

Keysight Technologies B1500A Semiconductor Device Analyzer

Connection Guide
for Wafer Prober

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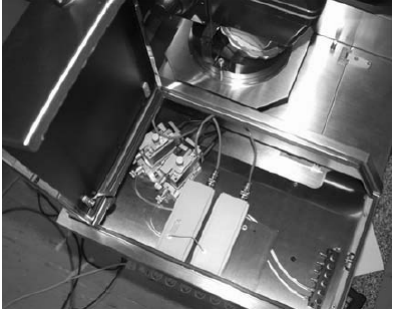
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1 Connection Guide for Wafer Prober

SMU/GNDU connection with prober

This section describes how to connect a wafer prober to the Keysight B1500A semiconductor device analyzer.

Table 1-1 Semi automated prober with B1500A

B1500A with Cascade Prober	B1500A with Vector Prober
 A photograph of a Keysight B1500A semiconductor device analyzer connected to a Cascade Prober. The B1500A is on the left, and the Cascade Prober is on the right. Both are on a black stand. The Cascade Prober has a large front panel with a horizontal slot and the number '2300' on the bottom right. There are two computer monitors on top of the stand, displaying test results.	 A photograph of a Keysight B1500A semiconductor device analyzer connected to a Vector Prober. The B1500A is on the left, and the Vector Prober is on the right. The Vector Prober is a white cabinet with a large front panel and the text 'vector vx-3200SV' on it. There is a computer monitor on top of the B1500A.
B1500A with Cascade (Suss) Prober	ASUs on the probe station
 A photograph of a Keysight B1500A semiconductor device analyzer connected to a Cascade (Suss) Prober. The B1500A is on the left, and the Cascade (Suss) Prober is on the right. Both are on a black stand. The Cascade (Suss) Prober has a large front panel with a horizontal slot. There are two computer monitors on top of the stand, displaying test results.	 A close-up photograph of the probe station area of a wafer prober. It shows a probe tip positioned over a wafer. There are several ASUs (Automated Sample Units) on the probe station, which are used to hold and position the wafer. The probe station is a complex mechanical structure with various components and wiring.

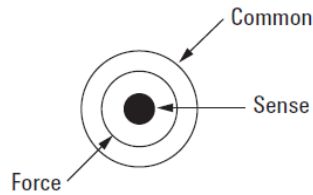
GNDU connections

An SMU has FORCE (SENSE), GUARD, and COMMON, but a GNDU has SENSE, FORCE, and COMMON as shown in Figure 1-1. User needs some sort of GNDU to Kelvin adapter when connecting the GNDU to standard triaxial connections.

CAUTION

User should use the Keysight 16493L GNDU cable to connect the GNDU to the connector plate; do not use a standard triaxial cable. The GNDU cable can handle the maximum GNDU current of 4.2 A, but standard triaxial cables (16494A) are only rated to 1 A.

Figure 1-1 GNDU terminal



Non-Kelvin connection

Connect the triaxial connector using an adapter for GNDU (N1254A-107) as shown in Figure 1-2. For parts information for this connection, see Table 1-2.

Figure 1-2 Example of a GNDU non-Kelvin connection

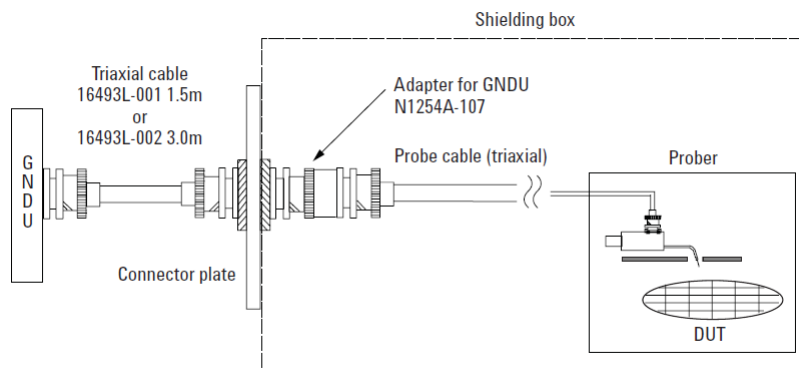


Table 1-2 Item number information for GNDU non-Kelvin connection with B1500A

Description	Qty	Product Number	Part number
Ground unit cable (1.5 m) - max 4.2 A	1	16493L-001	N/A
Ground unit cable (3.0 m) - max 4.2 A	1	16493L-002	N/A
Triaxial (m) to triaxial (f) adapter	1	N1254A-107	1250-2654

Kelvin connection

Connect the dual triaxial connector using a GNDU to Kelvin Adapter (N1254A-100) as shown in Figure 1-3. For parts information, see Table 1-3. Maximum current is restricted when the Kelvin triaxial cable is used.

Figure 1-3 Example of a GNDU Kelvin connection

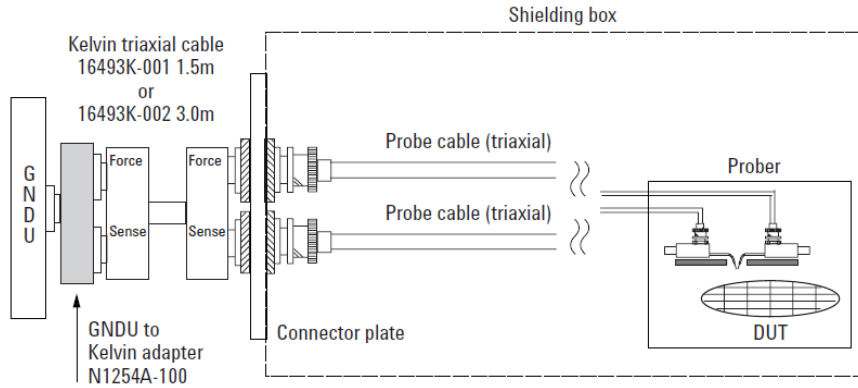


Table 1-3 Item number information for GNDU Kelvin connection with B1500A

Description	Qty	Product Number	Part number
Kelvin triaxial cable (1.5 m) - Max 3.0 A	1	16493K-001	N/A
Kelvin triaxial cable (3.0 m) - Max 2.6 A	1	16493K-002	N/A
GNDU to Kelvin adapter	1	N1254A-100	N/A

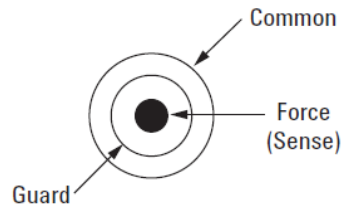
SMU connections

An SMU terminal is shown in Figure 1-4.

CAUTION

Never connect the Guard terminal to any output, including circuit common, chassis ground, or any other guard terminal. Doing so will damage the SMU.

Figure 1-4 SMU terminal



Non-Kelvin connection

These instructions apply when all connections are non-Kelvin. Connect the Keysight 16494A triaxial cables between the SMU and the Connector plate. Connect the triaxial connector on the probe cable as shown in Figure 1-5. For parts information, see Table 1-4.

NOTE

Making non-kelvin connection

The Force terminals can be used to force and measure DC voltage or current. If you want to simplify the cable connections, open the Sense terminals and connect the Force terminals only to the connector plate by using the triaxial cables. If user makes the Kelvin connection, use both Force and Sense terminals. Connecting the Force and Sense lines together at the terminal of the device under test minimizes the measurement error caused by the residual resistance of the connection cables. The Kelvin connection is effective for the low resistance measurement and the high current measurement.

