M8000 Series BER Test Solutions

M8020A High-Performance BERT

M8040A High-Performance BERT 64 GBd

M8050A High-Performance BERT 120 GBd

Supported Modules:

M8041A, M8042A, M8043A, M8045A, M8046A, M8051A, M8052A, M8054A, M8057A/B, M8058A, M8059A, M8062A, M8009A & M8067A

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CAUTION

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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.

Contents

Tools shipped with M8000 series modules

Table 1 lists the tools that are shipped with M8000 series modules. The type of wrench you receive in the kit may vary depending on the module you procure. The sections below specify the type of wrench you require for the connection and removal of the associated cables.

Table 1 Tools shipped with M8000 series modules

Tool type	Part number	Description
Wrench	M8042-03801	9 mm
Counter Wrench	54964-03801	2 mm thick, dual-ended, fits 6 mm and 7 mm
Counter Wrench	54964-03802	1.5 mm thick, dual-ended, fits 8 mm
Torque Wrench	8710-1765	Torque 8 lb-in, 5/16 Inch
Torque Wrench	8710-2812	Torque 4-in-lb 6 mm

Figure 1 Tools shipped with modules

For more information about Keysight recommended wrenches, refer to https://www.keysight.com/in/en/lib/resources/technical-specifications/what-torque-wrenches-and-openended-wrenches-does-keysight-recommend-for-connecting-rf-connectors-2516881.html.

Preventing damage to M8050A connectors including M8042A/M8043A/M8067A connectors

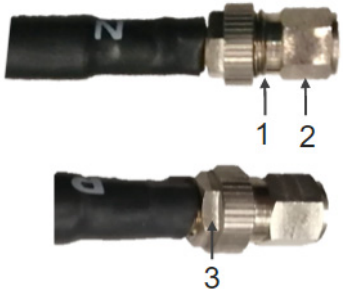
Tips for connecting and removing M8050A connectors

120G Head M8059A and M8067A-003/-004/-005 connectors and short cable

Tools required to connect/disconnect the cable

- 8710-2812 Torque Wrench: 4-in-lb 6 mm

Table 2 Steps to connect / disconnect the cables

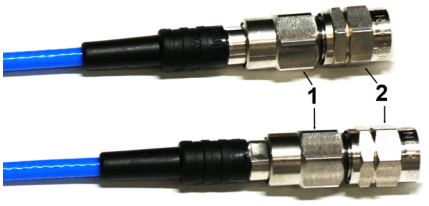
Steps to be performed	Reference image of the cable
Connecting the cables	
Loosen the grooved nut and confirm the screw thread is visible (position 1). The center pin is now retracted from the standard position.	
Use 8710-2812 wrench to tighten the Hex nut (position 2) to the female connector of module or device.	
By tightening the grooved nut (position 3) using the 8710-2812 wrench, the center pin will extend into the female connector's socket.	
Disconnecting the cables	
Use 8710-2812 wrench to loosen the grooved nut and confirm that the screw thread is visible (position 1). The center pin is now retracted from the standard position.	
Use the 8710-2812 wrench to open the hex nut (position 2) from the female connector of module or device.	

64G Head M8058A/M8052A and M8067A-001/-002 connectors and short cable

Tools required to connect/disconnect the cable

- 54964-03802 Counter Wrench: 1.5 mm thick, dual-ended, fits 8 mm
- 8710-1765 Torque Wrench: 8lb-in, 5/16 Inch

Table 3 Steps to connect / disconnect the cables

Steps to be performed	Reference image of the cable
Connecting the cables	
Use the 54964-03802 wrench to hold at position 1. Avoid turning inner pin.	
Use 8710-1765 wrench to torque / tighten at position 2.	
Disconnecting the cables	
Use the 54964-03802 wrench to hold at position 1. Avoid turning inner pin.	
Use 8710-1765 wrench to loosen at position 2.	

Connecting & removing M8058A remote head

Tools required to connect/disconnect the cable

- 8710-2812 Torque wrench: 4-in-lb 6 mm
- 54964-03801 Counter wrench: 2 mm thick, dual-ended, fits 6 mm and 7 mm

Table 4 Steps to connect / disconnect the cables

Steps to be performed	Reference image of the cable
Connecting remote head to Data Out on module	
Note that the pre-connected adapter 11921-60007 (1 mm male side) is part of the remote head.	
Use the 7 mm side of the 54964-03801 wrench to hold at position 1. Avoid turning inner pin.	
Use 8710-2812 wrench to torque at position 2.	
Disconnecting remote head from Data Out on module	
Keep the adapter 11921-60007 (1 mm male side) as part of remote head.	
Use the 7 mm side of the 54964-03801 wrench to hold at position 1. Avoid turning inner pin.	
Use 8710-2812 wrench to loosen at position 2.	

