

Model 9139B-PCA Probe Card Adapter

Instructions

9139B-901-01 Rev. B / May 2019



9139B-901-01B

Model 9139B-PCA
Probe Card Adapter
Instructions

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Cleveland, Ohio, U.S.A.

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Document number: 9139B-901-01 Rev. B / May 2019

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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General information

In this section:

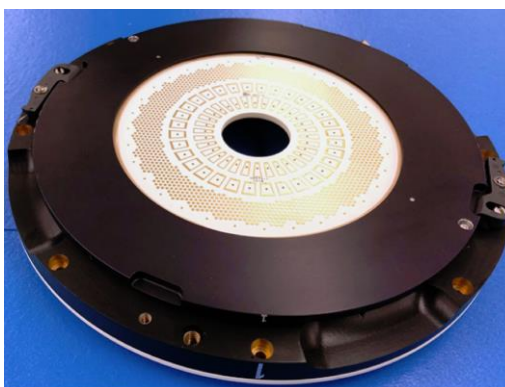
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Introduction

The Model 9139B-PCA Probe Card Adapter (PCA) is an interface specifically designed to connect a Keithley Instruments 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-PCA probe card adapter allows you to make high-voltage measurements in multi-pin, fully automated production test applications.

The 9139B-PCA also meets the requirements of IEC61010, Standard for Measurement, Control, and Laboratory Equipment, third edition.

Figure 1: 9139B-PCA probe card adapter with probe card



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 [stack height](#) (on page 3-6) and [Prober information](#) (on page 6-1) for details.

Features

Key features of the 9139B-PCA 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 top-load hinged interface 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 the 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 Keithley Parametric Test Systems:

- **Administrative Guide** (part number S530-924-01 or 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 or S535-924-01): This manual contains information about system instruments, installation, getting started, using function libraries, software, frequency analysis, pulse generation, diagnostics and troubleshooting, and maintenance of the Keithley Parametric Test System.

Unpacking and inspection

The following topics provide information about your shipment.

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. For detailed information about proper handling techniques, read [Handling precautions](#) (on page 3-1).

Inspection for damage

Carefully unpack your 9139B-PCA probe card adapter from its original shipping carton and inspect it for any obvious signs of physical damage. Report any 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-PCA:

- Model 9139B-PCA 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

Probe card adapter overview

In this section:

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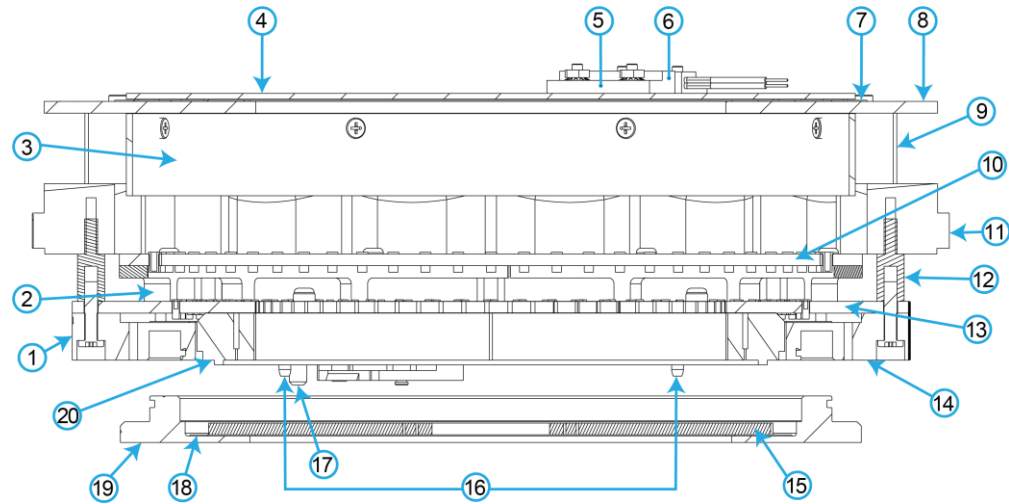
Probe card adapter standard components

The 9139B-PCA probe card adapter consists of the following components. See the figure 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 2: 9139B-PCA probe card adapter components

Number	Description
1	Vacuum connection (not shown), PF-6
2	Wire guide quadrant HI, 386-8008-XX*, 4 places
3	Probe ring shield strap, 9139-314
4	Interlock light cover, S500-339
5	Interlock magnet, MA-4
6	Interlock switch, SW-498
7	Insulator, black decal, 9139-313-02
8	Probe ring shield plate, 9139-310
9	Shield strap mounting spacer, 386-8004-XX*
10	Probe ground ring, 389-5347
11	Probe ring insert, 9139A-325
12	Spacer (sets stack height;): 9139B-PCA-01: ST-166-9, 3.790 cm (1.492 in.) 9139B-PCA-02: ST-166-10, 3.378 cm (1.330 in.)
13	Probe ring motherboards, 389-5348-XX*
14	Motherboards retainer ring, 9139A-326
15	Probe card, 9139B-172
16	Alignment pins, spring contact retainer - probe card
17	Alignment pin, motherboards retainer - probe card retainer
18	Insulator (Teflon ring), 9139B-303
19	Probe card retainer cap, 9139B-301
20	Spring contact retainer, 9139B-302