Figure 1-5 Example of an SMU non-Kelvin connection

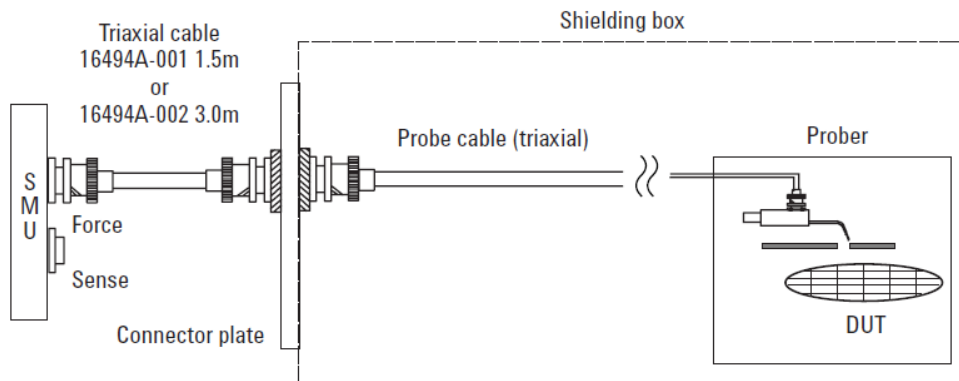


Table 1-4 Item number information for GNDU non-Kelvin connection with B1500A

Description	Qty	Product Number	Part number
Triaxial cable (1.5 m)	1	16494A-001	N/A
Triaxial cable (3.0 m)	1	16494A-002	N/A

Kelvin connection

These instructions apply when all connections are Kelvin. Two probes must contact the wafer in this connection. Connect an Keysight 16493K Kelvin triaxial cable (or two Keysight 16494A triaxial cables) between the SMU and the connector plate. Connect the FORCE and SENSE lines to probes separately. Connect the triaxial connector on the probe cable as shown in Figure 1-6. For parts information, see Table 1-5.

NOTE To prevent oscillations, do not use cables longer than 1.5 m, if you use two 16494A triaxial cables with Kelvin connections.

Figure 1-6 Example of an SMU Kelvin connection

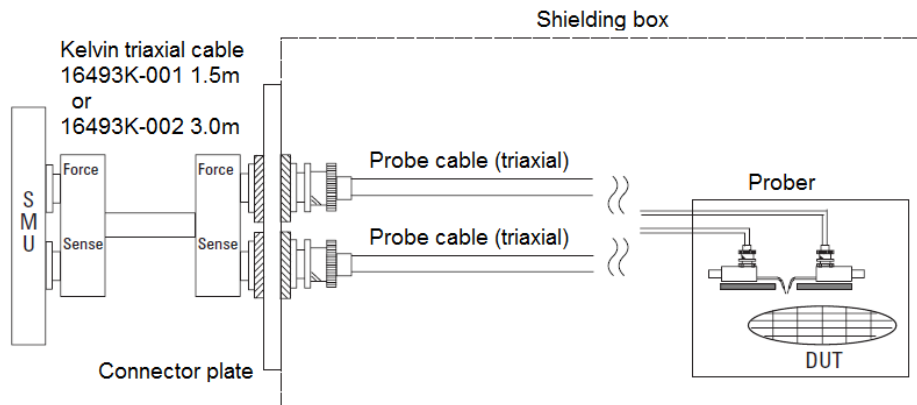


Table 1-5 Item number information for SMU Kelvin connection with B1500A

Description	Qty	Product Number	Part number
Kelvin triaxial cable (1.5 m) - max 3.0 A	1	16493K-001	N/A
Kelvin triaxial cable (3.0 m) - max 2.6 A	1	16493K-002	N/A

Kelvin to non-Kelvin connection

These instructions apply when the connections up to the Connector Plate are Kelvin, but the probe is a non-Kelvin connection. Connect an Keysight 16493K Kelvin triaxial cable (or two Keysight 16494A triaxial cables) between the SMU and the Connector plate. Connect the triaxial connector on the probe cable as shown in Figure 1-7. Connect the FORCE and SENSE lines on this side of the probe input terminal. A Tee Triaxial BNC adapter can be used. For parts information, see Table 1-6.

NOTE To prevent oscillations, do not use longer than 1.5m, if user uses two 16494A triaxial cables with Kelvin connections.

NOTE When connecting the cable and tee connector as shown in Figure 1-7, space restrictions make an adjacent connector unusable. Since three connectors are necessary for a Kelvin connection a connector plate must be used. Select the correct connector plate for your application. To make two Kelvin connections, use an Keysight 16495H. To make three Kelvin connections, use an Keysight 16495J.

Figure 1-7 Example of an SMU Kelvin to non-Kelvin connection

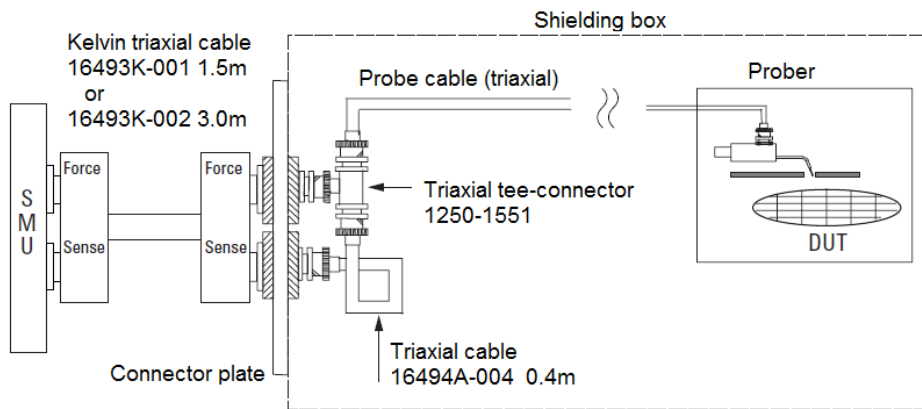


Table 1-6 Item number information for SMU Kelvin to non-Kelvin connection with B1500A

Description	Qty	Product Number	Part number
Kelvin triaxial cable (1.5 m) - max 3.0 A	1	16493K-001	N/A
Kelvin triaxial cable (3.0 m) - max 2.6 A	1	16493K-002	N/A
Triaxial cable (0.4 m)	1	16494A-004	N/A
Triaxial tee-connector	1	N/A	1250-1551

MCSMU connections

The MCSMU output connection example is shown in Figure 1-8.

For the connection of the MCSMU, the Keysight N1255A connection box is required. Input panel provides six triaxial connectors for connecting two MCSMU and one GNDU or SMU. Output panel provides six triaxial connectors for the High1, High2, and Low terminals. See Figure 1-11 for image of the Input panel and the Output panel. Also see Figure 1-8 for the connection image. And see Figure 1-10 for the internal connection. To connect the N1255A Output terminals to the connectors as shown in Figure 1-9, use the 16494A triaxial cable.

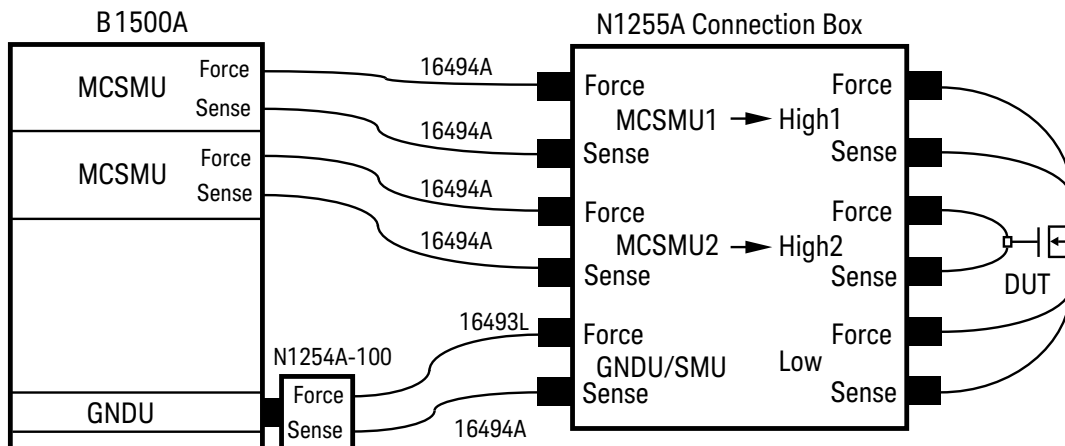
Use the following cables to connect the N1255A to the MCSMU

- 16494A Triaxial cable, 2 ea. per one MCSMU

Use the following cables and adapter to connect the N1255A to the GNDU.

