Model 9139B-PCA Probe Card Adapter

Instructions

9139B-PCA-901-01 Rev. A / January 2019
Model 9139B
Probe Card Adapter
Instructions
Safety precautions

The following safety precautions should be observed before using this product and any associated instrumentation. Although some instruments and accessories would normally be used with nonhazardous voltages, there are situations where hazardous conditions may be present.

This product is intended for use by personnel who recognize shock hazards and are familiar with the safety precautions required to avoid possible injury. Read and follow all installation, operation, and maintenance information carefully before using the product. Refer to the user documentation for complete product specifications.

If the product is used in a manner not specified, the protection provided by the product warranty may be impaired.

The types of product users are:

- **Responsible body** is the individual or group responsible for the use and maintenance of equipment, for ensuring that the equipment is operated within its specifications and operating limits, and for ensuring that operators are adequately trained.

- **Operators** use the product for its intended function. They must be trained in electrical safety procedures and proper use of the instrument. They must be protected from electric shock and contact with hazardous live circuits.

- **Maintenance personnel** perform routine procedures on the product to keep it operating properly, for example, setting the line voltage or replacing consumable materials. Maintenance procedures are described in the user documentation. The procedures explicitly state if the operator may perform them. Otherwise, they should be performed only by service personnel.

- **Service personnel** are trained to work on live circuits, perform safe installations, and repair products. Only properly trained service personnel may perform installation and service procedures.

Keithley products are designed for use with electrical signals that are measurement, control, and data I/O connections, with low transient overvoltages, and must not be directly connected to mains voltage or to voltage sources with high transient overvoltages. Measurement Category II (as referenced in IEC 60664) connections require protection for high transient overvoltages often associated with local AC mains connections. Certain Keithley measuring instruments may be connected to mains. These instruments will be marked as category II or higher.

Unless explicitly allowed in the specifications, operating manual, and instrument labels, do not connect any instrument to mains.

Exercise extreme caution when a shock hazard is present. Lethal voltage may be present on cable connector jacks or test fixtures. The American National Standards Institute (ANSI) states that a shock hazard exists when voltage levels greater than 30 V RMS, 42.4 V peak, or 60 VDC are present. A good safety practice is to expect that hazardous voltage is present in any unknown circuit before measuring.

Operators of this product must be protected from electric shock at all times. The responsible body must ensure that operators are prevented access and/or insulated from every connection point. In some cases, connections must be exposed to potential human contact. Product operators in these circumstances must be trained to protect themselves from the risk of electric shock. If the circuit is capable of operating at or above 1000 V, no conductive part of the circuit may be exposed.

Do not connect switching cards directly to unlimited power circuits. They are intended to be used with impedance-limited sources. NEVER connect switching cards directly to AC mains. When connecting sources to switching cards, install protective devices to limit fault current and voltage to the card.

Before operating an instrument, ensure that the line cord is connected to a properly-grounded power receptacle. Inspect the connecting cables, test leads, and jumpers for possible wear, cracks, or breaks before each use.

When installing equipment where access to the main power cord is restricted, such as rack mounting, a separate main input power disconnect device must be provided in close proximity to the equipment and within easy reach of the operator.

For maximum safety, do not touch the product, test cables, or any other instruments while power is applied to the circuit under test. ALWAYS remove power from the entire test system and discharge any capacitors before connecting or disconnecting cables or jumpers, installing or removing switching cards, or making internal changes, such as installing or removing jumpers.

Do not touch any object that could provide a current path to the common side of the circuit under test or power line (earth) ground. Always make measurements with dry hands while standing on a dry, insulated surface capable of withstanding the voltage being measured.
For safety, instruments and accessories must be used in accordance with the operating instructions. If the instruments or accessories are used in a manner not specified in the operating instructions, the protection provided by the equipment may be impaired.

Do not exceed the maximum signal levels of the instruments and accessories. Maximum signal levels are defined in the specifications and operating information and shown on the instrument panels, test fixture panels, and switching cards.

When fuses are used in a product, replace with the same type and rating for continued protection against fire hazard.

Chassis connections must only be used as shield connections for measuring circuits, NOT as protective earth (safety ground) connections.

If you are using a test fixture, keep the lid closed while power is applied to the device under test. Safe operation requires the use of a lid interlock.

The ▲ symbol on an instrument means caution, risk of hazard. The user must refer to the operating instructions located in the user documentation in all cases where the symbol is marked on the instrument.

The ▲ symbol on an instrument means warning, risk of electric shock. Use standard safety precautions to avoid personal contact with these voltages.

The ▲ symbol on an instrument shows that the surface may be hot. Avoid personal contact to prevent burns.

The ▲ symbol indicates a connection terminal to the equipment frame.

If this ▲ symbol is on a product, it indicates that mercury is present in the display lamp. Please note that the lamp must be properly disposed of according to federal, state, and local laws.

The WARNING heading in the user documentation explains hazards that might result in personal injury or death. Always read the associated information very carefully before performing the indicated procedure.

