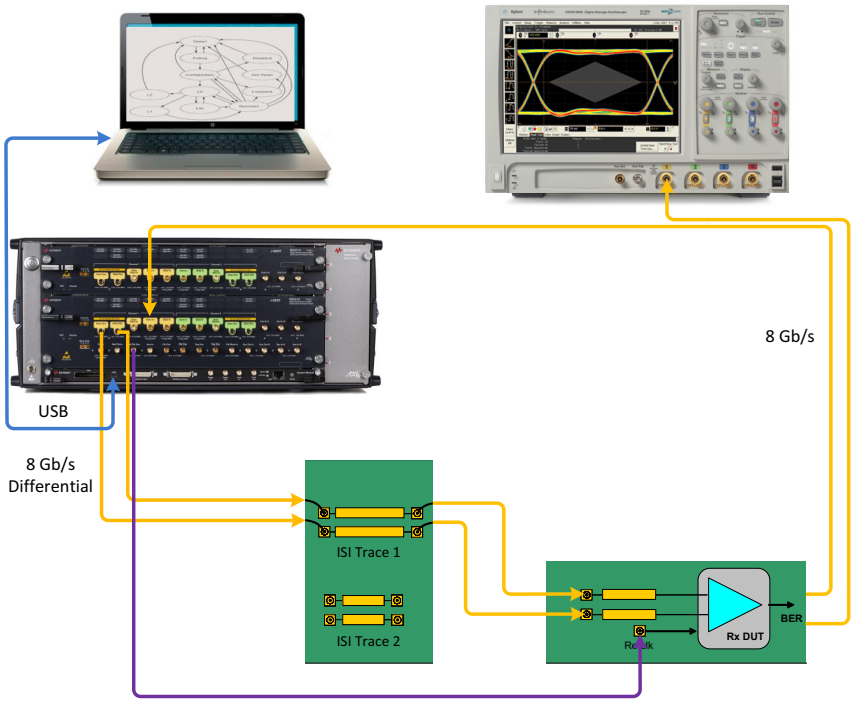


Figure 22 Typical test setup example

M9537A Embedded Controller Setup Example

Figure 23 on page -54 shows a basic setup using the M9537A Embedded Controller. The embedded controller module must be installed in slot 1 of the M9505A AXIe Chassis. The embedded controller module communicates with the ESM through the chassis backplane. Therefore, there is no need to establish any external PCIe/USB or LAN connection between the embedded controller module and chassis.

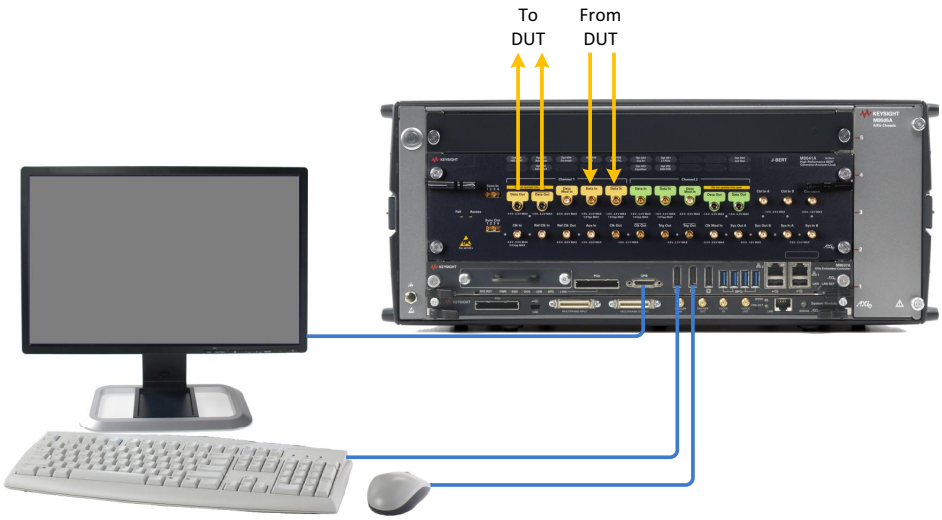


Figure 23 M9537A embedded controller setup example

M8061A Multiplexer Setup Example (32 Gb/s)

Figure 24 on page -55 shows a basic setup using the M8061A multiplexer with the M8041A module in **Mux** mode.

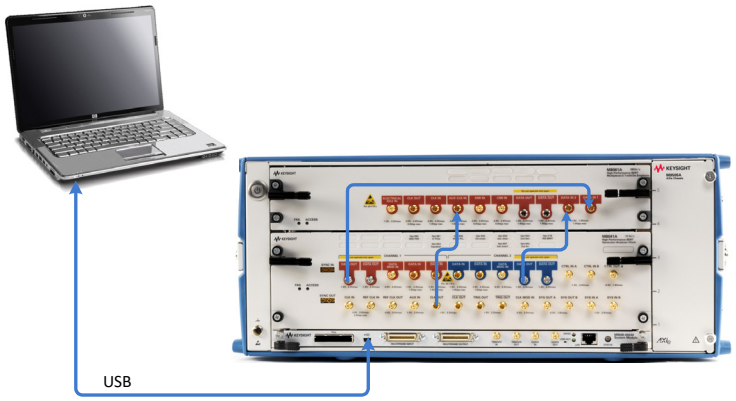


Figure 24 M8061A with M8041A (Mux mode) setup example

Figure 25 on page -55 sows a basic setup using the M8061A multiplexer with the M8041A module in **Demux** mode.

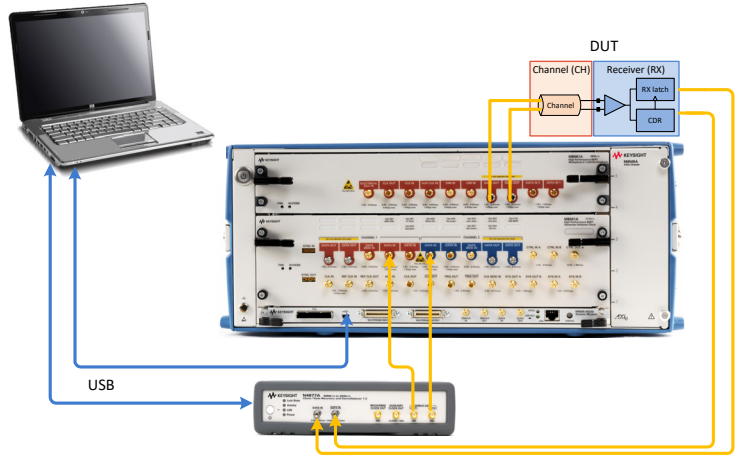


Figure 25 M8061A, M8041A and N4877A (Demux mode) setup example

Figure 26 on page -56 shows a basic setup using the M8061A multiplexer with the M8041A module in **Mux and Demux** mode. The M8061A expands the data rate up to 32 Gb/s and provides integrated and calibrated 4-tap de-emphasis (expandable to 8 taps).