- N1254A-100 GNDU to Kelvin adapter, 1ea.
- 16493K GNDU cable, 1ea.
- 16494A Triaxial cable, 1 ea.

Figure 1-8 N1255A Connection Example



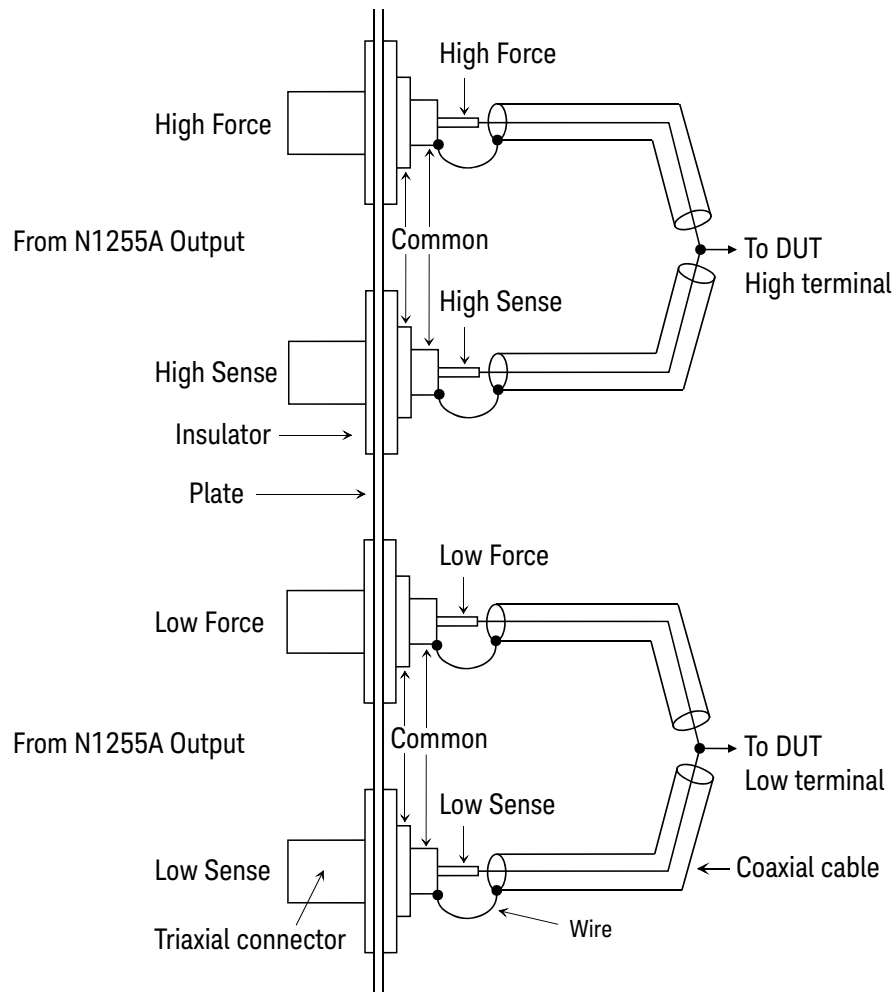
NOTE N1255A Input and Output terminals

If a MP/HP/HRSMU is connected instead of the GNDU, use the following cable. Also, do not use the SMU current range less than 100 mA.

Voltage ranging of terminals is indicated near connector on the Input or Output panel.

The N1255A cannot be used for measurement of the IEC Measurement Category II, III, or IV.

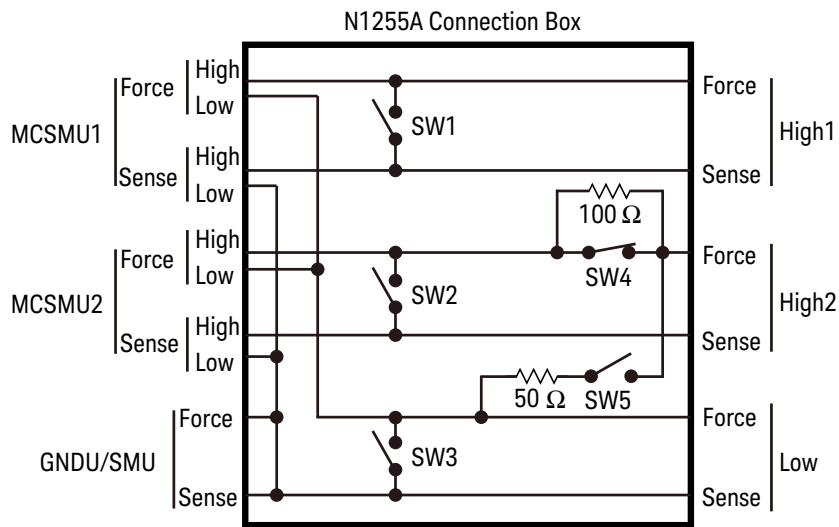
Figure 1-9 MCSMU Output Connection



The High Force/High Sense/Low Force/Low Sense lines should be connected to the DUT as shown in Figure 1-9. Wiring shown in Figure 1-14 Cable and Probing needle can be used. To simplify the connections, omit the wiring of the Common.

For the non-Kelvin connection, use the High Force and the Low Force only. Omit the wiring of the High Sense and the Low Sense.

Figure 1-10 N1255A Internal Connections



- SW1: Kelvin/Non-Kelvin selection switch for High1
- SW2: Kelvin/Non-Kelvin selection switch for High2
- SW3: Kelvin/Non-Kelvin selection switch for Low
- SW4: 0 Ω/100 Ω series resistor selection switch for High2 Force
- SW5: Open/50 Ω shunt resistor selection switch between High2 and Low, Force

NOTE

Selection switch SW2 and SW4

The SW4 switches the series resistance 0 Ω/100 Ω on the High2 Force line. The resistor is not mounted on the High2 Sense line.

Set the SW4 to “0 Ω” if the SW2 is set to “Kelvin”.

Set the SW2 to “Non-Kelvin” if the SW4 is set to “100 Ω”.

NOTE

Selection switch SW1/SW2/SW3

The switch is used to make or break the connection between Force and Sense in the N1255A. Setting it to “Non-Kelvin” makes this internal connection to enable the non-Kelvin connection. And setting it to “Kelvin” breaks this internal connection to enable the Kelvin connection.