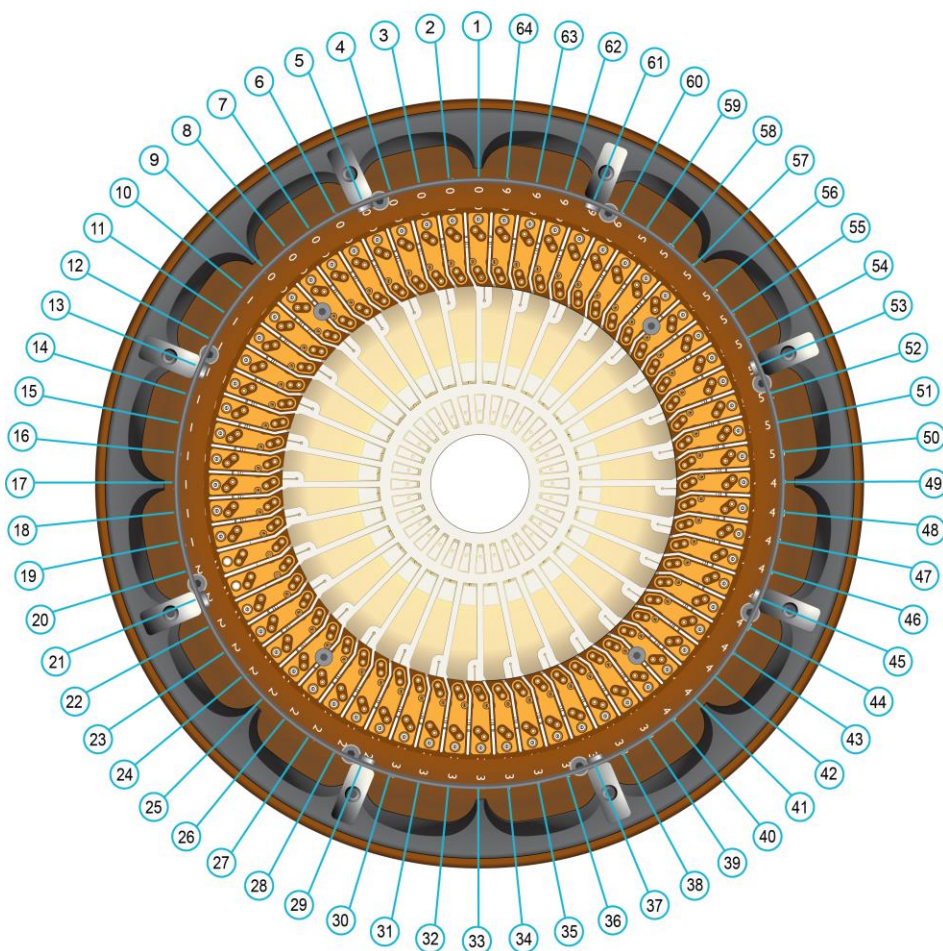
* XX represents the revision.

Pin arrangement

The 9139B-PCA probe card adapter has 64 pins, each rated to 1100 V. The pins are arranged into symmetric sectors around a central point.

All pins in the 9139B-PCA can also accommodate low-current signals. See the following figure for the pin arrangement.

Figure 3: 9139B-PCA pin arrangement



Planning your pin connections

When you purchase a 9139B-PCA, Keithley Instruments provides a Prober Pin Generator, which is an automated Microsoft® Excel® spreadsheet that helps you plan the pin connections for your prober. The following figure is an example of the Prober Pin Generator tool.

Figure 4: Prober Pin Generator tool

KEITHLEY

Customer: Two Wire Connection
 Revision: Four Wire Connection
 Date:

Number of Pins selected: 0

Select system type before selecting pin location

☒ Low Current Parametric Test ☐ High Voltage Test

Clear

System 1 Pin Selection		System 1 Pin Selection	
<input type="radio"/> Pin 1	<input type="radio"/> None	<input type="radio"/> Pin 34	<input type="radio"/> None
<input type="radio"/> Pin 2	<input type="radio"/> None	<input type="radio"/> Pin 35	<input type="radio"/> None
<input type="radio"/> Pin 3	<input type="radio"/> None	<input type="radio"/> Pin 36	<input type="radio"/> None
<input type="radio"/> Pin 4	<input type="radio"/> None	<input type="radio"/> Pin 37	<input type="radio"/> None
<input type="radio"/> Pin 5	<input type="radio"/> None	<input type="radio"/> Pin 38	<input type="radio"/> None
<input type="radio"/> Pin 6	<input type="radio"/> None	<input type="radio"/> Pin 39	<input type="radio"/> None
<input type="radio"/> Pin 7	<input type="radio"/> None	<input type="radio"/> Pin 40	<input type="radio"/> None
<input type="radio"/> Pin 8	<input type="radio"/> None	<input type="radio"/> Pin 41	<input type="radio"/> None
<input type="radio"/> Pin 9	<input type="radio"/> None	<input type="radio"/> Pin 42	<input type="radio"/> None
<input type="radio"/> Pin 10	<input type="radio"/> None	<input type="radio"/> Pin 43	<input type="radio"/> None
<input type="radio"/> Pin 11	<input type="radio"/> None	<input type="radio"/> Pin 44	<input type="radio"/> None
<input type="radio"/> Pin 12	<input type="radio"/> None	<input type="radio"/> Pin 45	<input type="radio"/> None
<input type="radio"/> Pin 13	<input type="radio"/> None	<input type="radio"/> Pin 46	<input type="radio"/> None
<input type="radio"/> Pin 14	<input type="radio"/> None	<input type="radio"/> Pin 47	<input type="radio"/> None
<input type="radio"/> Pin 15	<input type="radio"/> None	<input type="radio"/> Pin 48	<input type="radio"/> None
<input type="radio"/> Pin 16	<input type="radio"/> None	<input type="radio"/> Pin 49	<input type="radio"/> None
<input type="radio"/> Pin 17	<input type="radio"/> None	<input type="radio"/> Pin 50	<input type="radio"/> None
<input type="radio"/> Pin 18	<input type="radio"/> None	<input type="radio"/> Pin 51	<input type="radio"/> None
<input type="radio"/> Pin 19	<input type="radio"/> None	<input type="radio"/> Pin 52	<input type="radio"/> None
<input type="radio"/> Pin 20	<input type="radio"/> None	<input type="radio"/> Pin 53	<input type="radio"/> None
<input type="radio"/> Pin 21	<input type="radio"/> None	<input type="radio"/> Pin 54	<input type="radio"/> None
<input type="radio"/> Pin 22	<input type="radio"/> None	<input type="radio"/> Pin 55	<input type="radio"/> None
<input type="radio"/> Pin 23	<input type="radio"/> None	<input type="radio"/> Pin 56	<input type="radio"/> None
<input type="radio"/> Pin 24	<input type="radio"/> None	<input type="radio"/> Pin 57	<input type="radio"/> None
<input type="radio"/> Pin 25	<input type="radio"/> None	<input type="radio"/> Pin 58	<input type="radio"/> None
<input type="radio"/> Pin 26	<input type="radio"/> None	<input type="radio"/> Pin 59	<input type="radio"/> None
<input type="radio"/> Pin 27	<input type="radio"/> None	<input type="radio"/> Pin 60	<input type="radio"/> None
<input type="radio"/> Pin 28	<input type="radio"/> None	<input type="radio"/> Pin 61	<input type="radio"/> None
<input type="radio"/> Pin 29	<input type="radio"/> None	<input type="radio"/> Pin 62	<input type="radio"/> None
<input type="radio"/> Pin 30	<input type="radio"/> None	<input type="radio"/> Pin 63	<input type="radio"/> None
<input type="radio"/> Pin 31	<input type="radio"/> None	<input type="radio"/> Pin 64	<input type="radio"/> None
<input type="radio"/> Pin 32	<input type="radio"/> None		
<input type="radio"/> Pin 33	<input type="radio"/> None		

Leakage paths, low-current and high-voltage capabilities

The Model 9139B-PCA 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 Model 9139B-PCA 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 connect easily 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 device under test (DUT) cable on the motherboard.