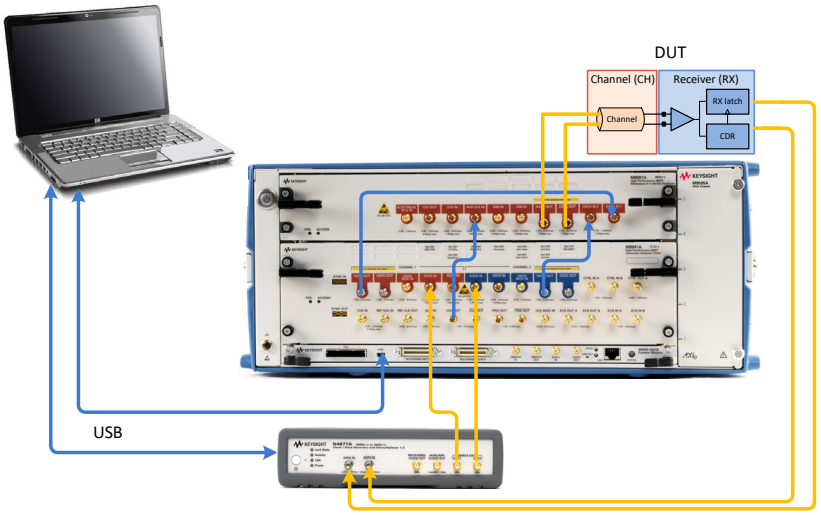


Figure 26 M8041A, M8061A and N4877A (Mux and Demux mode) setup example

Hardware Connections

Make the hardware connections as described below:

- Connect the M9505A AXIe chassis to the laptop via the USB micro-to-A cable.
- Connect the N4877A CDR/DMX (if present) to the laptop via the USB A-to-B cable.
- Connect M8041A Channel 1 DATA OUT to M8061A DATA IN 1 with a triplet phase-matched cable (PN: M8061A-804).
- Terminate M8041A Channel 1 /DATA OUT.
- Connect M8041A Channel 2 DATA OUT to M8061A DATA IN 2 with a triplet phase-matched cable (PN: M8061A-804).
- Terminate M8041A Channel 2 /DATA OUT.
- Connect M8041A CLK OUT to M8061A AUX CLK IN with a triplet phase-matched cable (PN: M8061A-804).
  Insert the M8061A-802 or M8061A-803 clock filter between these connectors, which will dramatically decrease the intrinsic RJ of the output when bitrates are >25Gb/s.
- Terminate M8041A /CLK OUT

M8061A Output to Single-ended DUT Connection

Connect the M8061A output to a DUT and then to the N4877A as described below:

- Connect M8061A DATA OUT to DUT DATA IN.
- Connect M8061A /DATA OUT to DUT /DATA IN with a phase-matched cable, or alternately terminate the M8061A /DATA OUT as shown (single-ended configuration).
- Connect DUT DATA OUT to N4877A DATA IN.
- Connect DUT /DATA OUT to N4877A /DATA IN with a phase-matched cable for best results, or alternately terminate the DUT /DATA OUT and leave the N4877A /DATA IN unterminated.
- Connect N4877A DEMUX DATA - OUT1 to M8041A Channel 1 DATA IN.
- Terminate M8041A Channel 1 /DATA IN.
- Connect N4877A DEMUX DATA - OUT2 to M8041A Channel 2 DATA IN (this does not need to be phase-matched to the cable used for channel 1).
- Terminate M8041A Channel 2 /DATA IN.

Figure 27 on page -58 shows the proper connection from the M8061A output to a DUT in a single-ended configuration.

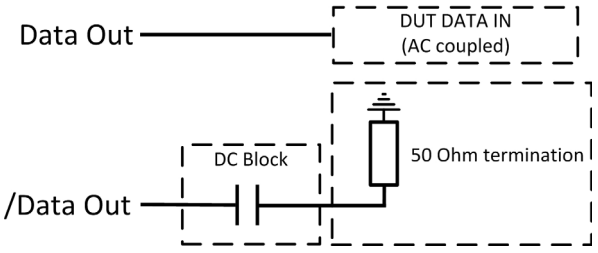


Figure 27 M8061A to DUT connection (single-ended)

NOTE The M8061A /Data Out must be terminated to ensure proper performance.

M8061A Output to Scope Input Connection

Connect the M8061A output to a scope (non 50 Ohm input) as described below:

- Connect M8061A DATA OUT to scope input.
  Figure 28 on page -59 shows the proper connection from the M8061A output to a scope input (non 50 Ohm input).

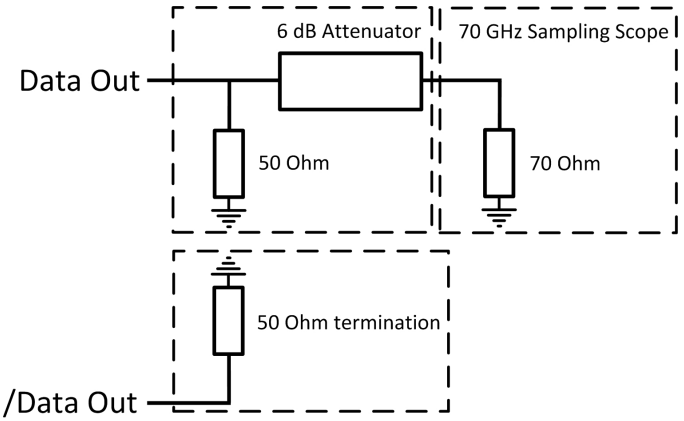


Figure 28 M8061A to scope connection

- Connect M8061A /DATA OUT to a 50 Ohm termination.
- If necessary, remove termination and connect M8041A /CLK OUT to scope.

NOTE The M8061A /Data Out must be terminated to ensure proper performance.

M8061A Output to N4877A Connection

Connect the M8061A output to N4877A as described below:

- Connect M8061A DATA OUT to N4877A DATA IN.
- Connect M8061A /DATA OUT to N4877A /DATA IN with a phase-matched cable, or alternately terminate M8061A /DATA OUT as shown and leave the N4877A /DATA IN unterminated (single-ended configuration).
  Figure 29 on page -60 shows the proper connection from the M8061A output to a the N4877A input in a single-ended configuration.

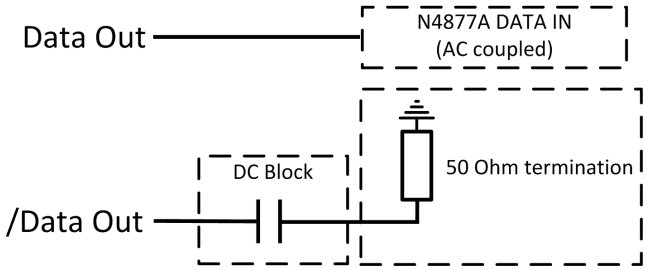


Figure 29 M8061A to N4877A connection

- Connect N4877A DEMUX DATA OUT1 to M8041A Channel 1 DATA IN.
- Terminate M8041A Channel 1 /DATA IN.
- Connect N4877A DEMUX DATA-OUT2 to M8041A Channel 2 DATA IN (this does not need to be phase-matched to the cable used for channel 1).
- Terminate M8041A Channel 2 /DATA IN.