The CAUTION heading in the user documentation explains hazards that could damage the instrument. Such damage may invalidate the warranty.

The CAUTION heading with the ▲ symbol in the user documentation explains hazards that could result in moderate or minor injury or damage the instrument. Always read the associated information very carefully before performing the indicated procedure. Damage to the instrument may invalidate the warranty.

Instrumentation and accessories shall not be connected to humans.

Before performing any maintenance, disconnect the line cord and all test cables.

To maintain protection from electric shock and fire, replacement components in mains circuits — including the power transformer, test leads, and input jacks — must be purchased from Keithley. Standard fuses with applicable national safety approvals may be used if the rating and type are the same. The detachable mains power cord provided with the instrument may only be replaced with a similarly rated power cord. Other components that are not safety-related may be purchased from other suppliers as long as they are equivalent to the original component (note that selected parts should be purchased only through Keithley to maintain accuracy and functionality of the product). If you are unsure about the applicability of a replacement component, call a Keithley office for information.

Unless otherwise noted in product-specific literature, Keithley instruments are designed to operate indoors only, in the following environment: Altitude at or below 2,000 m (6,562 ft); temperature 0 °C to 50 °C (32 °F to 122 °F); and pollution degree 1 or 2.

To clean an instrument, use a cloth dampened with deionized water or mild, water-based cleaner. Clean the exterior of the instrument only. Do not apply cleaner directly to the instrument or allow liquids to enter or spill on the instrument. Products that consist of a circuit board with no case or chassis (e.g., a data acquisition board for installation into a computer) should never require cleaning if handled according to instructions. If the board becomes contaminated and operation is affected, the board should be returned to the factory for proper cleaning/servicing.

Safety precaution revision as of June 2017.
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Introduction

The Model 9139B Probe Card Adapter is an interface specifically designed to connect a Keithley parametric test system to a device under test (DUT) while maintaining system specifications. It provides greater accuracy of parametric tests in applications that require a wide range of measurements, including high voltage up to 1.1 kV, while maintaining low-level measurement performance. The high-capacity, low-leakage 9139B Probe Card Adapter allows you to make high-voltage measurements in multi-pin, fully automated production test applications.
NOTE

Refer to the manufacturer documentation for your prober for information about connecting hardware to it. Refer to the documentation provided with your Keithley parametric test system for information about connections to the system.

Make sure you order the PCA with the correct stack height for your prober. Refer to probe card adapter with and stack height (on page 6-2)

Features

Key features of the 9139B Probe Card Adapter include:

- Vacuum lock allows quick exchange of probe cards with accurate and repeatable alignment
- System supports up to 64 pins at up to 1.1 kV
- All pins use 1.1 kV triaxial connectors
- Optional hinged interface mechanism for easy probe card changes
- Easily connects device under test (DUT) cables to a probe card
- Each pin supports fully guarded measure and sense lines
- Maintains test system specifications to the probe tip
- Preserves full Kelvin connections to the probe tip
- Reduces capacitance with extended guards
- Extends low-current capabilities of the Keithley Parametric Test system
Safety symbols and terms

Refer to Safety precautions (on page 1-1) for important information about safety symbols and all precautions that must be taken when using the probe card adapter.

**WARNING**

Hazardous voltages may be present on the probe card adapter, even after you disengage the interlock. Cables can retain charges after the interlock is disengaged, exposing you to live voltages that, if contacted, may cause personal injury or death.

Never attempt to touch or change a probe card when tests are running. You must be absolutely certain that all tests have stopped before making contact with anything in the vicinity of the probe card adapter. Also, never run tests without a probe card installed.

Related documentation

The following related customer documentation is included with the Keithley Parametric Test System:

- **Administrative Guide** (part number S530-924-01 and S535-924-01): This guide provides information about Keithley Parametric Test Systems, including available configurations, site preparation and installation, equipment startup, connection diagrams, and maintenance.
- **Reference Manual** (part number S530-924-01 and S535-924-01): This manual describes how to use the diagnostic and verification software suite that is part of your Keithley Parametric Test System.

Unpacking and inspection

The following topics provide information about your shipment.
Handling precautions

The 9139B Probe Card Adapter is assembled at the factory to provide the highest quality connections possible between the device under test (DUT) and your system. Use care when handling these parts.

**CAUTION**

Do not touch high-impedance areas of the probe card assembly or the probe card. Touching a high-impedance area will cause leakage and problems when performing low-current measurements. Excessive leakage will cause the probe card adapter to fail system tests. See the following figure for the location of high-impedance areas.

![Figure 2: Handling 9139B](image)

Take these precautions when handling the 9139B:

- Handle the board only by the edges.
- Use clean gloves to prevent inadvertent contact with high-impedance areas.
- Avoid bringing the board into contact with sources of contamination.
- Always confirm that fixtures and handling equipment are clean.
**Inspection for damage**

Carefully unpack your 9139B Probe Card Adapter from its original shipping carton and inspect the card for any obvious signs of physical damage. Report any such damage to the shipping agent immediately. Save the original packing carton for possible future shipment.