Tips for connecting and removing M8042A connectors (External semi-rigid cable connection)

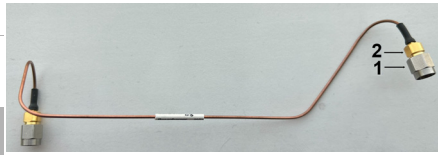
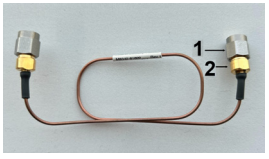
WARNING Avoid repeated bending of cables; a single sharp bend can damage a cable instantly.

Connecting & disconnecting 1.85 mm cables (M8042-61621 / M8042-61622 / M8052A-801)

Tools required to connect/disconnect the cables

- 54964-03801 Counter Wrench: 2 mm thick, dual-ended, fits 6 mm and 7 mm
- 8710-1765 Torque Wrench: 8lb-in, 5/16 Inch

Table 5 Steps to connect / disconnect the cables

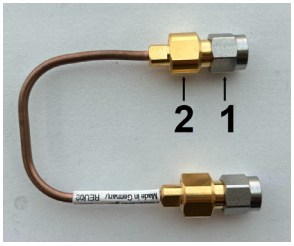
Steps to be performed	Reference image of the cable
Connecting the cables	
Use the 54964-03801 wrench to hold at position 2. Avoid turning inner pin.	
Use the 8710-1765 wrench to torque at position 1.	
Disconnecting the cables	
Use the 54964-03801 wrench to hold at position 2. Avoid turning inner pin.	
Use the 8710-1765 wrench to loosen at position 1.	

Connecting & disconnecting 3.5 mm cables (M8042-61623)

Tools required to connect/disconnect the cable

- M8042-03801 Wrench: 9 mm
- 8710-1765 Torque Wrench: 8lb-in, 5/16 Inch

Table 6 Steps to connect / disconnect the cables

Steps to be performed	Reference image of the cable
Connecting the cables	
Use the M8042-03801 wrench to hold at position 2. Avoid turning inner pin.	
Use the 8710-1765 wrench to torque at position 1.	
Disconnecting the cables	
Use the M8042-03801 wrench to hold at position 2. Avoid turning inner pin.	
Use the 8710-1765 wrench to loosen at position 1.	

WARNING The following image displays the actual connections of the 1.85 mm semi-rigid cables, connected at positions 1-1 & 2-2, along with the 3.5 mm semi-rigid cable, connected at position 3-3, between the M8009A and M8042A modules. All these cables are highly sensitive and must be handled with care.

Figure 2 Using semi-rigid cables to connect M8009A and M8042A

General tips to prevent unnecessary repairs

Use proper connector care and connection techniques

- Proper connector care and connection techniques are critical for accurate, repeatable measurements, and for extending the life of your devices.
- Prior to making connections, be sure to read all of the connector care information provided with your product.
- Follow the connector care and connection techniques listed in the following tables.

Handling and Storage	
DO	**DO NOT**
Keep connectors clean	Touch mating-plane surfaces
Extend sleeve or connector nut	Set connectors contact-end down
Use plastic end caps during storage	

Visual Inspection	
DO	**DO NOT**
Inspect all connectors carefully before every connection	Use a damaged connector - ever
Look for metal particles, scratches, dents	

Gauging Connectors	
DO	**DO NOT**
Clean and zero the gauge before use	Use an out-of-spec connector
Use the correct gauge type	
Use correct end of calibration block	
Gauge all connectors before first use	

Connector Cleaning	
DO	**DO NOT**
Try compressed air first	Use any abrasives
Use isopropyl alcohol	Get liquid into plastic support beads
Clean connector threads	

Making Connections	
DO	**DO NOT**
Align connectors carefully	▪ Apply bending force to connection ▪ Over tighten preliminary connection
Turn only the connector nut	Twist or screw any connection
Use a torque wrench for final connect	Tighten past torque wrench "break" point

Protect the input and output connectors

- Avoid repeated bending of cables; a single sharp bend can damage a cable instantly and permanently.
- Limit the number of connections and disconnections to reduce wear.
- Inspect the connectors prior to use; look for dirt, nicks, and other signs of damage or wear. A bad connector can ruin the good connector instantly.
- Clean dirty connectors to prevent poor electrical connections and avoid damage to the connector.

Protect the RF connectors

- Be careful not to bend, bump or flex any device under test (DUT) connected to instrument (such as filters, attenuators, or large cables). This will reduce the amount of strain placed on the connectors and the mounting hardware.
- Ensure externally connected items are properly supported (not freely suspended) from the connectors.
- Always use torque wrench and gauge tools for connecting RF connectors.
- Do not mix 50 Ω and 75 Ω connectors and cables.