NOTE **The N4877A /DATA IN is unterminated and the M8061A /Data Out must be terminated to ensure proper performance.**

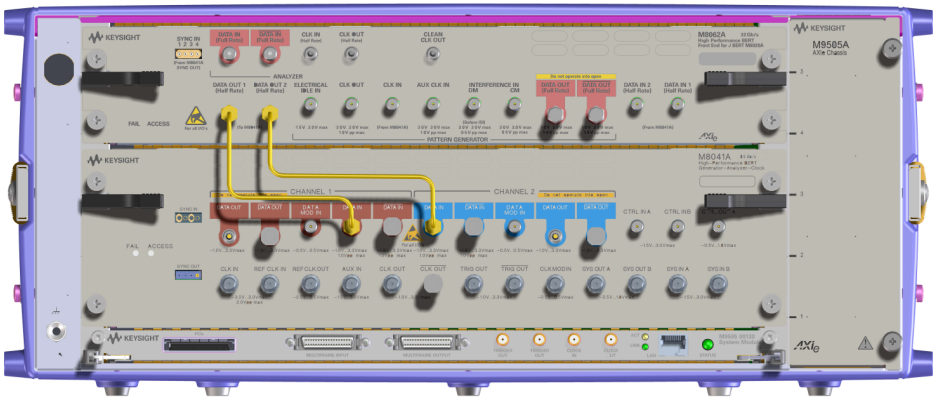
M8062A Setup Example (32 Gb/s)

Make the hardware connections as described in this section. The provided semi-rigid cable set (M8062-61641, M8062-61642 and M8062-61643) should be installed in the order listed below. The cables are labeled with corresponding port names for reference.

1 Connect the M9505A AXIe chassis to the laptop or PC via the USB micro-to-A cable.

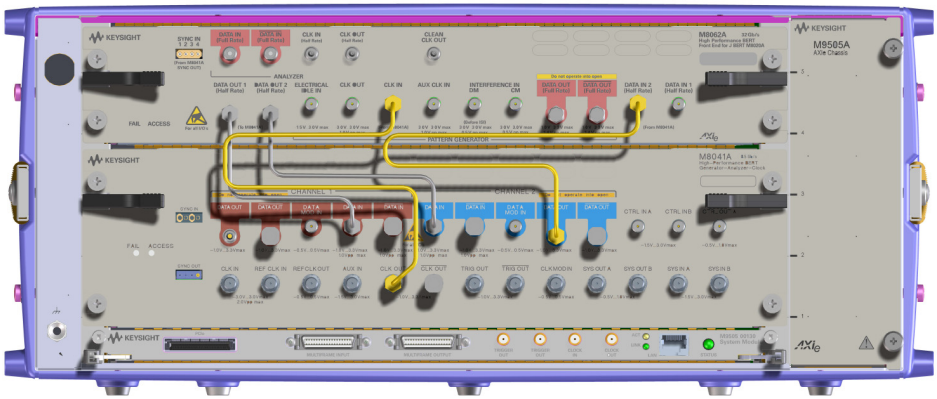
2 Connect M8062A DATA OUT 1 to M8041A DATA IN CH 1 (PN: M8062-61641)

3 Connect M8062A DATA OUT 2 to M8041A DATA IN CH 2 (PN: M8062-61642)

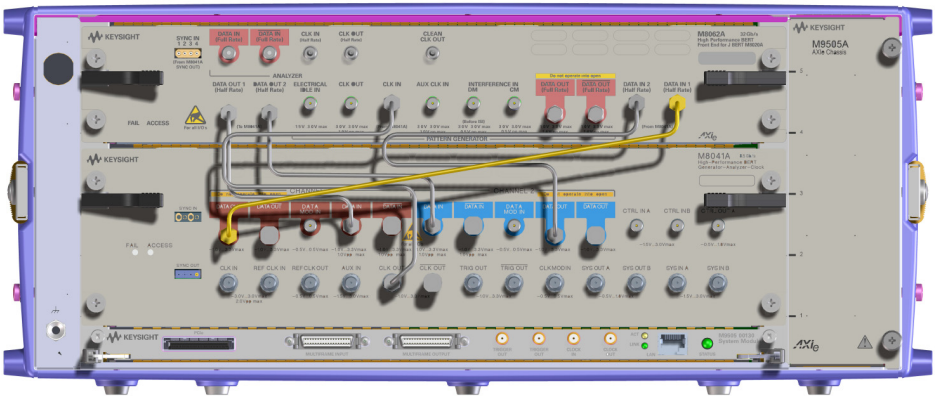


4 Connect M8062A CLK IN to M8041A CLK OUT (PN: M8062-61643-1)

5 Connect M8062A DATA IN 2 to M8041A DATA OUT CH 2 (PN: M8062-61641-2)

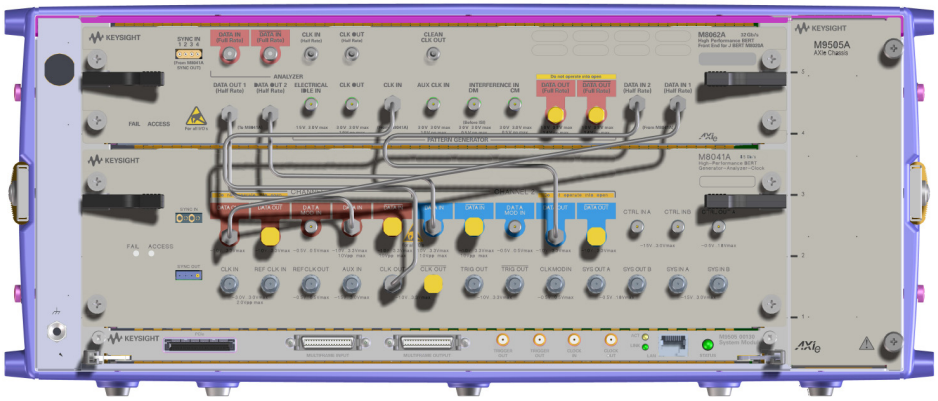


6 Connect M8062A DATA IN 1 to M8041A DATA OUT CH 1 (PN: M8062-61641-3)

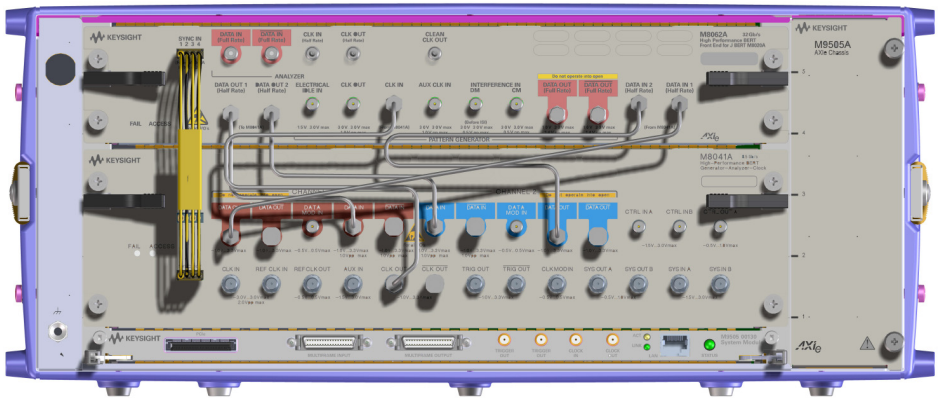


7 Terminate the following M8041A ports into 50-ohms: Channel 1 /DATA OUT, Channel 2 /DATA OUT, /CLK OUT, Channel 1 /DATA IN, Channel 2 /DATA IN.