**Shipment contents**

The following items are included with every 9139B:

- 9139B Probe Card Adapter
- Model 9139A-VUA vacuum control box
- Unpopulated (blank) probe card (this probe card is used for diagnostics and is installed in the probe card adapter)
- A shorted probe card for system verification
- 6 m (15 ft) of 0.64 cm (1/4 in.) vacuum hose
In this section:

- Probe card adapter standard components ........................................ 2-1
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Probe card adapter standard components

The 9139B probe card adapter consists of the following components. See the drawing following this list for details.

- Prober hardware
- Probe card adapter assembly:
  - Appropriate device under test (DUT) cables
  - Strain reliefs and other miscellaneous hardware
  - Motherboard containing interconnect pins for DUT cable connections
  - Pogo pins and retention ring
  - Light cover
  - Prober ring
  - Motherboard support plate
  - Insulation ring (Teflon®)
  - Probe card ring
  - Vacuum connection
  - Interlock switch cable assembly
  - Interlock magnet
- Probe cards (without probe pins)
  - One shorted probe card
  - One blank probe card
### Figure 3: 9139B-PCA probe adapter components

<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Vacuum connection (not shown), PF-6</td>
</tr>
<tr>
<td>2</td>
<td>Wire guide quadrant HI, 386-8008-XX*, 4 places</td>
</tr>
<tr>
<td>3</td>
<td>Probe ring shield strap, 9139-314</td>
</tr>
<tr>
<td>4</td>
<td>Interlock light cover, S500-339</td>
</tr>
<tr>
<td>5</td>
<td>Interlock magnet, MA-4</td>
</tr>
<tr>
<td>6</td>
<td>Interlock switch, SW-498</td>
</tr>
<tr>
<td>7</td>
<td>Insulator, black decal, 9139-313-02</td>
</tr>
<tr>
<td>8</td>
<td>Probe ring shield plate, 9139-310</td>
</tr>
<tr>
<td>9</td>
<td>Probe ground ring, 389-5347</td>
</tr>
<tr>
<td>10</td>
<td>Probe ring insert, 9139A-325</td>
</tr>
<tr>
<td>11</td>
<td>Spacer (sets stack height), 9139B-PCA-01: ST-166-9 (3.790 cm, 1.492 in.);</td>
</tr>
<tr>
<td></td>
<td>9139B-PCA-02: ST-166-10 (3.378 cm, 1.330 in.)</td>
</tr>
<tr>
<td>12</td>
<td>Probe ring motherboard, 389-5348-XX*</td>
</tr>
<tr>
<td>13</td>
<td>Motherboard retainer ring, 9139A-326</td>
</tr>
<tr>
<td>14</td>
<td>Probe card, 389-5349-XX*</td>
</tr>
<tr>
<td>15</td>
<td>Alignment pins, spring contact retainer - probe card</td>
</tr>
<tr>
<td>16</td>
<td>Alignment pin, motherboard retainer - probe card retainer</td>
</tr>
<tr>
<td>17</td>
<td>Insulator (Teflon ring), 9139B-303</td>
</tr>
<tr>
<td>18</td>
<td>Probe card retainer cap, 9139B-301</td>
</tr>
<tr>
<td>19</td>
<td>Spring contact retainer, 9139B-302</td>
</tr>
<tr>
<td>20</td>
<td>Shield strap mounting spacer, 386-8004-XX*</td>
</tr>
</tbody>
</table>

* XX represents the revision.
Pin arrangement

The 9139B Probe Card Adapter has 64 pins, each rated to 1100 V. All pins in the 9139B can accommodate low-current signals.

The pins are arranged into symmetric sectors around a central point.

Leakage paths, low-current and high-voltage capabilities

The 9139B Probe Card Adapter provides 1.1 kV capability to each of its 64 pins. It also significantly improves low current leakage and settling time on each pin compared to the 9139A-PCA.

The 9139B Probe Card Adapter includes triaxial connectors that meet safety spacing requirements and are compatible with existing triaxial mating connectors. This allows the included triaxial cables to easily connect to the test hardware.
Motherboard characteristics

The motherboard is the interface between the system and the probe card. It accepts up to 128 system cables (64 Kelvin pins) and is suspended from the prober mounting hardware. Source, sense, guard, and ground (where appropriate) are terminated for each DUT cable on the motherboard.

Source, sense, and guard signals are kept separate for each pin and are carried to the probe card through spring-loaded contacts (pogo pins). Source and measure lines are guarded on the motherboard using printed circuit board manufacturing techniques.

System cables can be routed vertically or horizontally to the motherboard. Vertical routing is used when the system cables are routed above the top platform (head plate) of the prober. Horizontal routing is used when the system cables are routed under the top platform of the prober.

Probe card configuration

The probe card contains 64 fully guarded measure and sense lines. It contains mounting traces for 64 probe needles. Drilled, plated-through holes are provided for needle connection.