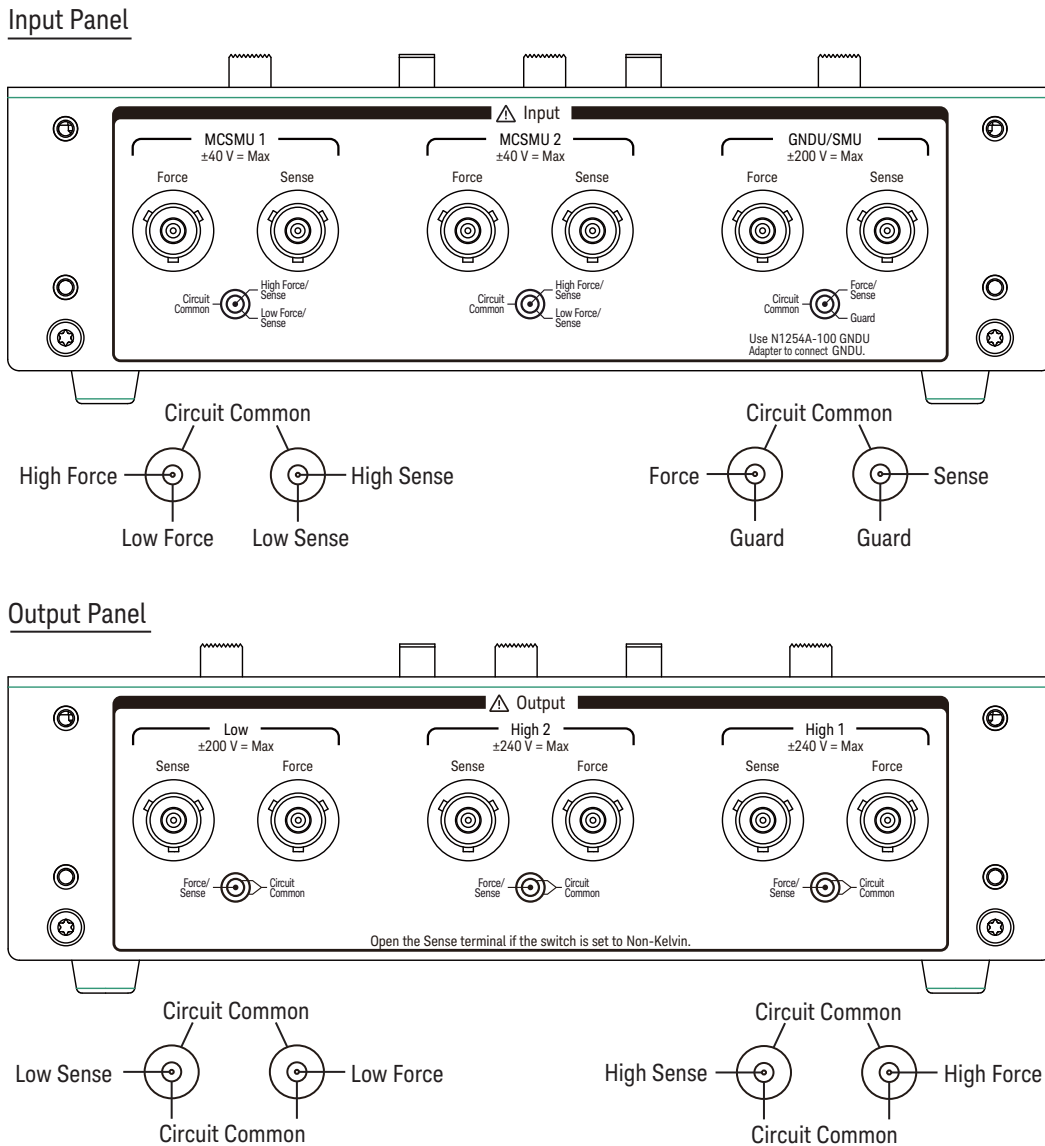
If the switch is set to “Non-Kelvin”, do not extend the Sense output corresponding to it. Voltage on the Force line also appears on the Sense line. So, open the Sense connector on the Output panel.

NOTE Series Resistor and Shunt Resistor

The series resistor and the shunt resistor can be used for preventing MCSMU from oscillation. If the MCSMU oscillates, insert either 100 Ω series resistor or 50 Ω shunt resistor.

If it does not stop the oscillation, prepare the resistor of the other value and insert it between the Output High and the device under test (DUT).

Figure 1-11 N1255A Input Panel and Output Panel



Connection for low current measurement

This section provides the information useful for connecting cables and probing needles to a connector plate.

To make connection to reduce leakage current

To reduce the leakage current caused by connection cables, the guard technique is effective. Connect the probing needles to the coaxial cables as shown below:

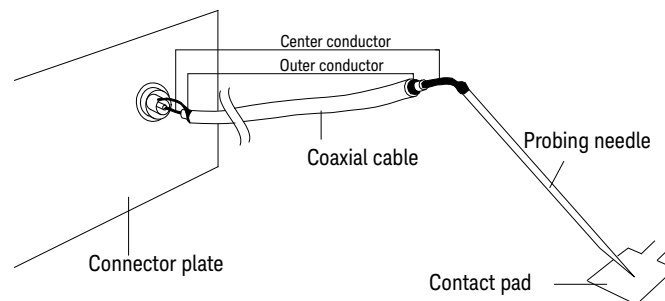
Guarding reduces the leakage current between the instrument and a DUT. This is important when you measure low current.

1. Cut and trim end of the coaxial cable so that the center conductor does not touch the outer conductor (connected to the guard terminal).
2. Connect the center conductor to tail of the probing needle. Never connect the outer conductor to the probing needle. However, the outer conductor should be extended as close as possible to the probing needle.
3. Connect the outer conductor to the outer conductor of the probing needle if it is a coaxial probing needle.

The following example connection can be used to reduce the leakage current. Extend the outer conductor as close as possible to the probing needle, This is also reduces the induced noise.

Figure 1-12

Cable and Probing needle

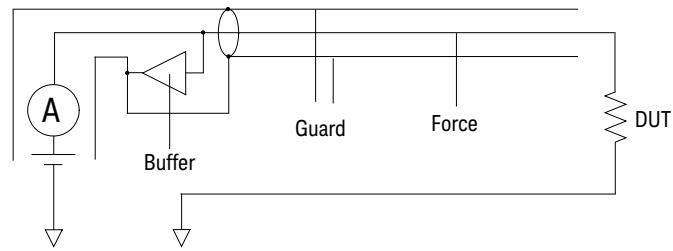


Guarding

Guarding reduces the leakage current between the instrument and the measurement point. This is important when you measure low current.

The following figure shows the theory of guarding. The buffer amplifier ($\times 1$) keeps the potential of the guard conductor at the same potential as the force conductor, so current does not flow between the force and guard conductors. Therefore, the current measured by the instrument is same as current at the DUT terminal because no current is leaked.

Figure 1-13 **Guarding**



WARNING

Do not touch the guard terminal with bare hands because you may be shocked by high voltage. The potential of the guard terminal is equal to the output voltage.

CAUTION

Never connect the Guard terminal to any other output, including circuit common, chassis ground, or any other guard terminal. Doing so will damage the B1500A.

Connection for low resistance measurement

This section provides the information useful for connecting cables and probing needles to a connector plate with Kelvin connections.

To make connection to measure low resistance

When you measure a low resistance, high current flows through the DUT. This high current increases the measurement error caused by the residual resistance of cables. To cancel the effect of this resistance, you can use Kelvin connections (4-wire, remote sensing), which means the Force and Sense lines are extended separately to the DUT.

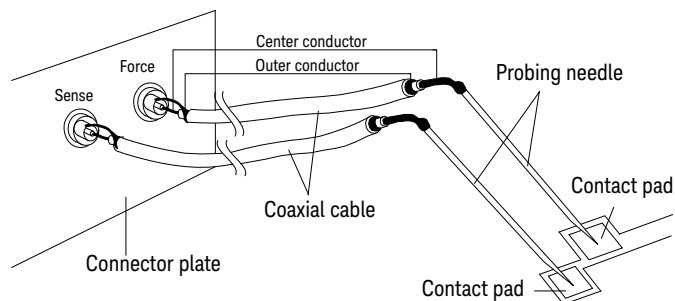
Connect the probing needles to the terminals of the connector plate by using test leads or coaxial cables. Following instruction uses the coaxial cables:

1. Cut and trim end of the coaxial cable so that the center conductor does not touch the outer conductor (connected to the guard terminal).
2. Connect the center conductor to tail of the probing needle. Never connect the outer conductor to the probing needle. However, the outer conductor should be extended as close as possible to the probing needle.
3. Connect the outer conductor to the outer conductor of the probing needle if it is a coaxial probing needle.
4. Perform 1 to 3 for both Force and Sense lines.
5. Contact the probing needles for the Force and Sense lines as close as possible to the DUT.

The following example connection can be used to measure low resistance. The Sense line is extended to the probing pad, and contacts the Force line through the pad, so the voltage drop due to the residual resistance caused by cables and test leads is canceled.