8 Terminate the following M8062A ports into 50-ohms: DATA OUT and /DATA OUT.



9 Connect M8041A SYNC OUT to M8062A SYNC IN



10 Torque the connectors at both ends of each cable to 0.9 N/m (8.0 in-lbs).

NOTE

While connecting a module which requires the sync cable connection (e.g. M8051A, M8062A) to the test setup, make sure to connect the sync cable after completing the other connections and also remove the sync cable first while disconnecting the connections.

3 Basic Setup for M8030A

Step 1 - Unpack the Shipment

The M8030A-BU1 or M8030A-BU2 is shipped with the modules pre-installed in the M9514A AXIe Chassis.

Unpack and verify the shipment contents to check if you have received all the items that you ordered. The shipment contents can vary depending on the options that you ordered. Therefore, the shipping list delivered with the shipment should supersede these lists.

Table 32 Typical contents of an M8030A instrument shipment

Item	Description
M8030A-BU1 or M8030A-BU2	The M8030A that you ordered. M8030A-BU1 - M9514A 14-slot AXIe chassis with embedded AXIe controller. Software is pre-installed on embedded controller. M8030A-BU2 - M9514A 14-slot AXIe chassis, does not include a PC, requires an external PC.
Accessories	The accessories will vary depending on the M8030A and the options that you ordered while purchasing the module. Accessories include standard items that are shipped with the M8030A as well as optional items that you ordered separately. (Please check the M8030A product data sheet for the latest list of default and optional accessories. Latest version can be downloaded from www.keysight.com/find/M8030A)
M8070B	CD-ROM with M8070B system software.
Start Here	Document which provides instructions to be followed before operating the M8030A Multi-Channel BERT.
Tips for Preventing Damage to M8020A and M8030A	Document which provides tips for preventing damage to M8020A and M8030A.
Getting Started Guide	This document, *Keysight M8020A and M8030A Getting Started Guide*. (Please check the Keysight website: www.keysight.com/find/M8030A for the latest guide.)
M8192A Multi-Channel Synchronization Module	For further information, please check the Keysight website www.keysight.com/find/M8192A for the latest version of related documents and data sheet.

Carefully inspect all items in the shipment for any damage.

Return the Damaged/Defective Item to Keysight for Repair/Replacement

If anything is missing, defective, or damaged,

1 Review the warranty information shipped with your product or check the warranty information on Keysight website.
   - To check the warranty information on your module, go to www.keysight.com/find/warranty and specify the module's model number (for example, M8041A) in the Product Number field, and specify the serial number from the top of the module in the Serial Number field.

2 Contact the nearest Keysight Sales Office. If you need assistance finding Keysight contact information, go to www.keysight.com/find/assist (worldwide contact information for repair and service).

Step 2 - Install the Chassis

If you have not already done so, please refer to the *Keysight M8020A and M8030A Installation Guide* for detailed installation instructions.

Product specifications, available accessories, firmware and software may change over time. Please check the Keysight website at www.keysight.com/find/M9514A for the latest updates to the product software, guides, data sheet and help files.

WARNING Chassis exceeds 48 kg. Use a mechanical lift to lift the chassis. The chassis should be transported using a rolling cart. Do not lift the chassis by the handles on the front and rear of the chassis.

WARNING Hearing protection must be worn when working on or around the chassis when it is powered on. The airflow noise around the chassis can exceed 79 dB(A). This is outside the range that is normally considered safe (70 dB(A)). Over and above that level is considered hazardous and can result in permanent hearing damage.

Step 3 - Install the ASM in the Chassis

Before powering on the chassis, install the M9521A AXIe System Module (ASM) in chassis slot 7. Please refer to the *Keysight M8020A and M8030A Installation Guide* for detailed installation instructions.

Step 4 - Power-Up and Power-Down the Chassis

This step ensures that the ASM is properly installed in the AXIe chassis and that the chassis and ASM power-up properly. It is not necessary to connect the chassis or ASM to a host computer for this step. After verifying that all of the chassis and ASM Status LEDs have turned solid green, please power-down the chassis.

To Power Up the Chassis

Ensure Circuit Breakers are Closed - Close all three rear panel circuit breakers (ON position).

Press Chassis On/Standby Button - Press the chassis' front panel ON/STANDBY switch. It will be dimly lit to indicate that AC power is available and the chassis is in the Standby mode; it will be brightly lit when depressed and the chassis is powered on.

The Status LEDs on the chassis and ASM cycle as follows:

1 Light off - with button in STANDBY mode

2 Green, blinking - for a few seconds after POST

3 Green, steady - successful chassis power-up is complete.

If either the chassis or the ASM do not power up to a steady green Status LED, or either powers up to a steady red Status LED, the chassis or ASM has detected a failure. Immediately power down the chassis.

If the chassis ON/STANDBY switch flashes continuously after turning on the chassis, press and hold the ON/STANDBY switch for five seconds. If this does not resolve the issue, power down the chassis. Refer to the *M9514A and M9521A Service Guide*.

To Power Down the Chassis

There are two power-down modes:

- For routine power-down or to cycle power to the chassis, momentarily press the chassis ON/STANDBY switch. The system does a controlled shutdown of the embedded controller (if installed) and instrument modules and then shuts down the power supply. The main chassis fans will gradually drop in speed to off. This is normal.
- If you press and hold the ON/STANDBY button for more than five seconds, the system shuts down the power supplies immediately.

Step 5 - M8030A Configuration

The M8030A is a modular test solution which can be tailored to your specific needs from two channels with one M8041A to up to 10 channels. The modules must be installed in the M9514A AXIe 14-slot chassis as described in Table 33 on page -69:

Table 33 M8030A Modules Configuration

Slot Number	Module
# 1	M8030A-BU1 AXIe embedded controller.
# 2, 3 & 4	M8041A module
# 5 & 6	M8051A module
# 7	M9521A AXIe system module
# 8 & 9	M8051A module
# 10 & 11	M8051A module
# 12 & 13	M8051A module
# 14	M8192A multi-channel synchronization module

M8030A Modules Arrangement Example

Figure 30 on page -70 shows an example of modules arrangement in the M9514A AXIe 14-slot chassis.

Slot #1	Slot #2	Slot #3	Slot #4	Slot #5	Slot #6	Slot #7	Slot #8	Slot #9	Slot #10	Slot #11	Slot #12	Slot #13	Slot #14
M9537A AXIe Embedded Controller	M8041A J-BERT High-Performance BERT Module			M8051A J-BERT High-Performance BERT Module		M9521A AXIe System Module	M8051A J-BERT High-Performance BERT Module		M8051A J-BERT High-Performance BERT Module		M8051A J-BERT High-Performance BERT Module		M8192A AXIe Clock Sync Module

Figure 30 Example of M8030A module arrangement

Step 6 - Set up the Host PC (not required for M8030A-BU1)

Communication with the M9514A chassis, AXIe System Module (ASM) and installed instrument modules requires a host PC, a Windows based computer that may be:

An Embedded Controller (takes up slot one in the chassis). An AXIe embedded PC (also commonly called an embedded controller) such as the Keysight M9537A, allows for stand-alone test system operation. PCIe and LAN connections from PC to ASM are made directly at the chassis backplane.