An unpopulated (blank) probe card is provided with the probe card adapter assembly. Additional blank probe cards are available through your Keithley sales representative.
Probe needle

Ceramic needles are recommended; other types of needles (such as epoxy) may be used if they conform to the dimensions in the following figure.

Figure 5: Probe needle mounting

Light cover

The light cover shields the opening in the center of the probe card adapter. This blocks ambient light and permits testing under lights-out conditions.

Opening the light cover trips the safety interlock and interrupts testing.
Introduction

WARNING

The installation procedures contained in this manual are intended for use only by qualified service personnel. Do not perform these procedures unless qualified to do so. Failure to observe normal safety precautions could result in personal injury or death.

This section contains information needed to install the 9139B Probe Card Adapter on your prober. Several topics contain general installation steps. Other topics contain installation steps required for your specific prober. Review the appropriate topics before handling or installing the 9139B.

General installation considerations

The following topics provide information you should know before installing the 9139B Probe Card Adapter.

NOTE

Use of the 9139A prober card in the 9139B Probe Card Adapter will result in diminished performance.

WARNING

Do not use the 9139A probe card in testing that exceeds 200 V. Testing in excess of 200 V may damage test equipment or cause injury or death due to electric shock.
Section 3: Installation

Mechanical structure

The mechanical structure of the 9139B enables installation in a wide variety of probers. It consists of a motherboard suspended from the prober ring. See the figure in [Probe card adapter standard components](on page 2-1) for details.

Spacers inserted between the motherboard and prober ring connect the two assemblies. The length of the spacers determines the overall stack height of the probe card assembly.

Safety

⚠️ WARNING

Failure to make sure that the safety interlock and safety shields and guards are properly installed and arranged as indicated will put personnel in severe danger. Severe personal injury or death due to electric shock or electrocution may result.

For the safety interlock to function properly, the device under test (DUT) interlock sensor must be installed near the DUT connections and the interlock magnet must be installed on the safety shield. It must be set up so that when the magnet is near the switch (interlock closed) the operator cannot touch voltage-carrying conductors. If not properly installed, it will render the interlock inoperative and place personnel at severe risk.
Keeping operators safe from hazardous voltages depends on proper installation. After installation, but before energizing the unit, make sure all prober safety shields are properly in place.Refer to the manufacturer of your specific prober for prober safety shield information.

The light cover contains components that allow installation of an interlock switch, such as that provided with a Keithley S530 or S535 Parametric Test Systems, as shown in the following figure.

**Figure 6: Probe card adapter light cover**

![Interlock switch, MA-4 interlock magnet, Light cover](image)

⚠️ **WARNING**

Do not operate the system until it is properly installed and all prober safety shields are in place. Failure to have the complete system properly installed with all safety shields in place could result in personal injury or death.
Additional probe card adapter safety interlock cable

The Model 174-7047-XX Safety Interlock Cable provides additional protection from electric shock at the Keithley probe card adapter (PCA). The cable attaches to the prober top plate and the PCA so that if you unlatch the top plate of the prober and lift it up to change a probe card or take off the PCA, the interlock is tripped.

Figure 7: Model 174-7047-XX Safety Interlock Cable

The Model 174-7037-XX cable can be used with customer-supplied PCA solutions.

Figure 8: Model 174-7037-XX interlock cable

NOTE

The Model 174-7047-XX cable interfaces with your prober interlock through a relay contact. A shorted prober contact engages the interlock circuit. An open contact interrupts the interlock, turning off hazardous voltage.
9139B Probe Card Adapter interlock schematic

The following diagram shows an example interlock configuration.

*Figure 9: 9139B-PCA interlock block diagram*
Stack height

The height from the mounting seat of the prober to the surface of the chuck (stack height) is a basic installation consideration.

Figure 10: 9139B-PCA

Stack height must be equal to the stack height of the probe card adapter. The stack height of the Keithley probe card adapter can be 3.378 cm (1.330 in.) or 3.790 cm (1.492 in.), depending on the type of prober and the requirements for cable routing.

Refer to Mechanical specifications (on page 6-1) for detailed mechanical drawings of the 9139B to determine if your prober is compatible. You may have to install mounting hardware onto the prober to ensure that the prober stack height is the same as the probe card adapter stack height.

Cable routing

Cable routing is an important installation consideration. Device under test (DUT) cables can be routed above or below the top plate of the prober. For cable routing above the top plate, the DUT cables exit vertically from the probe card adapter. For cable routing below the top plate, the DUT cables exit horizontally from the probe card adapter.

The DUT cables are routed under the prober ring of the probe card adapter and may exit from the left, right, or back of the prober. The cable exit you use depends on the type of prober and how the prober is oriented next to the system.

All DUT cables must be the same length. Uniform cable length provides uniform electrical characteristics (capacitance and inductance) of the cables. This is important when performing capacitance measurements or when measuring low-level currents.