Figure 1-14

Cable and Probing needle

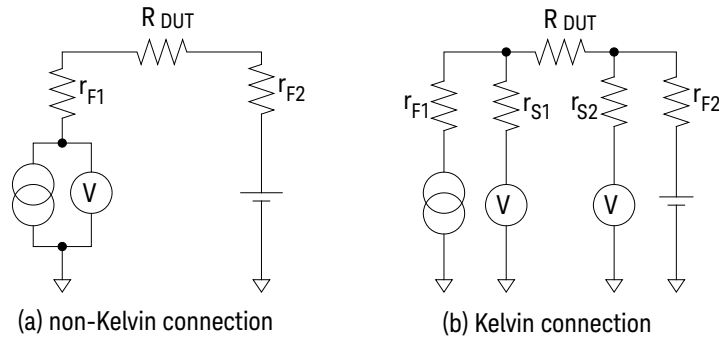


Kelvin connection

Kelvin connections give good measurement results when you force high-current. The following figure shows the equivalent circuits for Kelvin and non-Kelvin connections.

Figure 1-15

Kelvin connection



- For the non-Kelvin connection, the voltmeter measures the voltage drop of resistance r_{F1} , R_{DUT} , and r_{F2} .
- For the Kelvin connection, the voltmeter measures the voltage drop of resistance R_{DUT} only. The impedance of the voltmeter is very high, so the voltage drop of resistances r_{S1} and r_{S2} can be ignored.

The Kelvin connection is effective even when forcing voltage. The voltage drop due to the residual resistance of the Force line wiring is fed back to the voltage source via a comparator in the Sense line. The input impedance of comparator is high, and current flow into the Sense line is very low. So output error is not significant if the Sense line wiring has a residual resistance of 10 Ω or less. Therefore, the specified voltage appears at the sense point (point where Sense line contacts Force line).

NOTE

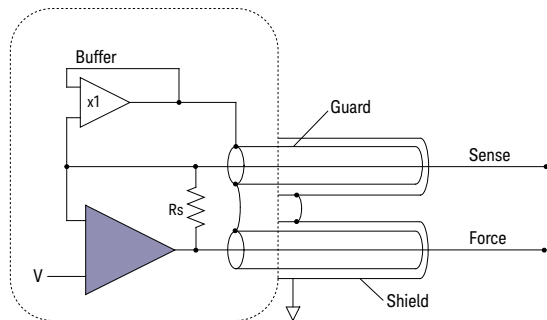
Kelvin connection and non-Kelvin connection

To make the Kelvin connection, use both Force and Sense terminals. Connecting the Force and Sense lines together at the terminal of the DUT (device under test) minimizes the measurement error caused by the residual resistance of the connection cables. The Kelvin connection is effective for the low resistance measurement and the high current measurement.

If you want to simplify the cable connections, use the 2-wire connections by connecting the Force terminals only. Then open the Sense terminals. This is the non-Kelvin connection. The Force terminals can be used to force and measure dc voltage or current via R_s in Figure 1-16.

Figure 1-16

Simplified SMU circuit diagram



SCUU and ASU

This section describes how to connect a wafer prober to the Keysight B1500A semiconductor device analyzer with SCUU and ASU.

SCUU positioner-based probing connection

The SCUU should be connected to the DUT by using triaxial cables as shown in Figure 1-17. When making IV measurements using the SMUs, the outputs of the SCUU function exactly the same as the Kelvin outputs of an SMU (both FORCE and SENSE lines are available).

NOTE

In the Figure 1-17, SENSE lines are not used. When making CV measurements using the MFCMU, only the FORCE outputs of the SCUU are used. SCUU FORCE output 1 corresponds to CMH, and SCUU FORCE output 2 corresponds to CML. The SCUU can be fixed on the prober by using SCUU Magnet Stand (N1301A-110).

Figure 1-17 Example of a SCUU remote docking mode

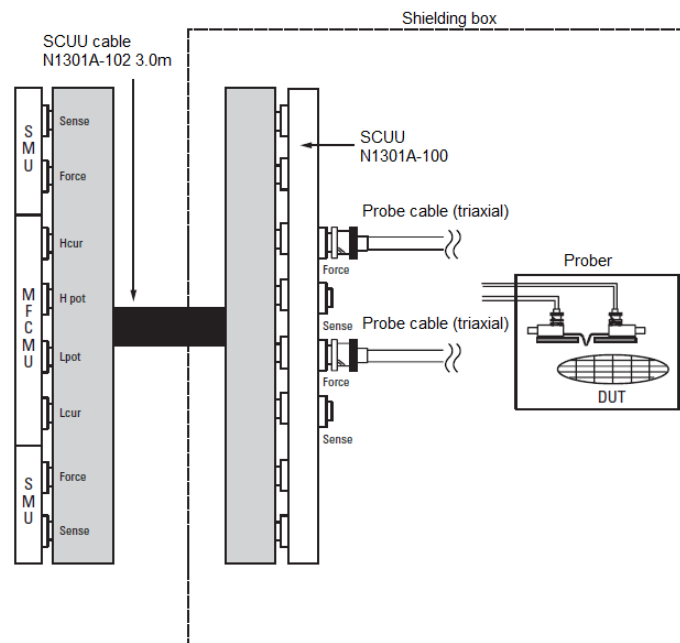


Table 1-7 Item number information for ASU connection with B1500A

Description	Qty	Product Number	Part number
SMU CMU unify unit (SCUU)	1	N1301A-100	N/A
SMU CMU unify unit Cable (3 m)	1	N1301A-102	N/A

ASU connection

Each ASU has one D-sub control cable, one triaxial cable, and (optionally) two coaxial cables connected to it. The cables can be connected to the ASU inside the shielding box through the 16495K plate. The ASU outputs should be connected to the DUT by using triaxial cables as shown in Figure 1-18. When making IV measurements with the SMUs, all measurements are Kelvin. The SENSE line information is fed back to the SMU via the D-sub cable. When making CV measurements, the four-terminal pair (4TP) connections are correctly terminated inside of the ASUs. The ASUs also allow for a current return path between the outer conductors to stabilize the series inductance and improve accuracy. You must connect the furnished wire between the two ASUs to enable this feature.

Figure 1-18 Example of an ASU connection

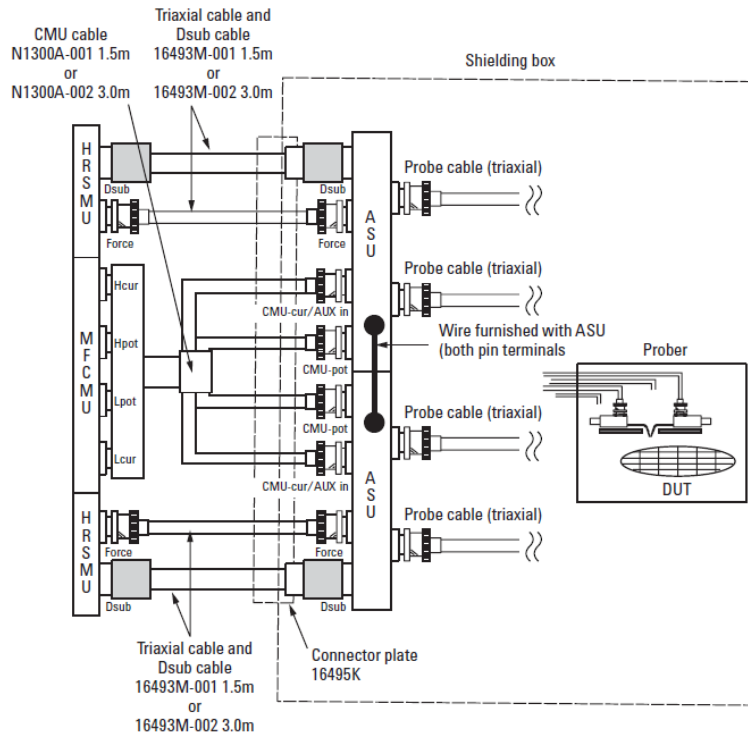


Table 1-8 Item number information for ASU connection with B1500A

Description	Qty	Product Number	Part number
Triax and D-sub cable for ASU (1.5 m)	2	16493M-001	N/A
Triax and D-sub cable for ASU (3.0 m)	2	16493M-002	N/A
CMU cable for B1500 (1.5 m)	1	N1300A-001	N/A
CMU cable for B1500 (3.0 m)	1	N1300A-002	N/A
Connector plate with universal cable holder	1	16495K	N/A

NOTE

About ASU output cables

To perform capacitance measurement accurately, the cable length between DUT and the ASU output must be as short possible.