A separate rack-mounted or desktop PC. To use the chassis PCIe data transfer capabilities, this external host PC must have an available PCIe x8 slot and BIOS support for proper enumeration of devices on the PCIe bus. PCIe connection from the host PC to ASM requires a PCIe adapter card and cable.

Keysight recommends use of a PC, card and cable tested with the AXIe mainframe; a current list can be found at: www.keysight.com/find/axie-chassis.

Computer Hardware and Software Requirements

The following are the hardware and software requirements that should be met on the host computer before the installation of software components on this computer:

Hardware requirements

- Pentium® processor 1 GHz or equivalent
- 16 GB available RAM
- USB 3.0 connection
- PCIe 2.0/8x (only for highest data throughput and desktop PC)
- VGA resolution 1024 x 768
- 1.5 GB or more free hard disc space

Software requirements

- The following operating systems are supported:
  - Windows 7 (64 bit) SP1
  - Windows 8 (64 bit)
  - Windows 8.1 (64 bit)
- Keysight I/O libraries version 16.3 or higher

NOTE The M8070B software is required to control the M8030A. M8070B-0TP or M8070B-0NP license is required for controlling hardware.

NOTE PCIe connectivity between the M9514A AXIe Chassis and an external desktop PC controller is recommended when full channel plus large patterns need to be downloaded.

Step 7 - Power on the Chassis First then the Host Controller

Power up all the connected hardware components in the M9514A AXIe Chassis.

1 Press the ON/Standby button on the front panel of the chassis to power on the chassis.

Figure 31 Chassis ON/standby button

2 After powering up the chassis, wait until the Status LED of the ASM is solid green. This ensures that the PCIe channel in the chassis is ready for the successful connectivity of the chassis to the host computer.

3 Wait until the Access LED(s) of the module(s) in the chassis is/are solid green.

4 Power up the host computer. By this time, the Status LED of the ASM in the chassis and the Access LED(s) of the module(s) should have been steady green indicating a power ready status of the setup.

   The step to power up the host computer is not required if you are using the M9537A AXIe Embedded Controller module as the host computer because it gets powered on simultaneously with the chassis through the chassis backplane.

NOTE If you plan to connect the J-BERT M8030A to a corporate LAN and the M9537A AXIe Embedded Controller is installed, you must use the Ethernet port available on the M9537A AXIe Embedded Controller or the LAN port on the external PC.

NOTE To power down a chassis, first turn off the host computer and then power down the chassis using the On/Standby button on its front panel.

If you are using the M9537A AXIe Embedded Controller module as the host computer, ensure that you first shut down the controller by executing the Windows shutdown process.

Do not use the circuit breaker for routine chassis turn off.

The module(s) are turned off automatically with the chassis.

Step 8 - Verify Basic M8030A Operation

After powering ON the connected hardware components, you can verify if you have correctly set up the hardware if:

- a steady green status light is displayed on the ASM of the M9514A AXIe Chassis indicating that the chassis has powered up successfully.
- the Access LED on the front panel of the instrument module turns on indicating that the module is in a power- ready state.
- the Out of Service (OOS) LED on the front panel of the M9537A AXIe Embedded Controller turns off. (Applicable only when you are using M9537A AXIe Embedded Controller as the host computer).

If the chassis does not power up to a steady green Status light, or powers up to a steady red light, the chassis has detected a failure and requires service.

If the Fail LED on the front panel of the instrument module is steady red and does not turn off, it indicates a power fault condition. In such a situation, the instrument module may require repair/service.

Contact your Keysight representative to replace or service the chassis/module.

Step 9 - Install Keysight IO Libraries Suite (not required for M8030A-BU1)

IO Libraries Suite version 16.3 or later is required. Always use the latest version of the Keysight IO Libraries.

NOTE **Perform this step if you are setting up an M8030A-BU2 system or the host computer you are using as part of the M8030A system requires I/O library installation.**

1. Disconnect any devices connected to the host computer.
2. If open, close all applications on the host computer.
3. Insert the *Automation-Ready* CD in your CD-ROM drive or download and install the IO Libraries from www.keysight.com/find/iosuite.
4. Follow the instructions as prompted during the installation.
5. After installation, you will see the Keysight IO icon in the taskbar notification area of the host computer screen.

Step 10 - Install M8070B Software (not required for M8030A-BU1)

NOTE **Perform this step if you are setting up an M8030A-BU2 system or the host computer you are using as part of the M8030A system requires I/O library installation.**

The M8070B software does not require any license for its installation. However, it can only be used to perform some basic operations. For advance operations, you need to install the plugins in the M8070B software. For details, go to Step 11 - Install the Plugins on page 75. These plugins need a valid license for their activation. For details, go to Step 12 - Install the Licenses on page 76.

NOTE **A CD-ROM is shipped when ordering the M8070B (part of the M8030A configuration).**

To install the software

1 Insert the CD ROM into the host computer or download the latest M8070B software from www.keysight.com/find/M8070B.

2 Double-click the setup (.exe) file.
The InstallShield Wizard is displayed.

3 If displayed, click **Install** to continue or click **Next** if the system controller meets the minimum system configuration requirements displayed by the wizard.

4 When displayed, accept the license agreement and click **Next**.

5 Click **Install** to start the installation then follow any on-screen prompts/instructions.

6 In Windows click **Start** > **All Programs** > **M8070B Keysight** > **M8070B Keysight** to verify software installation. The Startup screen of the M8070B software should display.

NOTE

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

Step 11 - Install the Plugins

The basic functionality of the M8070B can be used without installing any license. However, for advanced features, you need to install the M8070B plugins. The plugin file (*.M8KP) can be downloaded from Keysight web page. The M8070B software supports the following plugins:

- Advanced Measurement Package
- Error Distribution Analysis Package

Please make sure that you have M8070B software version 6.0 or later installed on your system. The M8070B software comes with a **Plugin Manager** to simplify all the tasks related to plugin management. The **Plugin Manager** also allows you to install, uninstall and upgrade the plugins.

NOTE

Please note that the M8070B plugins requires a license for its activation.

For further details on how to install, update or uninstall plugins, please refer to the *M8000 Series User Guide* or *M8000 Series Plugins Getting Started Guide*.

Step 12 - Install the Licenses

NOTE All M8030A-BU1 licenses have been pre-installed (except for a floating/networked license). All other system configurations require license installation as described in this step.

The usage of M8070B plugins is govern by Keysight Licensing. Keysight Licensing provides tools and processes for floating, USB portable, node-locked, and transportable licenses. 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.

Depending upon the license types, the following version of **Keysight License Manager** can be used to install the licenses:

- The node-locked and transportable licenses are installed by **Keysight License Manager 5**.
- The floating and USB probable licenses are installed by **Keysight License Manager 6**.

NOTE Please note that the Keysight License Manager 5 and Keysight License Manager 6 get installed on your system when you install M8070B system software.

For details on how to install these licenses, you can refer the following documents:

- M8000 Series User Guide (https://literature.cdn.keysight.com/litweb/pdf/M8000-91B08.pdf)
- Keysight Licensing Administrator's Guide (https://literature.cdn.keysight.com/litweb/pdf/5951-5739.pdf)

Installing Module Licenses (for upgrades only)

The M8030A, being a modular product, includes different sets of modules hosted in an M9514A AXI chassis. Each module has its own licenses corresponding to specific features. Module licenses are pre-installed at the factory according to the specific options that were ordered. For more detailed information about licensing, refer to the *M8000 Series User Guide*.