See Installation procedure (on page 3-7) for more information about installing DUT cables.
Light cover and microscope clearance

Check the light cover and microscope clearance. Most microscopes are located far enough above the probe card assembly that they do not present clearance problems when the light cover is installed.

Some microscopes may protrude into the probe ring assembly to the area below the shield plate. This presents clearance problems. If the microscope is mounted on a pivoted arm, move the microscope aside and then install the light cover.

Installation procedure

⚠️ WARNING

Hazardous voltages may be present on an installed probe card even after the output is disconnected, that if contacted, may cause personal injury or death.

To install the 9139B Probe Card Adapter:

NOTE

You must supply all connections and hardware associated with vacuum hosing, in addition to the vacuum source.

1. Unpack and inspect 9139B (see Handling precautions (on page 1-4) for special handling information).
2. Remove all power from the parametric test system.
3. Install the probe card adapter in your prober, following the instructions provided with the prober. The hardware supplied with your probe card adapter assembly varies depending on the type of prober you have.
   See Mechanical specifications (on page 6-1) to determine if your prober is compatible. If you need assistance with your specific prober configuration, contact your sales representative.
4. Route 0.635 cm (1/4 in.) outside diameter vacuum hose (provided) to the probe card adapter, away from any moving parts of the prober. Make sure the hose remains clear of any pinch points that could cut off or restrict flow through the vacuum hose.
5. Install the 9139B to a vacuum hose. Route a section of vacuum hose from the PCA through the "TO PCA" grommet on the vacuum control box.
6. Connect the vacuum control box end of the hose to valve PF-1 (see the following figure) and the other end of the hose to the PCA.
Figure 11: Vacuum control box

Vacuum control box cover (9139A-346)

Washer (WA-102-1)

Anti-rotation bracket valve handle (9139A-348)

4x40x5/16 PPH (4 places)

0.635 cm (0.25 in.) O.D. tubing (TX-40-1)

To PCA

Vacuum supply

Vent grommet (GR-46)

Vacuum in grommet (GR-46)

To PCA grommet (GR-46)

Vent

Valve (PF-1)

Check valve (PF-5)

Tie wrap (CC-38-3)

Tie mount (CC-47)

Vacuum control box (9139A-345)

Vacuum hose routing

To vacuum source

Cable tie

Vent (open)

Vacuum control box

PCA
7. Install the vacuum supply hose. Route the vacuum supply hose from the vacuum source through the "VACUUM IN" grommet on the vacuum control box.

8. Connect the vacuum control box end of the hose to check valve PF-5 (see the previous figure). Make sure the vacuum supply is at least 50.80 cm (20 in.) Hg.

9. Vent the vacuum control box to atmosphere (no connection required).

10. Connect the PCA safety interlock cable to the prober top plate and the PCA.

11. Connect the device under test (DUT) cables between the probe card assembly and the matrix pin cards of the parametric test system.

**NOTE**

Route the cables to avoid sources of electromagnetic fields, vibration, or any other mechanical disturbance.

12. Confirm that moving parts of the prober do not contact the cables.

Information about the location of connections within your system is in the configuration drawings for your system. The user's manuals for the system contain additional information, if required.

**To install the probe card:**

1. Turn the vacuum control box valve to the load/operate position.

2. Line up probe card pin 1 with the pin 1 indicator on the retainer cap (see the following figure).

![Figure 12: Probe card and probe card retainer](image)

3. Insert the probe card into probe card retainer cap.

**NOTE**

Two alignment pins and holes are provided along the perimeter of the probe card. These holes and pins allow proper orientation of the probe card during installation.
4. Align pin 1 of the probe card with pin 1 of the motherboard. Use the alignment marking on the edge of the probe card retainer cap and match to the same markings of the motherboard support ring.

5. Attach the retainer cap to the motherboard ring. Make sure latches secure the probe ring (retainer cap will click into place).

6. Use the system diagnostics tool to check Kelvin connections from the system matrix to the probe card adapter.

**Probe card removal procedure**

⚠️ **WARNING**

Hazardous voltages may be present on an installed probe card even after the output is disconnected, that if contacted, may cause personal injury or death.

Never attempt to touch or change a probe card when tests are running. You must be absolutely certain that all tests have stopped before making contact with anything in the vicinity of the probe card adapter. Also, never run tests without a probe card installed.

**To remove the probe card:**

1. Turn the vacuum control box valve to the unload position.

2. Release the probe card retainer cap latches.

3. Carefully remove the probe card and retainer cap from the probe card adapter.
Performance verification

A matrix test is run as part of system diagnostics and requires a blank (unpopulated) probe card. Run a matrix test after the probe card adapter installation to check for leakage, open connections, or shorted connections. Do not run a matrix test after installing each probe card.

⚠️ WARNING
During leakage tests, high voltages are present on the probe card adapter.

NOTE
You must install a blank probe card in the probe card assembly to run diagnostics. A blank probe card is supplied with the probe card adapter. You must keep this blank probe card.