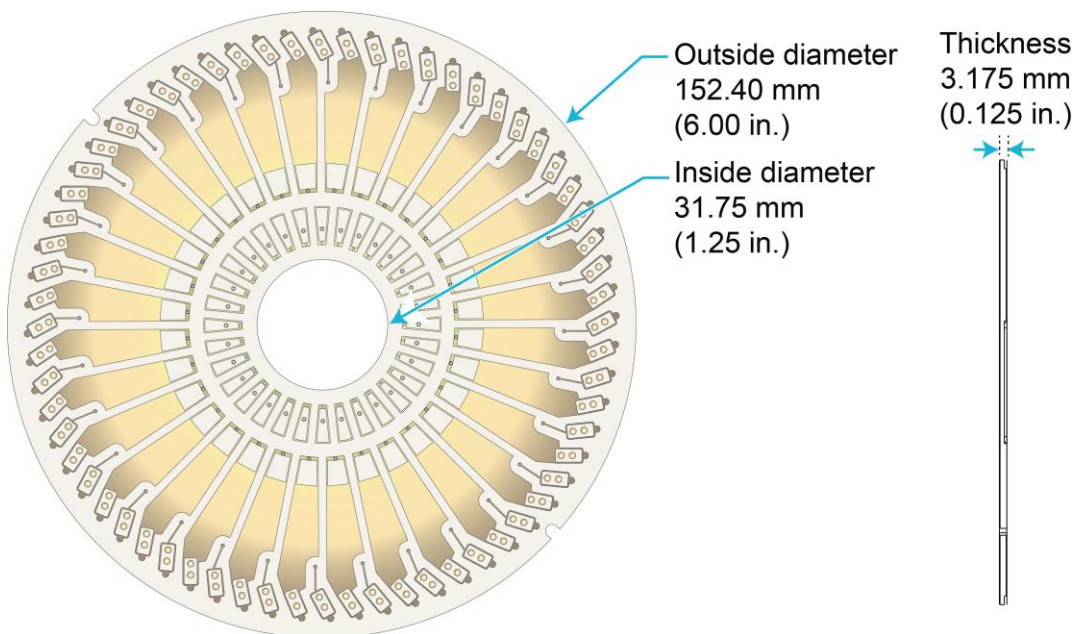
Source, sense, and guard signals are kept separate for each pin and are carried to the probe card through spring-loaded contacts (pogo pins). Source and measure lines are guarded on the motherboard using printed circuit board manufacturing techniques.

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 9139B-172 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 the needle connections. The following figure shows the dimensions of the probe card.

Figure 5: 9139B 1.1 kV 64-channel probe card dimensions



An unpopulated (blank) probe card is provided with the probe card adapter assembly. Additional blank probe cards are available through your Keithley Instruments office, sales partner, or distributor.

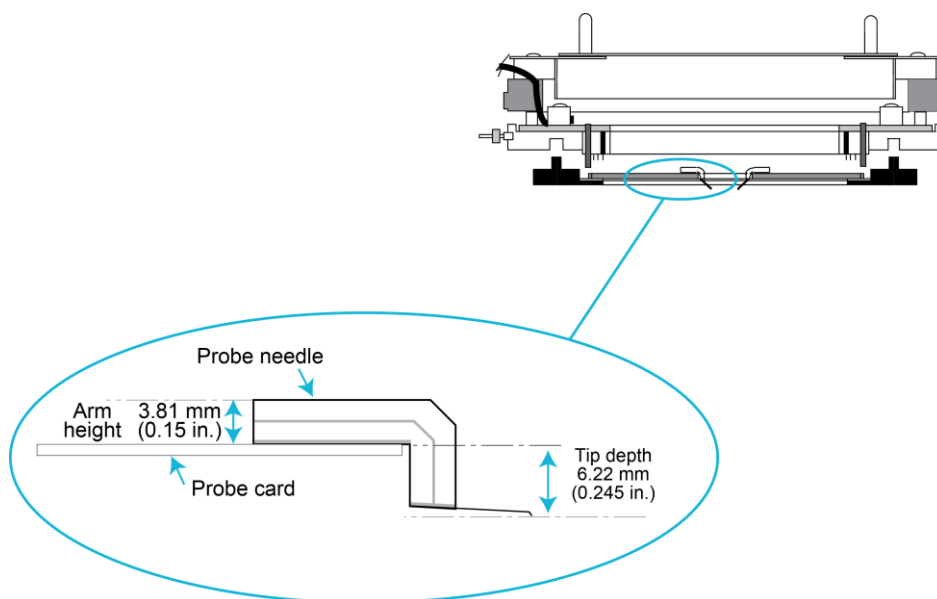
NOTE

To reduce pin-to-pin capacitance, use ceramic-tip probes.

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 6: Probe needle mounting

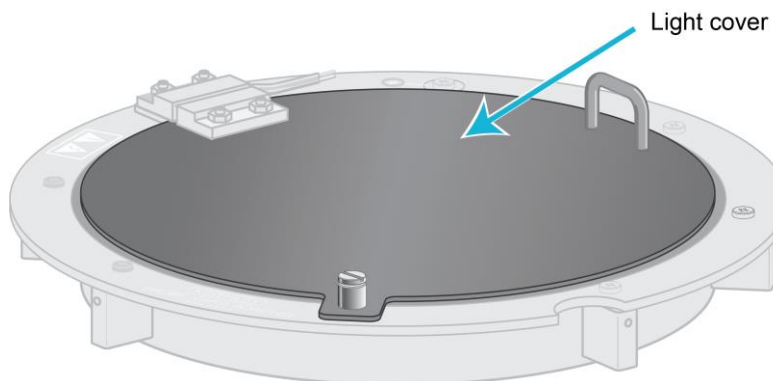


Light cover

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. For more information about the safety interlock, see [Safety](#) (on page 3-3).

Figure 7: Light cover



Installation

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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.