The following procedure shows how to redeem and install a module license.

1. Locate the Software License Entitlement Certificate (email or paper copy).
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.

4 Using M8020A / M8030A

KEYSIGHT TECHNOLOGIES

Locating Electronic Manuals and Online Help

Various electronic manuals and the *M8000 Series Online Help* provide information on how to configure and use the supported instrument modules.

On installing the M8070B software, you will find documentation by clicking **Start** > **All Programs** > **Keysight M8070B** > **Keysight M8070B Documentation**.

You can also visit www.keysight.com/find/M8020A to find the latest versions of various manuals and the data sheet for each M8020A module.

Routine Care

NOTE Except for performing initial chassis verification or troubleshooting, do not operate the chassis with empty slots. Always insert a filler panel in empty slots. This is especially important for the slots on either side of an installed instrument module. This allows proper air flow and cooling, and provides EMI shielding for the chassis and installed components. Leaving slots empty can increase fan speed, raise ambient noise, overheat components, and can cause the module to shut down.

CAUTION Do not block the vent holes on the chassis. This overheats and damages their components. Leave a gap of at least 2” (50 mm) around all vent holes.

CAUTION The enclosure surface of the module may become hot during use. If you need to remove the module, first power down the AXIe chassis, allow the module to cool, and then pull the module out of the chassis.

NOTE For preventing damage, for usage tips, and for ESD information, read and follow the instructions in the "*Tips for Preventing Damage to M8020A/M8030A*" (M8000-91010).

Starting the M8070B Software

1 Ensure that the system is powered up and ready to start as described in the sections Basic Setup for M8020A on page 39 and Basic Setup for M8030A on page 65.

2 On the host computer, click on **Start** > **All Programs** > **Keysight M8070B** > **Keysight M8070B**.

3 When the **Load Settings** screen appears as shown in Figure 32 on page -81, load the last used, factor preset, or new settings.

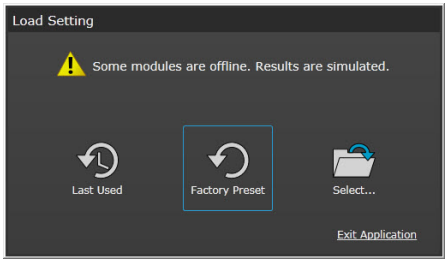


Figure 32 Load Settings screen

4 The screen shown in Figure 33 on page -82 should now be displayed.

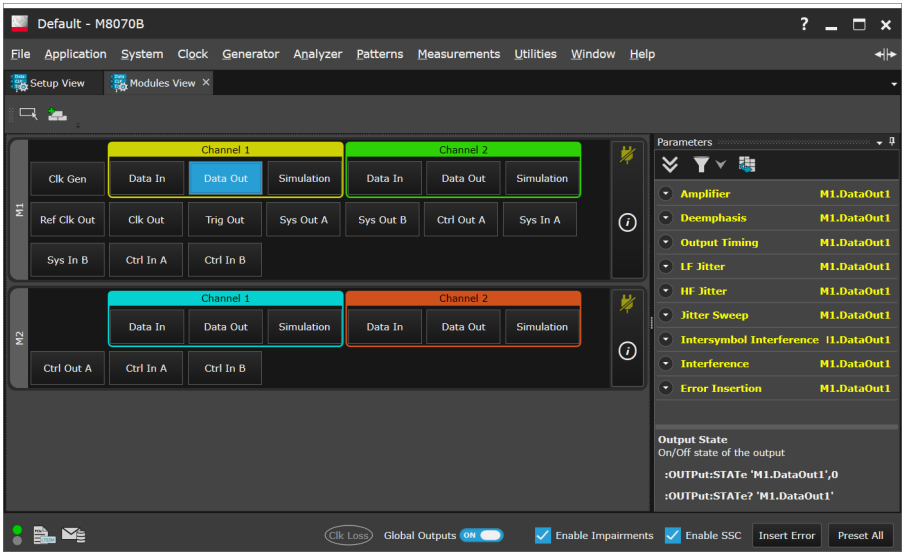


Figure 33 M8070B user interface

Perform a Measurement

The following measurement example verifies a BER of 0 in channel 1 of the M8041A.

1 Connect the M8041A Channel 1 Data Out to Channel 1 Data In.

2 In the M8070B software interface, set the data rate to 10 Gb/s as follows:

a Click on **System** > **System View**.

b Click on the **PLL Synthesizer Internal** block as shown in Figure 34 on page -83 to display the **Synthesizer** properties.

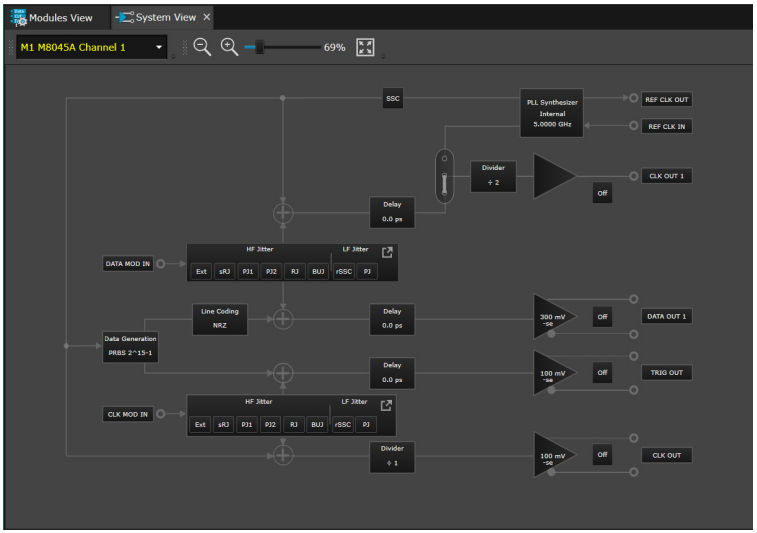


Figure 34 Synthesizer parameters

c In the **Synthesizer** parameters, click in the numeric field corresponding to the **Frequency** setting.

d Using the numeric keypad, enter **10** then click on the **GHz** button as shown in Figure 35 on page -83. If your system has a maximum data rate of 8 Gb/s, leave the frequency setting at 5 GHz.

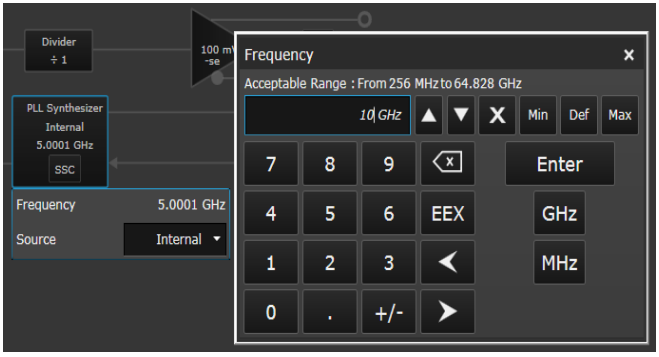


Figure 35 Set frequency to 10 GHz

3 Click on **Patterns** > **Sequence Editor**.

4 Click in the **Analyzer** block as shown in Figure 36 on page -84.

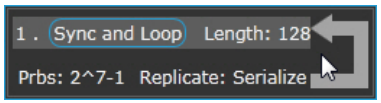


Figure 36 Analyzer controls

5 Expand **Block Data**.

6 Select a PRBS 9- 1 pattern as follows:

a In the **Block Data** properties, select **Prbs** as the **Pattern Type** as shown in Figure 37 on page -84.