The clean surface of the blank probe card provides a known, low-leakage test environment. The unmodified Kelvin connections assure accurate continuity tests.

Handling and storage of the blank probe card is important (see Handling precautions (on page 1-4)). For accurate leakage tests, follow these precautions:

- Do not populate the blank probe card; it must remain unpopulated.
- Store the blank probe card in a protective container in a clean, low-humidity environment.
- When installing the blank probe card, handle it by the edges; do not touch the surface of the probe card.

For more information about running system verification and diagnostics, refer to the diagnostics and verification manual for your system.

Performance verification using system diagnostics

Using the blank probe card provided with the 9139B, run the matrix test from the system diagnostics tool on your Keithley parametric test system to verify probe card adapter performance.

For more information about the system diagnostics and verification tool, refer to the Diagnostics and Verification Manual for your system.
Optional top-load (clamshell) mechanism installation

The following instructions are for the top-load (clamshells) mechanism that are not ordered from Keithley.

If present, remove the retainer clips and air fitting as shown in the following figure.

**Figure 13: 9139B probe card adapter**

Install the top-load mechanism as instructed by the manufacturer.

**WARNING**

Verify that the interlock will trip when the top-load mechanism is opened. Failure to make sure the interlock safety feature is functioning may cause injury or death due to electrical shock.
Introduction

This section describes how to maintain and preserve the high-performance characteristics of the probe card adapter.

A minimum amount of maintenance is required for the motherboard and the device system cables. However, when maintenance is required, it is important to perform maintenance operations correctly. Maintenance tasks such as replacing cables can have a significant effect on the performance of the probe card adapter.

When doing maintenance, lubricate all O-rings using VAC Goop® (from Swagelok®). Make sure to use adequate VAC Goop for lubrication, but do not over-lubricate O-rings.

For maintenance of the probe pins, refer to documentation provided by the manufacturer of the probe pins.

⚠️ WARNING

The system can source high voltages at current levels that can result in personal injury or death. Turn off power to the system before performing any maintenance procedure.
Mechanical disassembly

Disassembly of the probe card adapter is required when replacing device under test (DUT) cables or when motherboard maintenance is required.

**NOTE**

When reassembling the probe card adapter, use VAC Goop® (from Swagelok®) to lubricate all O-rings.

---

**WARNING**

Hazardous voltages may be present on an installed probe card even after the output is disconnected, that if contacted, may cause personal injury or death.

Never attempt to touch or change a probe card when tests are running. You must be absolutely certain that all tests have stopped before making contact with anything in the vicinity of the probe card adapter. Also, never run tests without a probe card installed.

**NOTE**

If time and space are available, it is possible to disassemble the probe card adapter without disconnecting the system cables.

**To disassemble the probe card adapter:**

1. Place the PCA in a safe state by resetting the test equipment.
2. Turn the vacuum control box valve to the unload position.
3. Disconnect the vacuum hose from the probe card adapter.
4. Disconnect the PCA cables from your system.
5. Disconnect the interlock cable from the probe card adapter.
6. Remove the probe card adapter assembly from your prober.
7. Remove the light cover assembly.
8. Remove the Allen screws that secure the cable strain relief for the cable being replaced or moved.
9. Release the probe card retainer cap latches.
10. Carefully remove the probe card and retainer cap from the probe card adapter.
Moving PCA cable connections

**WARNING**

Hazardous voltages may be present on an installed probe card even after the output is disconnected, that if contacted, may cause personal injury or death.

Typically, prober pin 1 is connected to system pin 1, prober pin 2 is connected to system pin 2, and so on. If an application requires different connections, you can connect the prober pins to other system pins.

If you have an S530 or S535 parametric test system, each device under test (DUT) cable is independently connected to the matrix. To move a PCA connection, unplug the DUT cable from the matrix.

Cleaning

Cleaning is important to ensure accurate measurements. The cleaning process removes contamination that causes shunt resistance (leakage) between measurement paths.

Contamination can take many forms. Some sources of contamination are:

- Residue remaining after incomplete cleaning
- Residue after using improper or contaminated cleaning fluids
- Residue from fingerprints (see Handling precautions (on page 1-4) for more information)
- Flux from soldering
- Condensation from room conditions that do not meet Keithley specifications

Observe the following precautions when it is necessary to use solder on a circuit board:

- Use lead-free solder, and take care not to spread the solder to other areas on the circuit board.
- Remove the solder from the work area when the repair has been completed. Use pure water and clean foam-tipped swabs or a clean soft brush to remove the solder.
- Once the solder has been removed, swab only the repaired area with methanol, then blow-dry the board with dry nitrogen gas.
- After cleaning, allow the board to dry in a 50 °C low-humidity environment for several hours.
Replacing a pogo pin

⚠️ WARNING

Hazardous voltages may be present on an installed probe card even after the output is disconnected, that if contacted, may cause personal injury or death.