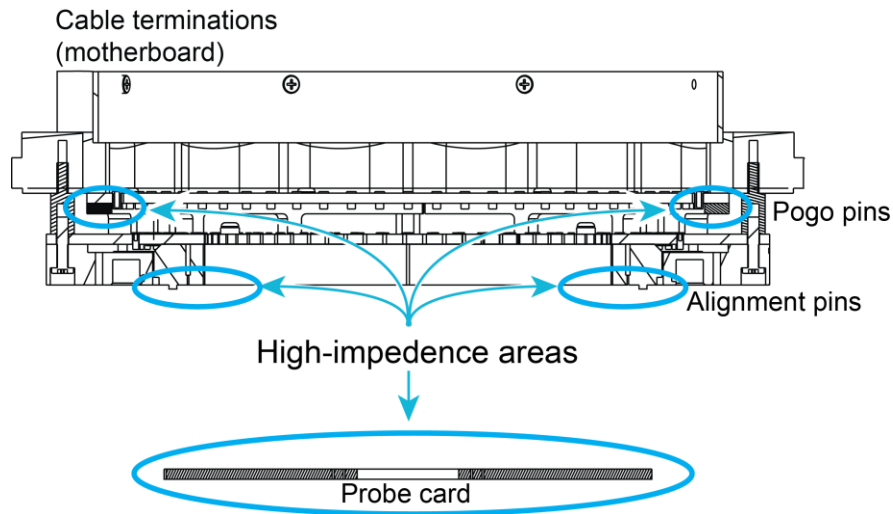
This section contains information needed to install the 9139B-PCA probe card adapter on your prober. Review the following topics before handling or installing the 9139B-PCA.

Handling precautions

The 9139B-PCA probe card adapter comes from the factory assembled 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 8: Do not touch high impedance areas

Take these precautions when handling the 9139B-PCA:

- 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.

General installation considerations

The following topics provide information you should know before installing and using the 9139B-PCA probe card adapter.

NOTE

For best performance, use 9139B probe cards with the 9139B-PCA probe card adapter. Using 9139A probe cards in the 9139B-PCA will result in diminished performance. For more information about 9139B probe cards, see [Probe cards](#) (on page 3-11).

Safety

⚠ WARNING

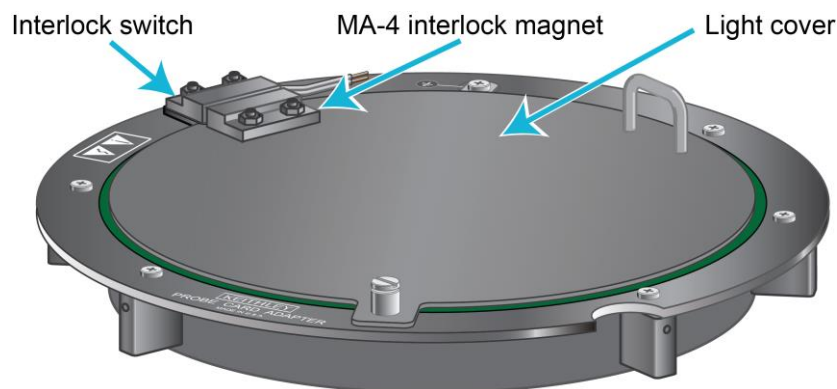
Failure to make sure that the safety interlock and safety shields and guards are properly installed and arranged as indicated will put personnel in severe danger. Severe personal injury or death due to electric shock or electrocution may result.

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 proper safety shields are properly in place. Refer to the manufacturer of your specific probe for proper safety shield information.

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

Figure 9: Probe card adapter light cover and interlock switch



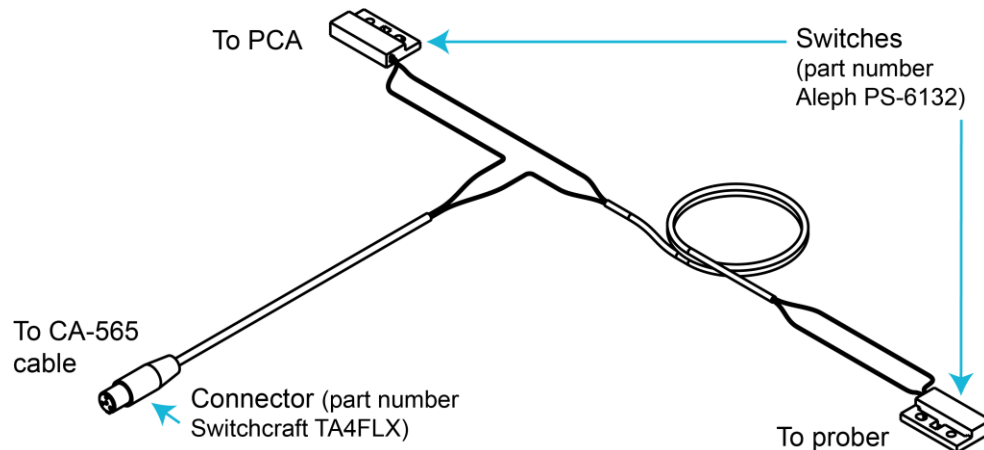
⚠ WARNING

Do not operate the system until it is properly installed and all proper 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

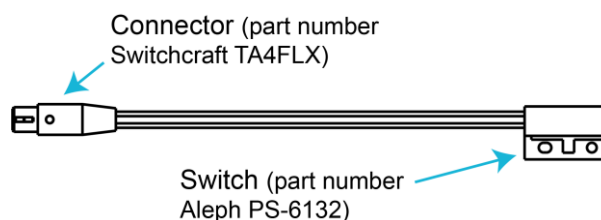
The Model 174-7047-XX¹ Safety Interlock Cable provides additional protection from electric shock at the Keithley probe card adapter (PCA). The cable attaches to the prober top plate and the PCA so that if you unlatch the top plate of the prober and lift it up to change a probe card or take off the PCA, the interlock is tripped.

Figure 10: Model 174-7047-XX Safety Interlock Cable



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

Figure 11: Model 174-7037-XX interlock cable



NOTE

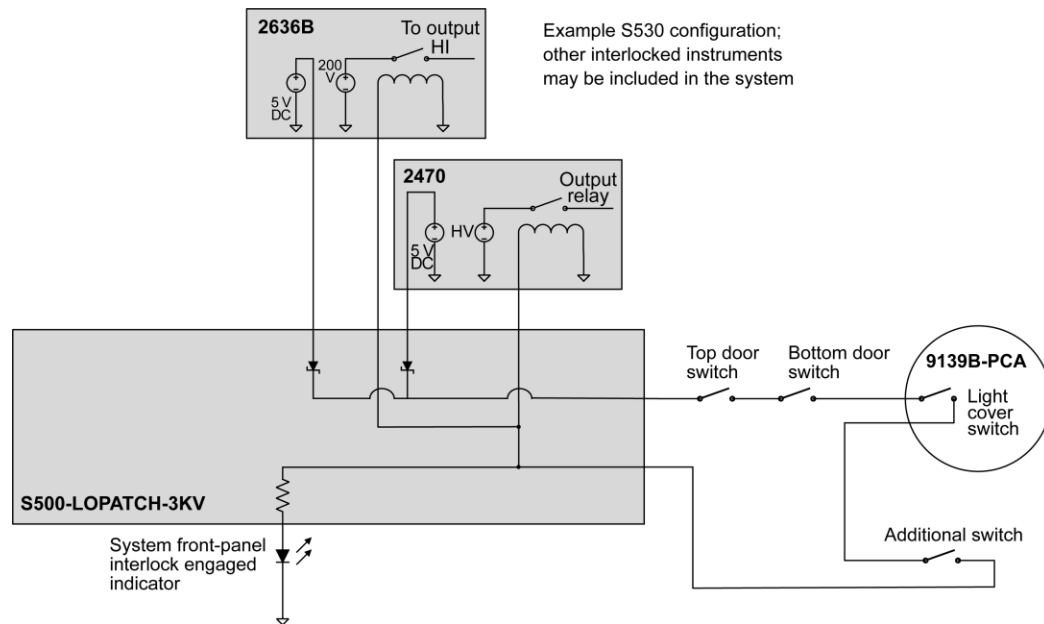
The Model 174-7047-XX cable interfaces with your prober interlock through a relay contact. A shorted prober contact engages the interlock circuit. An open contact interrupts the interlock, turning off hazardous voltage.