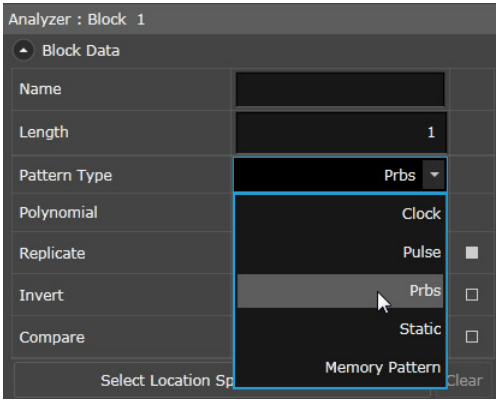


Figure 37 Select Pattern Type

b In the **Block Data** properties, select **2^9- 1** as the **Polynomial** as shown in Figure 38 on page -85.

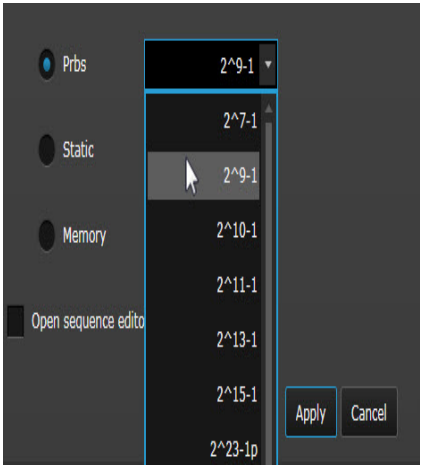


Figure 38 Select Polynomial

c In the **Block Data** properties, click on the **Select Location Specific Patterns** button.

d Select **M1.DataIn1** then click on the **Select** button as shown in Figure 39 on page -85.

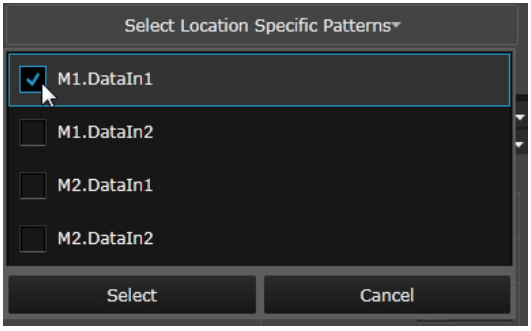


Figure 39 Select module/channel number

e The **Analyzer** block should now display the setup information as shown in Figure 40 on page -86.

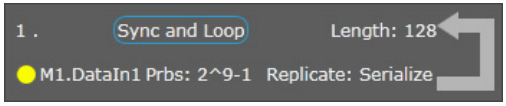


Figure 40 Analyzer setup information

f Click on the **Download** icon to download the setup to the module as shown in Figure 41 on page -86. After downloading, this icon turns green.

Figure 41 Download to module

g Click in the **Generator** block as shown in Figure 42 on page -86and repeat this procedure to set up the pattern generator (M1.DataOut1).

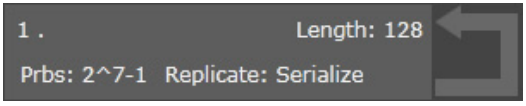


Figure 42 Select Generator block

7 Click on the **Modules View** tab.

8 Click on **Channel 1** > **DataOut** corresponding to the M8041A (M1) as shown in Figure 43 on page -86.

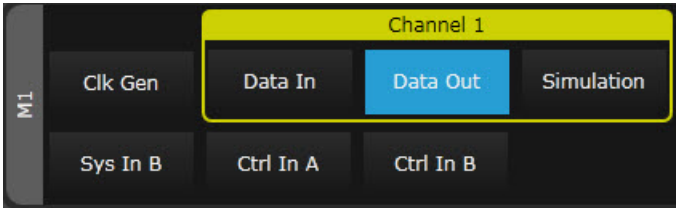


Figure 43 Select Channel 1 DataOut

9 Expand **Amplifier**.

10 Enable the output of the pattern generator by clicking on the **Output State** slider as shown in Figure 44 on page -87.

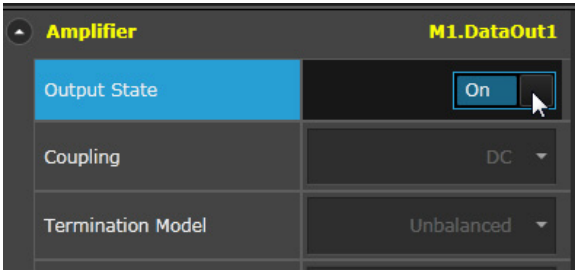


Figure 44 Enable pattern generator output

11 Enable the global outputs by clicking on the **Output** button present on the **Status Bar** as shown in Figure 45 on page -87.

Figure 45 Enable global outputs

12 Click on **Channel 1** > **DataIn** corresponding to the M8041A (M1) as shown in Figure 46 on page -87.

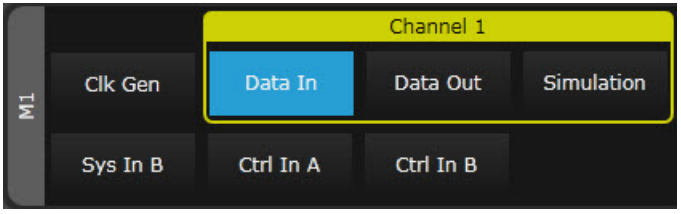


Figure 46 Select Channel 1 DataIn

13 Expand **Analyzer**.

14 Click on the **Alignment BER Threshold** button to synchronize and align the error detector as shown in Figure 47 on page -88.

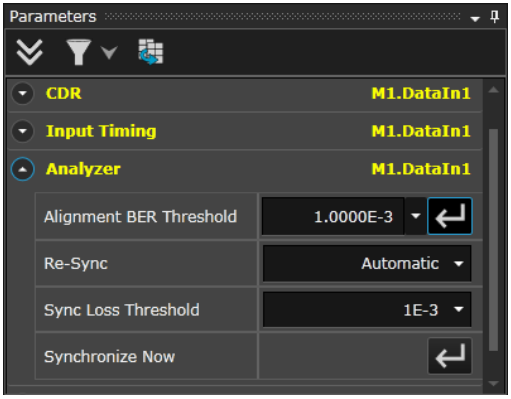


Figure 47 Alignment BER Threshold

15 At any time you can click on the **Hide Status Indicators Window** icon (bottom-left of display) to view/hide the module status including BER.