To replace a pogo pin:

1. Reset the tester hardware.
2. Remove the probe card from the probe card adapter assembly (see Probe card removal procedure (on page 3-10)).
3. Using a pair of needle-nose pliers, pull the defective pogo pin out of its socket.

⚠️ CAUTION

The pogo pins are not symmetrical. Damage to the socket may occur if the pogo pins are inserted incorrectly.

4. Locate the rounded end of the replacement pogo pin (see the following figure).

![Figure 14: Orientation of pogo pin and socket](image)

5. Insert the rounded end of the pin into the socket. The double-chisel tip, on the other end of the pogo pin, must protrude out of the socket. This end of the pogo pin contacts a pad on the probe card.

6. Reinstall the probe card.
Replacing a pogo pin socket

If a pogo pin breaks off in a socket or if the pin becomes lodged in a socket, the pogo pin socket can be replaced.

⚠️ WARNING

Hazardous voltages may be present on an installed probe card even after the output is disconnected, that if contacted, may cause personal injury or death.

To replace a socket:

1. Follow the steps in Mechanical disassembly (on page 4-2) to disassemble the probe card adapter.
2. Locate the defective pogo pin or socket assembly.
3. Locate the pad where the defective socket is soldered to the motherboard. This pad is on the probe-ring side of the motherboard (refer to the figure in Probe card adapter standard components (on page 2-1)).
4. Desolder the socket from the probe-ring side of the motherboard.

CAUTION

Do not apply excessive heat when desoldering the socket. Excessive heat can melt the retention ring of the probe card adapter.

5. Push the end of the desoldered socket that protrudes through the motherboard and remove it by pulling on the other side with a pair of needle-nose pliers.
6. Pull the socket out of its hole in the retention ring.
7. Remove residual solder from the hole of the solder pad.
8. Insert the small end of the replacement socket into the hole located in the retention ring (see the figure in Replacing pogo pins (on page 4-4)).
9. Slide the socket into the hole until the bottom of the socket is flush with the surface of the retention ring (pogo pin not installed in the socket).
10. Confirm that the socket is installed properly (see the figure in Replacing pogo pins (on page 4-4)). The small end of the socket protrudes through the hole on the motherboard. The open end of the socket is flush with the surface of the retainer ring.
11. Solder the socket to the pad located on the motherboard.
12. Install a pogo pin in the socket.
13. Clean the flux from the solder connection (see Cleaning (on page 4-3) for more information).
14. Reinstall the probe card.

Replacing the vacuum connection

The vacuum connection of the probe card adapter can be replaced if damaged.

To replace the vacuum connection:
1. Remove the vacuum connection.
2. Make sure all old sealant is removed from the threaded holes on probe card adapter.
3. Lightly apply standard pipe sealant to the new vacuum connection.
4. Install the new vacuum connection (do not over-tighten).
In this section:

Ordering information .................................................................5-1
Factory service ..........................................................................5-1
Parts list ..................................................................................5-1

Ordering information

To place an order or get information about replacement parts, contact your Keithley representative or see the back cover of this manual for contact information. When ordering parts, be sure to include the following information:

1. Probe card adapter model number: 9139B
2. Part description and part number

Factory service

To return the probe card adapter to Keithley Instruments for repair:

1. Obtain a return authorization (RA) number from Keithley.
2. Carefully pack the probe card adapter in the original packing carton or the equivalent.
3. Ship it to the address provided by the customer service representative that provided your RA number.

Parts list

This section contains a list of replaceable parts for the 9139B.

Blank probe card

For a replacement blank (unpopulated) probe card, order Keithley part number 389-5226-XX11.

1 Where XX represents the revision; the highest number is the most recent revision.
The following table lists the replaceable parts for the 9139B-01 and 9139B-02 probe card adapters.