NOTE

For the installation of the ASU and the connection to the DUT interface (probe card, manipulators, and so on), contact your favorite prober vender. The prober vender will have the solutions. Dimensions of the ASU are 132 mm (W) × 88.5 mm (H) × 50 mm (D) excluding the connectors.

WGFMU and RSU

This section covers the instructions to make connection between WGFMU and RF/DC probes. Before starting the instructions, complete the installation of the B1500A installed with the WGFMU. See Keysight B1500 manual.

NOTE About WGFMU module installation

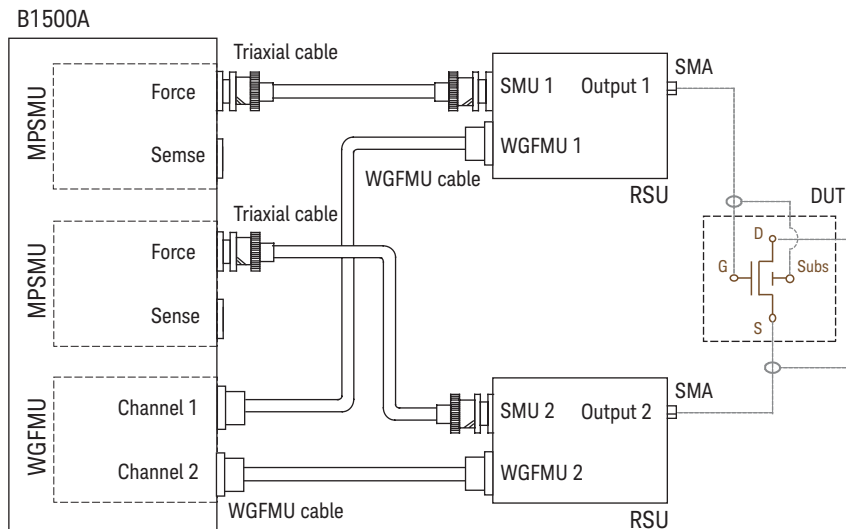
Module installation of WGFMU must be performed by Keysight Technologies service personnel. Contact Keysight Technologies for the module installation.

NOTE RSU has SMA terminal which is coaxial connection. In this connection, ultra low current measurement can not be performed.

Connecting RSU

Prepare the required accessories and connect cables between RSU and WGFMU or SMU. See Figure 1-19 for a connection example. This example connects two RSUs.

Figure 1-19 RSU Connection Example



Required accessories:

- WGFMU-to-RSU cable (D-sub), 1ea. per one RSU
1.5 m, 3 m, or 5 m cable (furnished with WGFMU module. If another length is required, order 16493R-006, 003 or 004)
The 16493R-801 adapter is required and mounted on a shielding box to make connection to the RSU in the shielding box. Then the 60 cm and 2.4 m cables (16493R-001 and 005) are required instead of the 1.5m, 3 m, or 5 m cable.
- Sync connection cable (furnished with WGFMU module), 1 ea. between two WGFMUs

- Magnet stand (16493R-802), 1 ea. per one RSU, optional
 The magnet stand is useful for fixing RSU. See Figure x-x for dimensions.
- Triaxial cable (SMU to RSU), 1ea. per one RSU, optional
 1.5 m, 3 m, cable (16494A-001 or 002)
 The 16495H-001 or 16495J-001 connector plate is required and mounted on a shielding box to make connection to the RSU in the shielding box. Then the 80 cm or 40 cm cable (16494A-003 or 004) is additionally required.
- 16495K-001 plate with cable holder, optional
 Instead of using both 16493R-801 and 16495H/J-001.

NOTE

Keysight 16493R-801 adapter

The 16493R-801 is used to connect the cable from WGFMU and the cable from RSU. See *Keysight B1530A Waveform Generator/Fast Measurement Unit User's Guide* for the dimensions of adapter and for the opening and screw holes which are required to mount the adapter on the shield box.

Figure 1-20

RSU terminal

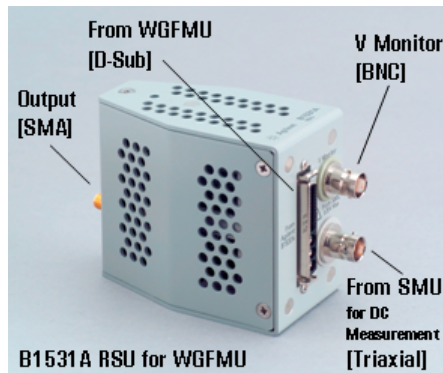
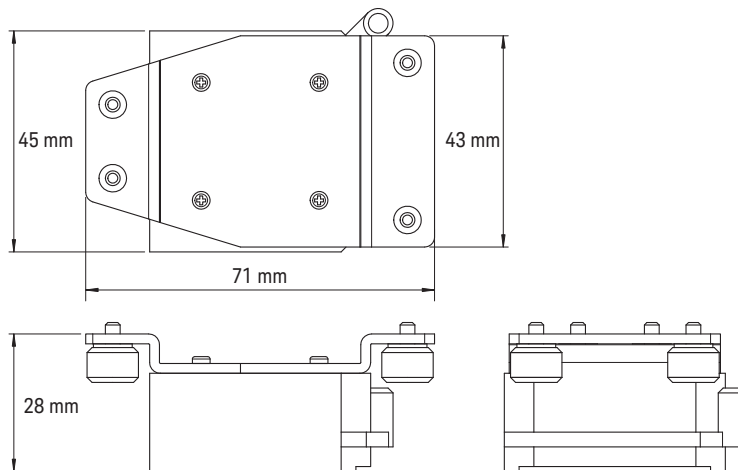


Figure 1-21

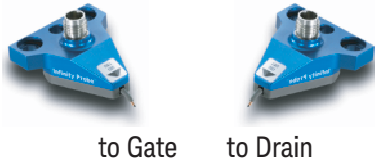
16493R-802 Magnet Stand



Connecting RF Probes

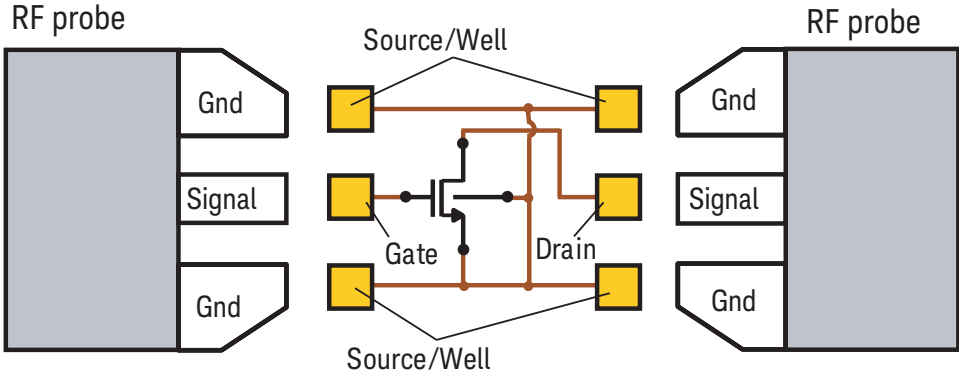
The RF measurement system supports the measurement of the three-terminal MOSFET (source and well (substrate) are shorted) by using the RF probes as shown in Figure 1-22. One measurement path is for the gate terminal and the other path is for the drain terminal. Moreover, the source/well terminal must be electrically connected to the ground via the shielding of the measurement path (RF probes and measurement cables). See Figure 1-23.

Figure 1-22 RF probes



Prepare two RF probes to perform the RF measurement. The RF probe must have the signal line and the ground lines as shown in Figure 1-23. The signal line is to connect the gate or drain pad, and the ground lines are to connect the source/well pads. For the RF probe and its installation, consult your favorite prober vender. Figure 1-22 shows RF probes from Cascade Microtech, Inc.