¹ Where XX represents the revision; the highest number is the most recent revision.

9139B-PCA interlock schematic

The following diagram shows an example interlock configuration.

Figure 12: 9139B-PCA interlock block diagram



Mechanical structure

The mechanical structure of the 9139B-PCA enables installation in a 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 a detailed drawing and list of components.

Spacers inserted between the motherboard and prober ring connect the two assemblies. The length of the spacers (there are two different lengths) determines the overall stack height of the probe card assembly, which is important for compatibility with your prober. For more information about stack height, see [Stack height](#) (on page 3-6).

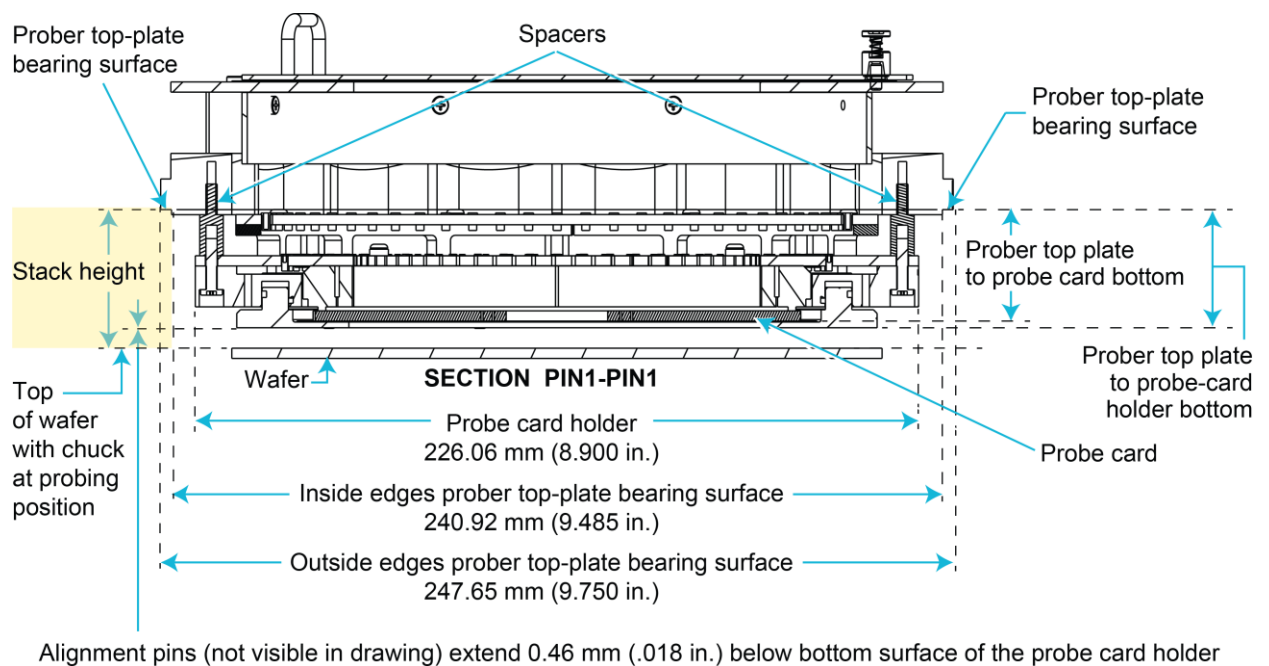
Stack height

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

Stack height of the probe must be equal to the stack height of the probe card adapter. Different spacers in the 9139B-PCA allow the stack height to be either 3.378 cm (1.330 in.) or 3.790 cm (1.492 in.). Probe stack heights may vary because of the thickness of the probe top plate and the requirements for cable routing. You may have to install mounting hardware onto the probe to ensure that the probe stack height is the same as the 9139B-PCA stack height.

To determine the stack height of your probe, measure the distance between the top of the wafer (with the chuck in probing position) and the probe top plate bearing surface. See the following figure and the table after it for details. For more specific information about supported probes, see [Prober information](#) (on page 6-1).

Figure 13: Stack width and height



Model number	Stack height	Prober top plate to probe-card holder bottom	Prober top plate to probe card bottom
9139B-PCA-01	37.90 mm (1.492 in.)	36.75 mm (1.447 in.)	34.67 mm (1.365 in.)
9139B-PCA-02	33.78 mm (1.330 in.)	32.64 mm (1.285 in.)	30.56 mm (1.203 in.)

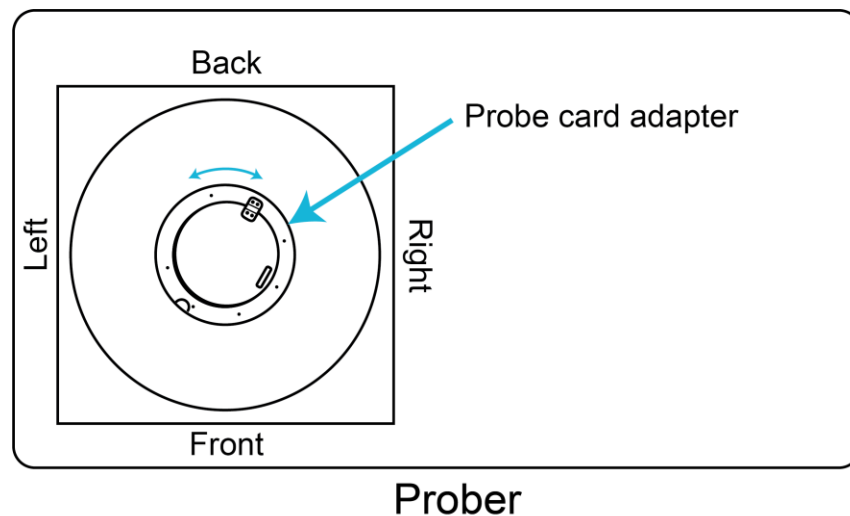
PCA and probe card orientation

The 9139B-PCA probe card adapter (PCA) can be installed on the prober in any direction (depending on cable routing). During installation, the PCA can be rotated so that pin 1 is aligned to the front, back, left, or right of the prober (or any position in between).