<table>
<thead>
<tr>
<th>Description</th>
<th>Keithley part number</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.025 pin</td>
<td>CS-835</td>
</tr>
<tr>
<td>4-40 × 1/4 Phillips pan-head screw (strap to mounting spacer)</td>
<td>4-40X1/4PPH</td>
</tr>
<tr>
<td>4-40 × 3/8 socket button head (probe ring to spring contact retainer)</td>
<td>4-40X3/8SOBTNH</td>
</tr>
<tr>
<td>4-40 × 3/4 socket, button head (ring segment mounting)</td>
<td>4-40X3/4SOBTNH</td>
</tr>
<tr>
<td>6-32 × 3/4 Phillips pan-head screw (shield plate mounting)</td>
<td>6-32X3/4PPH</td>
</tr>
<tr>
<td>6-32 × 1-1/4 socket, flat head (motherboard retainer mounting)</td>
<td>6-32X1-1/4SOFHS</td>
</tr>
<tr>
<td>10 AWG PVC green/yellow</td>
<td>SC-99-5</td>
</tr>
<tr>
<td>Cable assembly, interlock switch (single) includes interlock switch</td>
<td>174-7037-XX*</td>
</tr>
<tr>
<td>Cable assembly, interlock switch (double) includes interlock switches</td>
<td>174-7047-XX*</td>
</tr>
<tr>
<td>Cap, probe card retainer</td>
<td>9139A-327</td>
</tr>
<tr>
<td>Cover, interlock light</td>
<td>S500-339</td>
</tr>
<tr>
<td>Handle, shield</td>
<td>HH-37</td>
</tr>
<tr>
<td>Insulator (Teflon ring)</td>
<td>9139B-303</td>
</tr>
<tr>
<td>Insulator, black decal</td>
<td>9139-313-01</td>
</tr>
<tr>
<td>Insulator, black decal</td>
<td>9139-313-02</td>
</tr>
<tr>
<td>Interlock Magnet</td>
<td>MA-4</td>
</tr>
<tr>
<td>Interlock switch (included in cable assembly)</td>
<td>SW-498</td>
</tr>
<tr>
<td>Lug</td>
<td>LU-99-6</td>
</tr>
<tr>
<td>Lug</td>
<td>LU-113</td>
</tr>
<tr>
<td>Motherboard retainer ring</td>
<td>9139A-326</td>
</tr>
<tr>
<td>O-ring, thermobonded (use Swagelok® VAC Goop®)</td>
<td>GA-32</td>
</tr>
<tr>
<td>O-ring, thermobonded (use Swagelok VAC Goop)</td>
<td>GA-33</td>
</tr>
<tr>
<td>Pin, crimp barrel, 0.040</td>
<td>CS-836-1</td>
</tr>
<tr>
<td>Pin, crimp barrel, 0.060</td>
<td>CS-836-2</td>
</tr>
<tr>
<td>Probe card</td>
<td>389-5349-XX*</td>
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<tr>
<td>Probe card retainer cap</td>
<td>9139B-301</td>
</tr>
<tr>
<td>Probe ground ring</td>
<td>389-5347-XX*</td>
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<tr>
<td>Probe, pogo pin</td>
<td>CS-830</td>
</tr>
<tr>
<td>Probe ring insert</td>
<td>9139A-325</td>
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<tr>
<td>Probe ring shield</td>
<td>9139-310</td>
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<tr>
<td>Probe ring shield strap</td>
<td>9139-314</td>
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<td>Probe ring, motherboard</td>
<td>389-5348-XX*</td>
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<tr>
<td>Receptacle, pogo pin</td>
<td>CS-831</td>
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<tr>
<td>Retainer, spring contact</td>
<td>9139A-331</td>
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<tr>
<td>Shield strap mounting spacer</td>
<td>386-8064-XX*</td>
</tr>
<tr>
<td>Spring contact retainer</td>
<td>9139B-302</td>
</tr>
<tr>
<td>Socket, 0.025</td>
<td>SO-146-1</td>
</tr>
<tr>
<td>Socket, 0.040</td>
<td>SO-146-2</td>
</tr>
<tr>
<td>Socket, 0.060</td>
<td>SO-146-3</td>
</tr>
<tr>
<td>Spacer 3.790 cm (1.492 in.) (9139B-PCA-01)</td>
<td>ST-168-9</td>
</tr>
<tr>
<td>Spacer 3.378 cm (1.330 in.) (9139B-PCA-02)</td>
<td>ST-166-10</td>
</tr>
<tr>
<td>Vacuum connection</td>
<td>PF-6</td>
</tr>
<tr>
<td>Washer (motherboard to spring contact retainer)</td>
<td>WA-102-2</td>
</tr>
<tr>
<td>Wire guide quadrant HI (strain relief for high-voltage cables)</td>
<td>386-8008-XX*</td>
</tr>
</tbody>
</table>

* XX represents the revision.
In this section:

Probe card adapter mechanical drawings

Probe card adapter mechanical drawings

You can use the drawings in this section to determine whether your prober is compatible with the 9139B.

Probe card adapter assembly

Figure 15: Probe card adapter with probe card installed
Probe card adapter width and stack height

Figure 16: Stack width and height

<table>
<thead>
<tr>
<th>Model number</th>
<th>Stack height</th>
<th>Probe card holder bottom</th>
<th>Probe card bottom</th>
</tr>
</thead>
<tbody>
<tr>
<td>9139B-PCA-01</td>
<td>1.492 in (37.90 mm)</td>
<td>1.447 in (36.75 mm)</td>
<td>1.365 in (34.67 mm)</td>
</tr>
<tr>
<td>9139B-PCA-02</td>
<td>1.330 in (33.78 mm)</td>
<td>1.285 in (32.64 mm)</td>
<td>1.203 in (30.56 mm)</td>
</tr>
</tbody>
</table>

(Special note: guide pins extend below bottom surface of the probe card holder)

Probe card adapter top view pin arrangement

Figure 17: Pin arrangement
Probe card dimensions

Figure 18: 9139B 1.1 kV 64-channel probe card dimensions

Outside diameter 152.40 mm (6.00 in.)
Inside diameter 31.75 mm (1.25 in.)

Thickness 3.175 mm (0.125 in.)