Follow proper RF cable and connector care

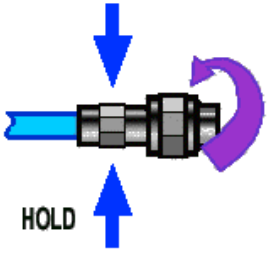
- Avoid repeated bending of cables; a single sharp bend can damage a cable instantly.
- Limit the number of connections and disconnections to reduce wear.
- Inspect the connectors prior to using; look for dirt, nicks, and other signs of damage or wear. A bad connector can ruin a good connector instantly.
- Always use torque wrench and gauge tools for connecting RF connectors.
- Clean dirty connectors to prevent poor electrical connections or damage to the connector.

Making a connection

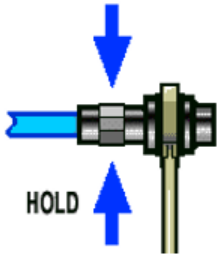
1 Inspect and clean. All connectors must be undamaged, clean, and within mechanical specification.

2 Carefully align center axis of both devices. Push the connectors straight together so they can engage smoothly. The male center conductor pin must slip concentrically into the contact fingers of the female connector.

3 CRITICAL: Rotate only the connector nut - NOT THE DEVICE OR CONNECTOR BODY - until finger-tight, being careful not to cross the threads. Damage to both connectors will occur if the male center pin is allowed to rotate in the female contact fingers.



4 Use a torque wrench to make final connection. Tighten until the “break” point of the torque wrench is reached. Do not push beyond initial break point. Use additional wrench, if needed, to prevent device body from turning.



Using the torque wrench

- Hold the torque wrench lightly, at the end of the handle only (beyond the groove).
- Apply downward force perpendicular to the wrench handle. This applies torque to the connection through the wrench. Do not hold the wrench so tightly that you push the handle straight down along its length rather than pivoting it, otherwise you apply an unknown amount of torque.
- You don’t have to fully break the handle of the torque wrench to reach the specified torque; doing so can cause the handle to kick back and loosen the connection. Any give at all in the handle is sufficient torque.
- Tighten the connection just to the torque wrench break point. The wrench handle gives way at its internal pivot point as shown in the figure. Do not tighten the connection further.
- Follow the torque wrench information listed in the following table:

Wrench Information	
M8042-03801 Wrench	9 mm
54964-03801 Wrench	Dual-ended, fits 6 mm and 7 mm
54964-03802 Wrench	Dual-ended, fits 8 mm

Torque Wrench Information	
Connector Type	**Torque lb-in (Nm)**
Precision 3.5 mm	8 (0.90) -> Torque Wrench 8710-1765, but 5 (0.57) -> Torque Wrench 8710-1582 will not damage
SMA	5 (0.57) -> Torque Wrench 8710-1582 Use the SMA torque value to connect male SMA connectors to the female precision 3.5 mm connectors. Use the 3.5 mm torque value to connect male 3.5 connectors to the female SMA (8 lb-in).
2.92 mm (no dielectrics)	8 (0.90) -> Torque Wrench 8710-1765, but 5 (0.57) -> Torque Wrench 8710-1582 will not damage
Precision 2.4 mm	8 (0.90) -> Torque Wrench 8710-1765
Precision 1.85 mm	8 (0.90) -> Torque Wrench 8710-1765
Precision 1.00 mm	4 (0.45) -> Torque Wrench 8710-2812

Final connection using a torque wrench

- Use a torque wrench to make a final connection. Using a torque wrench guarantees that the connection is not too tight, preventing possible connector damage.
  It also guarantees that all connections are equally tight each time.
- Prevent the rotation of anything other than the connector nut that you are tightening.

Ensure proper grounding

- Always use the three-prong AC power cord supplied with the product.
- Proper grounding of the instrument will prevent a build-up of electrostatic charge, which may be harmful to the instrument and the operator.
- Do not damage the earth-grounding protection by using an extension cable, power cable or autotransformer without a protective ground conductor.

- Check AC power quality and polarity; typical AC voltage required is 100 V, 120 V, 220 V ±10%, 240 V +5% / -10% or 380 V (3 Phase). Typical expected grounding wire resistance is < 1 Ω, the voltage between neutral and ground line is < 1 V. Install uninterruptible power supply [UPS] if necessary.

Read the warning labels and specifications

- Do not exceed the values provided in the datasheet or as indicated by the yellow warning labels on the product.
- Refer to the Getting Started Guide for conditions required to meet the listed specification. Note information regarding warm up time, instrument settings and calibration/air-flow requirements.

  For example, a yellow warning label on the front panel of the product indicates the maximum input level. Do not exceed this value. Do not operate outputs into open. Terminate unused outputs with 50 Ohms.