NOTE

Keithley only supports front, back, left, or right orientations, which are the most commonly used positions.

Figure 14: Probe card adapter orientation on prober



NOTE

The probe card must be installed in the PCA in a single position: Pin 1 of the probe card must be aligned with the pin 1 marking on the probe card retainer cap and pin 1 of the 9139B-PCA motherboard. For more information about installing probe cards in the PCA, see [Probe card installation procedure](#) (on page 3-12).

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 probe. 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.

Figure 15: PCA cable routing example



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 [PCA installation procedure](#) (on page 3-9) for more information about installing DUT cables. See [Prober information](#) (on page 6-1) for cable routing requirements for specific prober models.

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.

PCA 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.

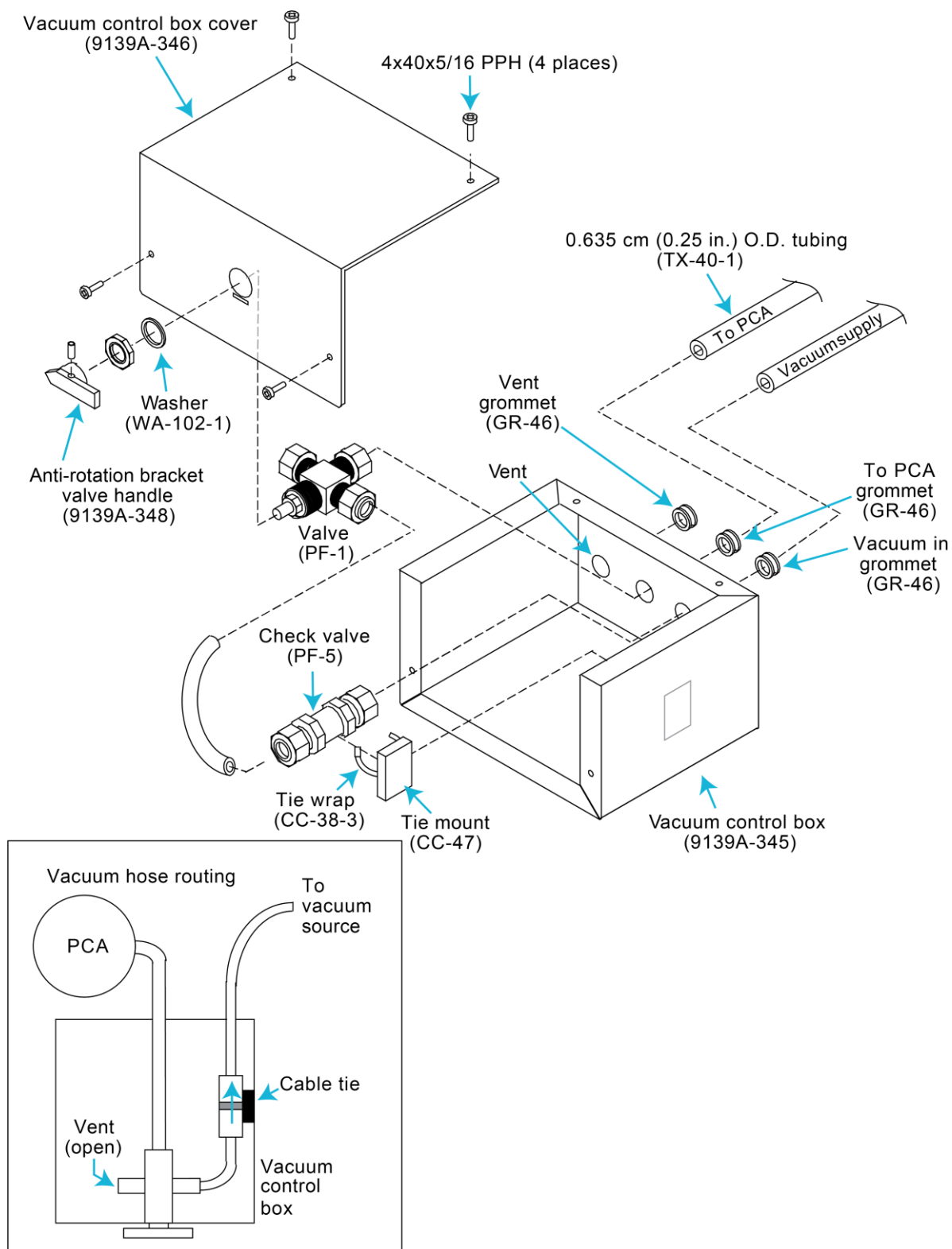
Use these instructions to install the 9139B-PCA probe card adapter (PCA) directly on your prober. If you are using the optional top-load hinged interface with the PCA, use the instructions in [Optional top-load hinged interface installation](#) (on page 3-15).

To install the 9139B-PCA:

NOTE

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

1. Unpack and inspect the 9139B-PCA (see [Handling precautions](#) (on page 3-1) 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 [Stack height](#) (on page 3-6) to determine if your prober is compatible. If you need assistance with your specific prober configuration, contact a Keithley office, sales partner, or distributor.
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-PCA 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 16: Vacuum control box

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.

Probe cards

For best performance, use 9139B probe cards with the 9139B-PCA probe card adapter. Using 9139A probe cards in the 9139B-PCA will result in diminished performance.

WARNING

Do not use a 9139A probe card with the 9139B-PCA in testing that exceeds 200 V. Testing in excess of 200 V using a 9139A probe card may damage test equipment or cause injury or death due to electric shock. Instead, use 9139B probe cards with the 9139B-PCA.

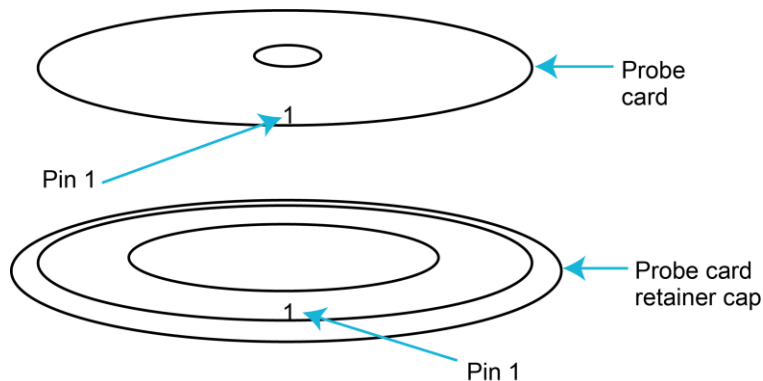
The following topics provide more information about using probe cards with the 9139B-PCA.