Figure 1-23 Contact Pad and Probe Tip



The following instructions apply when RF probes are used on Prober. Use a torque wrench and an open-end wrench to fasten the SMA connectors.



CAUTION Using torque wrench and open-end wrench

For the RF measurements, it is important to carefully contact and fasten the connectors of the RF cables. The condition of the cable connections may change the measurement result characteristics. Therefore treat the RF cables carefully, especially the RF connectors, and use the torque wrench and the open-end wrench when you fasten the RF connectors. The recommended tools are listed in the Table 1-9.

CAUTION Using cable tie

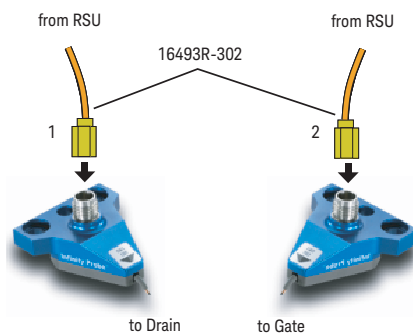
Use a cable tie to secure the cables. Then, do not tug the cable tie. You must treat the RF cables carefully to avoid the damage.

Table 1-9 Recommended Tools

Keysight part number	Description	Additional Information
8710-1582	Torque wrench, 5lb	
8710-1765	Torque wrench, 8lb	
5185-2174	Open-end wrench, 5/16 inch	
5188-4367	Open-end wrench, 11/32 inch	

Connect the following cables as shown in Figure 1-24. Use a torque wrench and an open-end wrench to fasten the SMA connectors.

Figure 1-24 Connection of RF probe



Required accessories:

- RF prober, 2 ea.
- 16493R-302 SMA-SMA cable 200 mm length, 2 ea.

Procedure:

- Connect a SMA-SMA cable between a RSU (ex: RSU1) and the Drain RF probe. And set the Drain RF probe to the appropriate place.

- Connect other SMA-SMA cable between other RSU (ex: RSU2) and the Gate RF probe. And set the Gate RF probe to the appropriate place.

Figure 1-25 RSU connection on the Prober

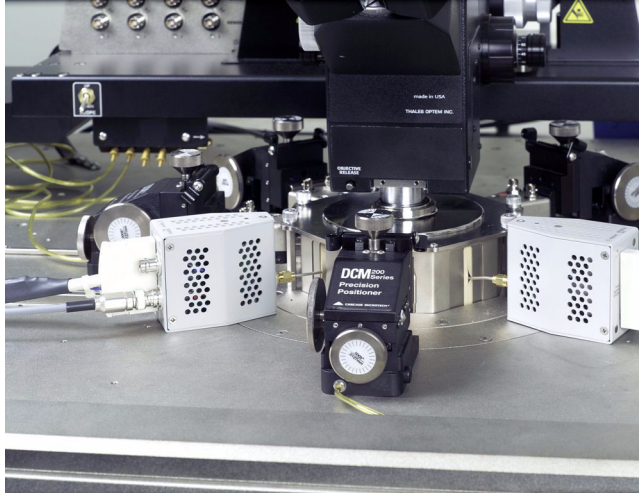


Table 1-10 Item number information for WGFMU with RF probing connection

Description	Qty	Option Number	Retrofit Kit
WGFMU. Including two RSU	1	B1500A-A30	B1500AU-030
3m cable between WGFMU and RSU (2ea)	1	B1500A-030	B1500AU-W02
SMA - SMA cable (200mm) between RSU and RF probe	2	B1500A-A3P	16493R-302
Magnet stand for RSU [Recommended]	2	16493R-802	16493R-802
Triaxial cable (3 m) [Optional]	2	16494A-002	B1500AU-T02

Connecting DC Probes

The MOSFET contact pads for DC measurement shown in Figure 1-26, are more popular than the RF contact pads shown in Figure 1-23. If device under test is configured with DC contact pads, use DC probes instead of RF probes. The DC probes are better suited for contact with the DC contact pads than the RF probes. See Figure 1-26 for the contact pads and the DC probes.

Prepare four DC probes and three connection cables to connect the DC probes together.

- 50 mm length SSMC short-open cable (Furnished with B1500A-A3P. Or 16493R-101)
- 70 mm length SSMC short-open cable (Furnished with B1500A-A3P. Or 16493R-102)
- 200 mm length SMA-SSMC cable (Furnished with B1500A-A3P. Or 16493R-202)

Figure 1-26

DC probing connection on Prober

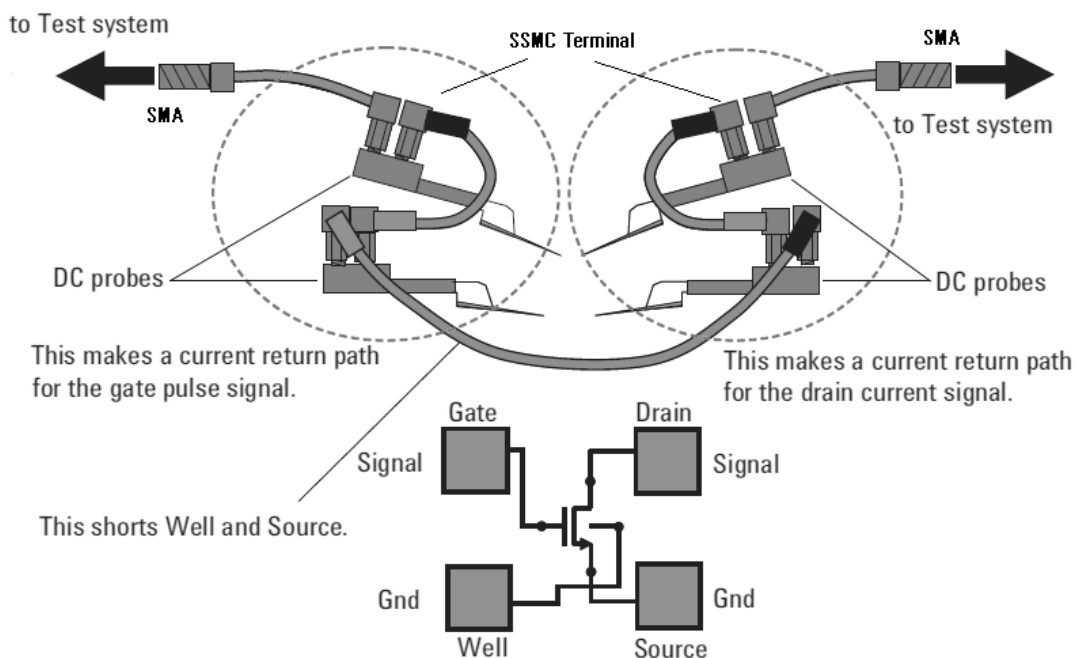


Table 1-11

Item number information for WGFMU with DC probing connection

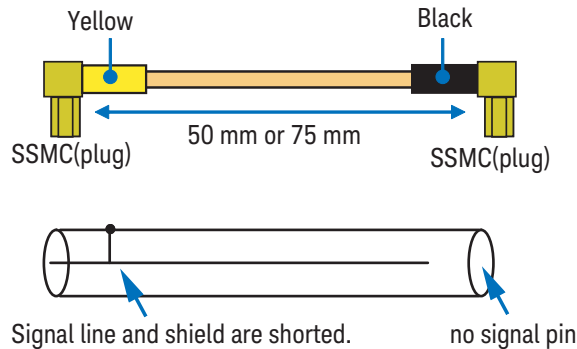
Description	Qty	Option Number	Retrofit Kit
WGFMU. Including two RSU.	1	B1500A-A30	B1500AU-030
3m cable between WGFMU and RSU (2ea)	1	B1500A-030	B1500AU-W02
SMA - SSMC cable (200mm) between RSU and DC probe	2	B1500A-A3P	16493R-202
SSMC-SSMC cable (75mm) for current return path	3	B1500A-A3P	16493R-102
Triaxial cable (3 m) [Optional]	2	16494A-002	B1500AU-T02

These instructions apply when DC probes are used on Prober.