Avoid overpowering the product

- Avoid damage by having an initial estimated power value for the signal level to be applied to the product. Overpowering the inputs may cause damage to front-end components. Do not exceed maximum input levels printed on front panel of the product.
- Before turning on or turning off the connected equipment or the DUT, reduce the signal level to the minimum level. This should help to prevent unexpected voltage swell or sag affecting the input or the output of the instrument.
- Properly apply a DC block, limiter or external attenuator as additional safety measure, if possible.

Ensure proper instrument cooling (airflow)

- Make sure that there is adequate clearance of minimum 50 mm (2 inches) around vent holes of the chassis to ensure adequate airflow, especially when the instrument is installed in the chassis.
- Some instruments have an internal fan to keep the components cooled to normal operating temperatures. Make sure that there is enough clearance for adequate air-flow.
- If the air-flow is restricted, the internal operating temperature will be higher, reducing the instrument's reliability.
- Do not cover the ventilation holes.

- Periodically check and clean the cooling vents of the instrument. Inadequate air-flow can result in excessive operating temperatures, which can lead to instrument failures. Refer to the product datasheet for allowable operating temperature range.

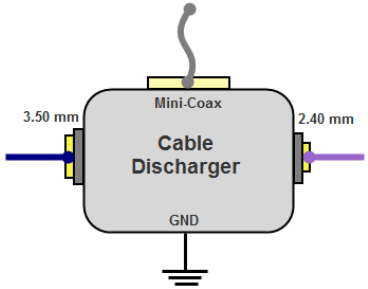
Follow electrostatic discharge precautions

- Electrostatic discharge (ESD) can damage or destroy electronic components. Whenever possible, conduct testing at a static-safe workstation.
- Ensure grounded environment and personnel.
- Wear ESD suitable clothes and shoes.
- Keep static-generating materials e.g. plastic boxes, tape, PC mouse, keyboard, etc. at least one meter away from all components.
- Damage of components by ESD can occur at voltages as low as 100 V.
- When testing a passive DUT, work on an ESD workstation or utilize an air ionizer. Discharge the test point by using a probe directly grounded to a primary earthing terminal.
- When testing an active (powered) DUT, be aware that the capacitors can hold charges even after power is removed from the DUT. Voltage on the board can exceed the maximum input level of the instrument and transient voltage may occur from DUT. Utilize an inline attenuator (e.g. 3 dB) to reduce the voltage entering the instrument.

Use Cable Discharger box to discharge cables

- Loose cables may hold an electrostatic charge. Before connecting any cable to product connector, short the center and outer conductors of the cable together to discharge any transient voltages that may be present.
- You should use the cable discharger provided with the initial product shipment and shown in the following figures.

- Ground the box appropriately while discharging a cable. Use the “GND” connector of the box (as shown in the figure) to the ground connector of the AXIe chassis.For grounding, either use the accessories provided with the discharger like the grounding cable or an ESD mat which is connected to the ground connector of the AXIe chassis.



- Discharge your cables using the matching connector e.g. 2.40 mm (also for 1.85 mm), 3.50 mm (also for 2.92 mm) and Mini-Coax. You may stick the cable discharger box to your instrument/AXIe chassis e.g. using the fastener tape provided.
- Plastic fixtures can store charges and probing powered devices can subject inputs to damaging voltage and power levels. A poor AC power supply into a product or DUT can create AC transients, insufficient grounding, or floating neutral lines which damages the current to flow into or out of the instrument.For more information about electrostatic discharge, contact the Electrostatic Discharge Association www.esda.org.

Use proper lifting techniques

- Lift the instrument by the handles when transporting.
- Avoid picking up the instrument with your hand over the front panel. If the instrument slips, damage may occur to the front panel connectors.
- Use a cart or two persons to help move any heavy instrument.

Use proper packaging for transport

- Instrument damage can result from using packaging materials other than those specified. Never use styrene pellets in any shape as packaging materials. They do not adequately cushion the equipment and can cause equipment damage by generating static electricity.
- If possible, retain the original packaging for re-use when shipping the instrument.

Check your instrument settings

- Review the measurement procedures and settings needed for a particular application prior to making any measurements (refer to the user guide).
- Depending on the type of repair, the instrument settings may have been reset to the factory defaults.

Get more information

- Consideration for instrument grounding 5989-9200
- Bench instrument site check table 5989-4992
- Do STEP daily ESD self-check 5989-5752
- EOS/ESD limiter N9355CK01

Get the latest information about your product

- 5-slot chassis related information:
  www.keysight.com/find/M9505A
  www.keysight.com/find/M9506A
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- Check for service and support:
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- Check for updated service notes:
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- For worldwide service locations information:
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