Probe card installation procedure

To install the probe card:

1. Turn the vacuum control box valve to the load/operate position.
2. Align probe card pin 1 with the pin 1 indicator on the retainer cap (see the following figure).

Figure 17: Probe card and probe card retainer



3. Insert the 9139B-172 probe card into the 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.

Figure 18: Aligning pin 1



NOTE

The probe card must be installed in the PCA in a single position: Pin 1 of the probe card must be aligned with the pin 1 marking on the probe card retainer cap and pin 1 of the 9139B-PCA motherboard.

5. Attach the retainer cap to the motherboard ring. Make sure latches secure the probe ring (the 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; this 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 ensure accurate continuity tests.

Handling and storage of the blank probe card is important (see [Handling precautions](#) (on page 3-1)). 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 detailed information about running diagnostic tests, refer to the "Diagnostics and troubleshooting" section of the reference manual for your system.

Performance verification using system diagnostics

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

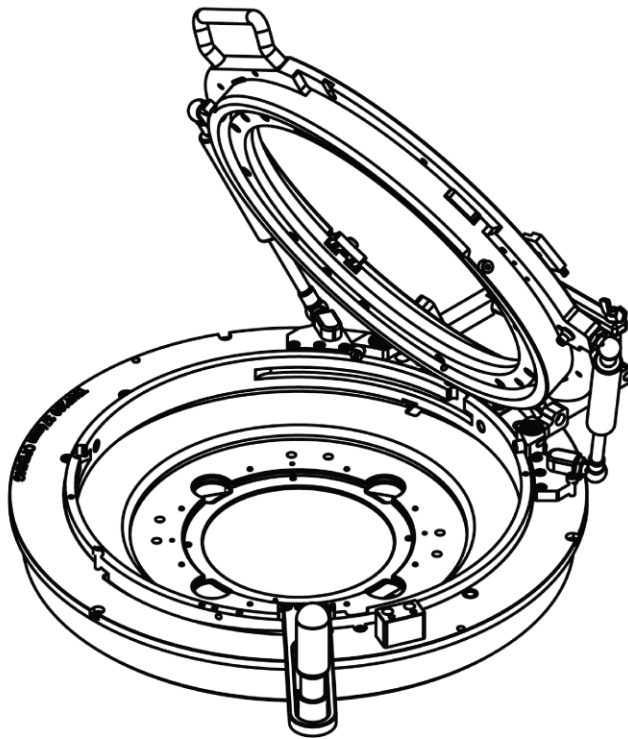
For more information about the system diagnostics and verification tool, refer to the "Diagnostics and troubleshooting" section of the reference manual for your system.

Optional top-load hinged interface installation

NOTE

The following instructions are for installation of the 9139B-PCA with an optional top-load hinged interface mechanism (clamshell) from inTest® Corporation. This example procedure is for installation on a TSK® UF200 prober. Other hinged interfaces and probers may require different procedures; refer to the manufacturer's documentation for details.

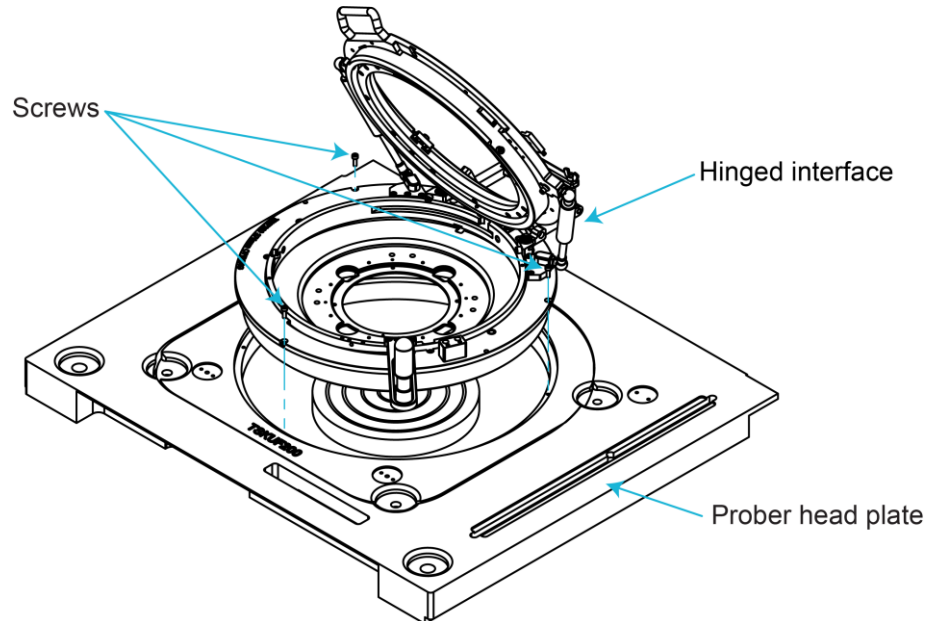
Figure 19: Optional inTest Corporation hinged interface



To install the 9139B-PCA probe card adapter with an inTest hinged interface:

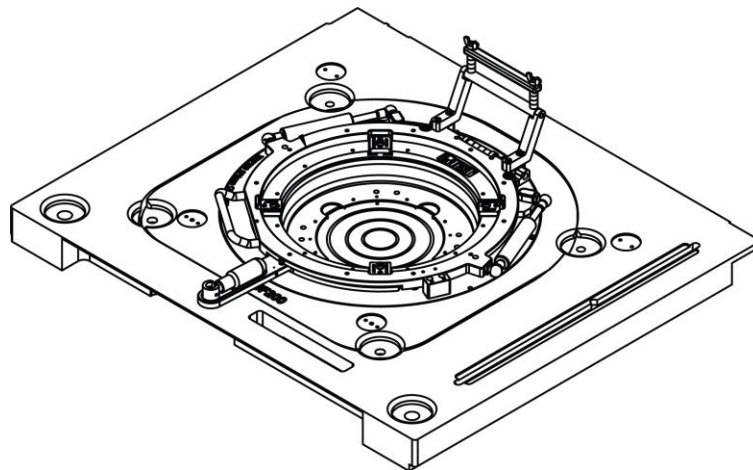
1. Place the hinged interface on the prober head plate and tighten the screws (supplied with the hinged interface), as shown in the following figure.