16 Click on **Measurements** > **Error Ratio**.

17 The default acquisition parameter settings are used as shown in Figure 48 on page -88.

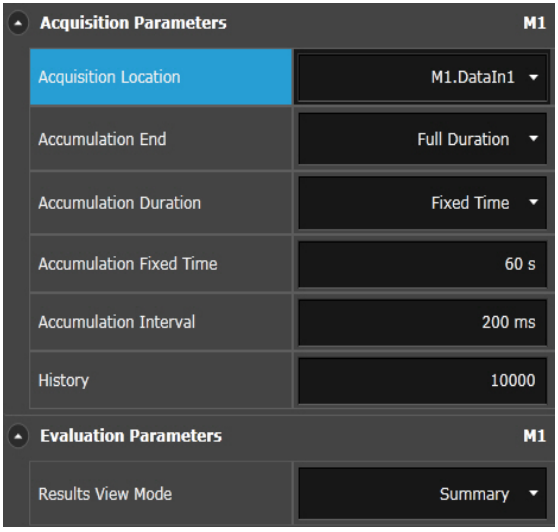


Figure 48 Acquisition parameter settings

18 Click on the **Start Measurement** button to start the measurement as shown in Figure 49 on page -89.

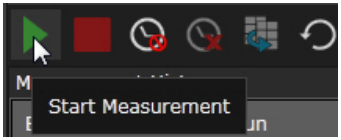


Figure 49 Start measurement

19 After the measurement has completed (60 sec), review the results shown below the graph in the **Calculated Results** table as shown in Figure 50 on page -89.

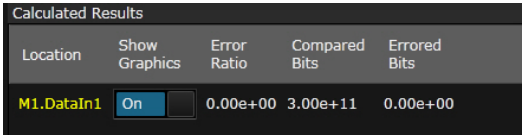


Figure 50 Calculated results

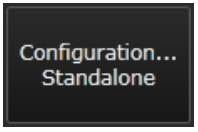
M8061A/62A Configuration (Optional)

M8061A Configuration

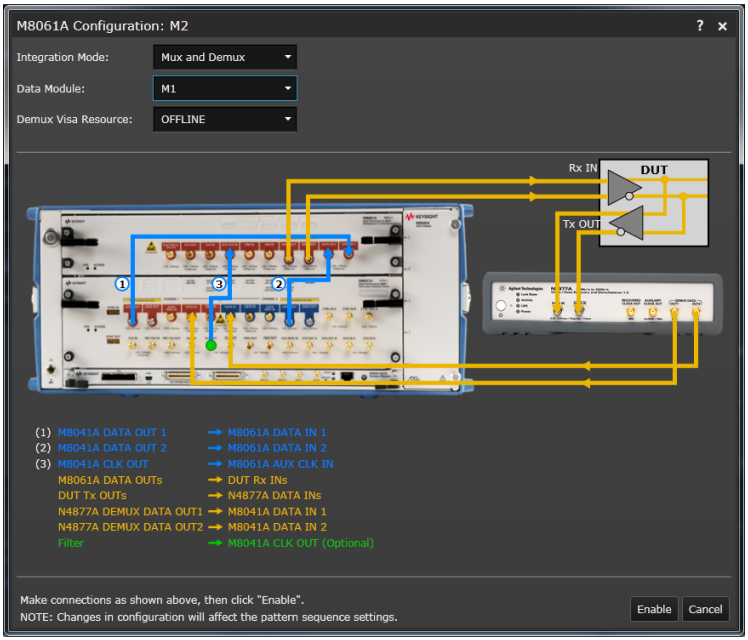
The following steps describe the procedure for M8061A configuration:

- Launch the M8070B software.
- Go to **Menu Bar** > **System** and then click **Module View**.
- Locate the **M8061A** module. The following figure shows an example of **Module View** when M8061A (M2) is connected with other M8020A modules:

- Click **Configuration...** button present on the **M8061A** module.



The **M8061A Configuration** dialog will appear as shown in the following figure:



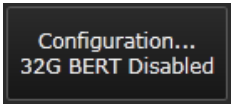
- Select the **Integration Mode**. The default mode is **Standalone Mode**. The other modes you can select are **Mux Only** mode, **Demux Only** mode and **Mux and Demux** mode.
- Select the **Data Module** to which the M8061A module is connected.
- Select the visa resource string for N4877A (Demux). This is required to connect N4877A instrument with M8020A.
- Click **Enable**. Depending upon the configuration settings, the ports which are used by the Data module and M8061A module will be disabled. For the block diagram representation and interactively modify the settings of the currently selected mode, switch to **System View**. For complete details, refer to the *M8000 Series User Guide* or *M8000 Series Online Help*.

M8062A Configuration

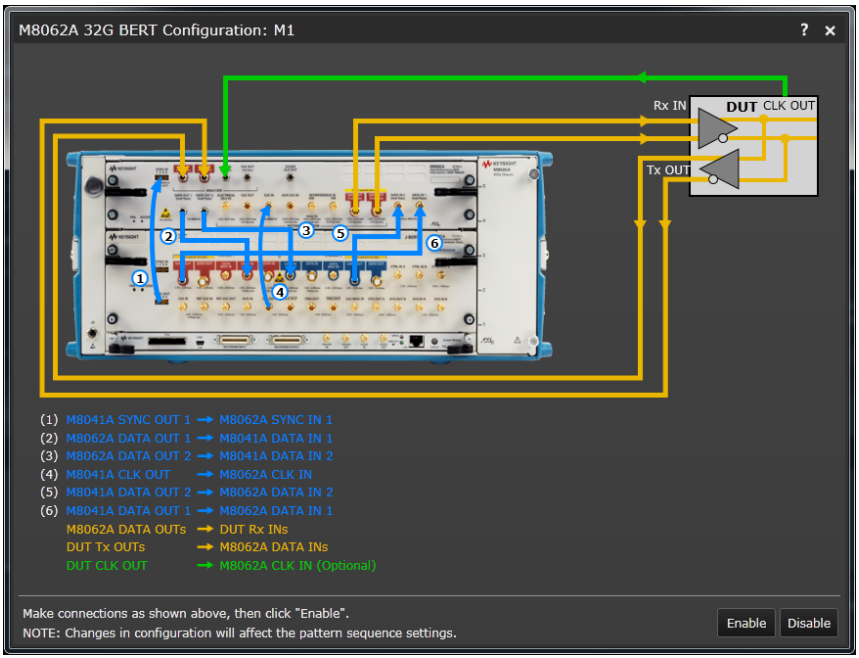
The following steps describe the procedure for M8062A configuration:

- Launch the M8070B software.
- Go to **Menu Bar** > **System** and then click **Module View**.
- Locate the **M8062A** module. The following figure shows an example of **Module View** when an M8062A (M2) and an M8041A (M1) are installed in the M8020A system:

- Click **Configuration...** button present on the **M8062A** module.



The **M8062A Configuration** dialog will appear as shown in the following figure:



- Make the connections as shown in the above figure. The connection details can also be found at M8062A Configuration on page 92.
- Click **Enable**.

In the 32G mode, access to some M8041A user controls are disabled to facilitate software control of this configuration. For additional information, refer to the *M8000 Series User Guide* or *M8000 Series Online Help*.

Updating Software Components

Updated versions of the M8070B and module specific software components are available on the Keysight website.

These software components are available as .EXE files. To download a software upgrade:

1 Go to http://www.keysight.com/find/M8070B
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 and Software** link on the module page.
6 Download the required software update from the list of available updates.

Contacting Keysight Service and Support

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

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