- Connect a SSMC short open cable between the Gate DC probe and the well DC probe, and set the DC probes to the appropriate place. Then, the black sleeve plug must be the Gate side. This electrically connects the Well probe needle, Well probe shield, and Gate probe shield together.
- Connect a SSMC short-open cable between the Drain DC probe and the Source DC probe, and set the DC probes to the appropriate place. Then, the black sleeve plug must be the Drain side. This electrically connects the Source probe needle, Source probe shield, and Drain probe shield together.
- Connect the last SSMC short-open cable between the Well DC probe and the Source DC probe, and set the DC probes to the appropriate place. Then, the black sleeve plug must be the Source side. This electrically connects the Well probe needle, Well probe shield, and Source probe shield together.
- Connect a SMA-SSMC cable between a RSU (ex: RSU1) and the Drain DC probe. And set the Drain DC probe to the appropriate place.
- Connect the other SMA-SSMC cable between the other RSU (ex: RSU2) and the Gate DC probe. And set the Gate DC probe to the appropriate place.

Figure 1-27

SSMC Short-Open Cable



Interlock circuit

The interlock circuit is designed to prevent electrical shock when a user touches the measurement terminals.

CAUTION

You must install an interlock circuit on a shielding box to prevent hazardous voltage when the door of the shielding box is open.

Figure 1-28 shows the pin assignments of the interlock connector that should be mounted on a connector plate or test fixture.

Figure 1-28 Interlock connector pin assignments

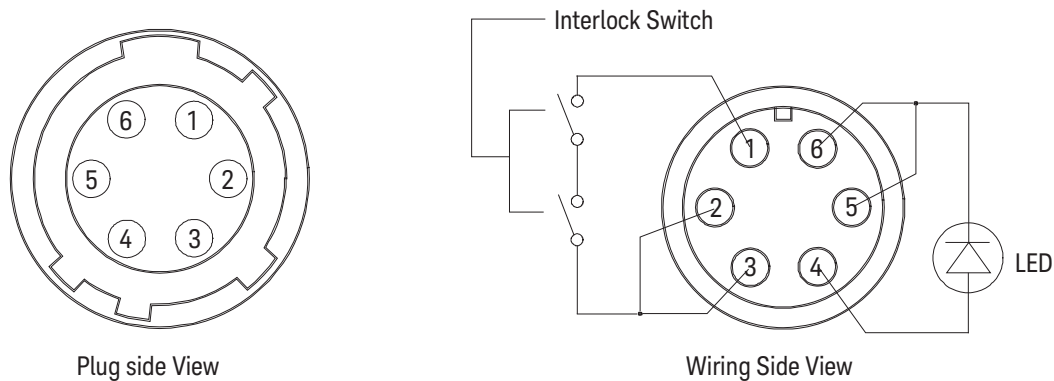


Table 1-12 Recommended parts for interlock circuit

Description	Qty	Product Number	Part number
Interlock connector (6 pin, female)	1	N/A	1252-1419
Interlock micro switch	1	N1254A-402	3101-0302 or 3131-3241
LED ($V_F \cong 2.1 \text{ V}$ @ $I_F = 10 \text{ mA}$)	1	N/A	1450-0641
Wire (24 AWG, 600 V)	1	N/A	8150-5680

Installing the interlock circuit

Prepare the required parts listed in Table 1-12. And install the interlock circuit as shown below.

1. Make mounting hole for the interlock connector. See Figure 1-30 for dimensions.
2. Mount two mechanical switches on your shielding box, so that the switches close when the door of the shielding box is closed, and open when the door is opened. For the dimensions of the switch, see Figure 1-31 below.
3. Mount an LED on your shielding box. For the dimensions of the LED, see Figure 1-29.

4. Use wire to connect the two switches in series between pin number 1 and 2 (or 3) of the interlock connector. See Figure 1-28.
5. Use wire to connect the LED between pin number 4 and 5 (or 6) of the interlock connector. See Figure 1-28.
6. Attach the interlock connector to the mounting hole.

If Keysight B1500A Interlock connector is connected to the interlock circuit, Keysight B1500A SMU *cannot* force more than ± 42 V when the door is open. When the door is closed, it can force more than ± 42 V.

When more than ± 42 V is forced from an SMU, the LED lights to indicate *high voltage output*.

Figure 1-29

Dimensions of the LED (Keysight part number 1450-0641)

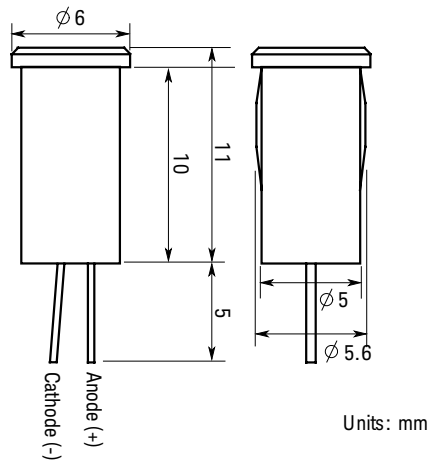


Figure 1-30

Dimensions of Mounting Hole for the Interlock Connector

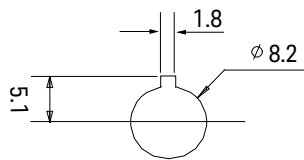
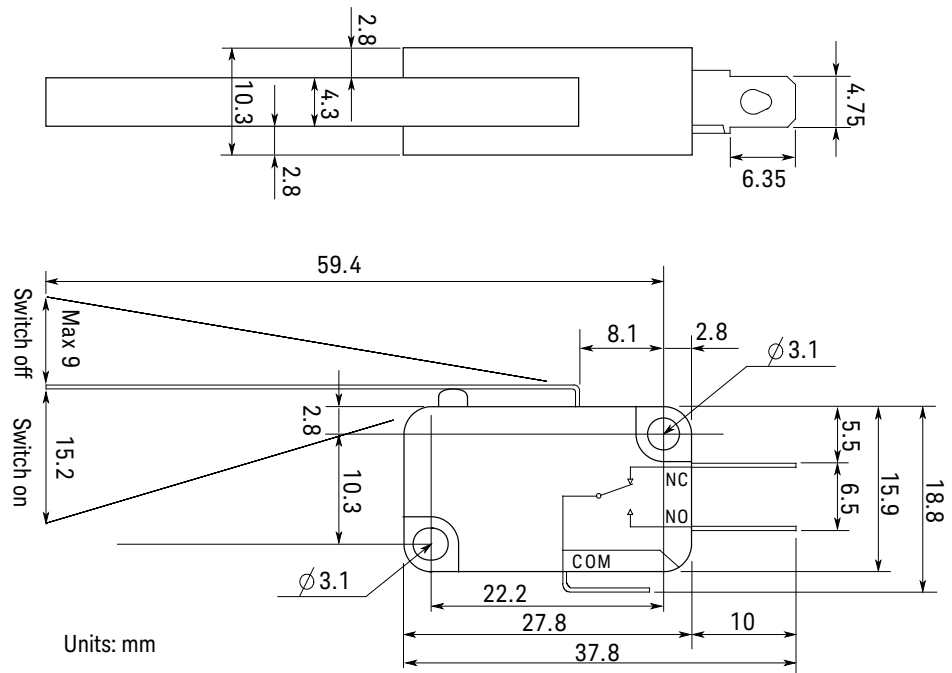


Figure 1-31 **Dimensions of the Interlock Switch (Keysight N1254A-402)**



To connect interlock circuit

The B1500A provides the Interlock connector to prevent you from receiving an electrical shock from high voltage (more than ± 42 V). If the interlock circuit is open, the B1500A *cannot* apply high voltage more than ± 42 V.

Before performing measurement, connect the 16493J interlock cable between the B1500A Interlock connector and the interlock connector which is a part of the interlock circuit installed in your DUT interface as described in the previous section.

This information is subject to change without notice.
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