Figure 20: Placing the hinged interface on the prober



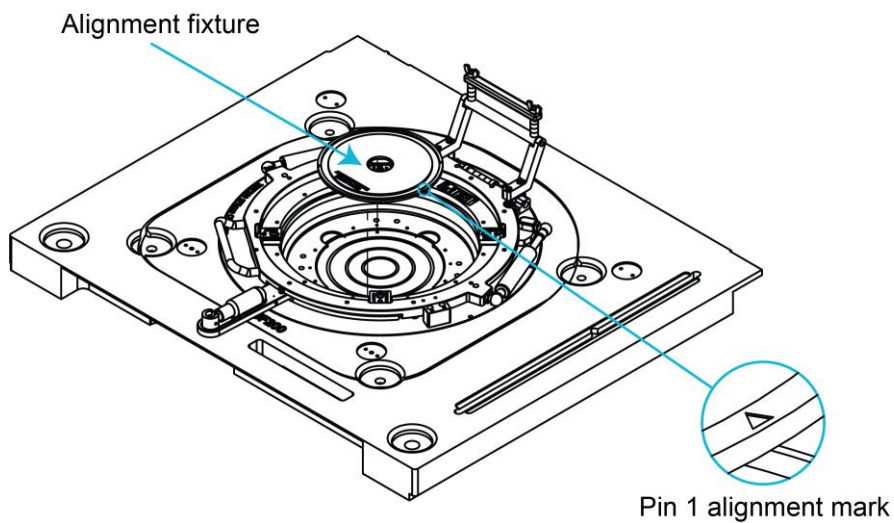
2. Close and lock the hinged interface into position.

Figure 21: Hinged interface closed and locked into position on prober



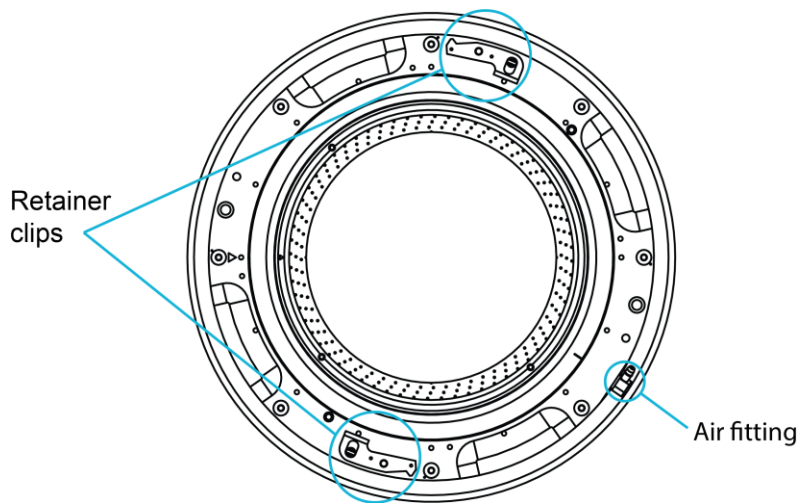
3. Place the alignment fixture on the hinged interface, aligning the pin 1 arrow on the alignment fixture with the pin 1 arrow on the probe card tray of the hinged interface.

Figure 22: Alignment fixture



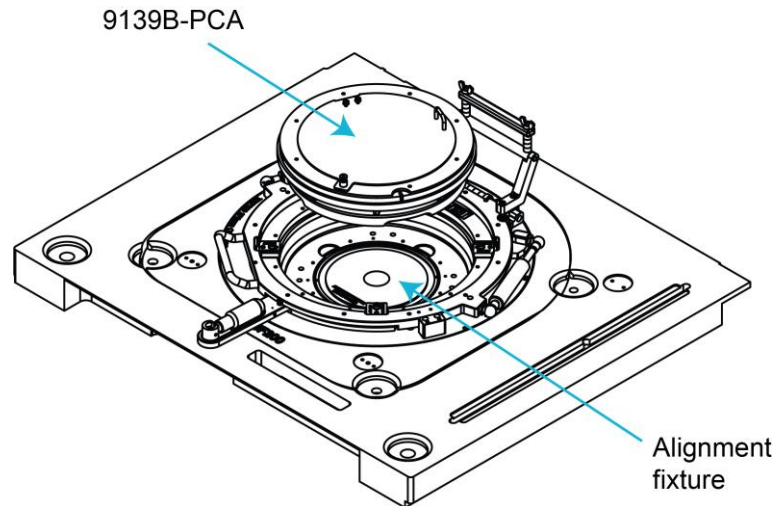
4. If present on the 9139B-PCA, remove the retainer clips and air fitting (identified in the following figure).

Figure 23: 9139B probe card adapter



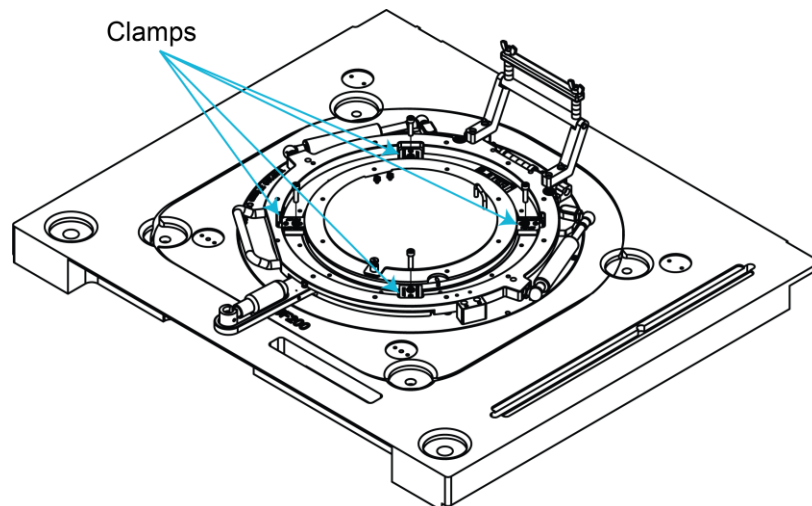
5. Install the 9139B-PCA in the hinged interface, aligning the guide pins on the PCA with the alignment holes in the alignment fixture.

Figure 24: Aligning the PCA with the alignment fixture



6. Slide the clamps on the hinged fixture inward and tighten on the PCA.

Figure 25: Slide manipulator clamps inward and tighten on PCA



⚠ WARNING

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

Maintenance

In this section:

Introduction	4-1
Mechanical disassembly	4-2
Moving PCA cable connections.....	4-3
Cleaning	4-3
Replacing a pogo pin	4-4
Replacing a pogo pin socket	4-5
Replacing the vacuum connection	4-6

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-head 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 probe-card adapter (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 3-1) 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:

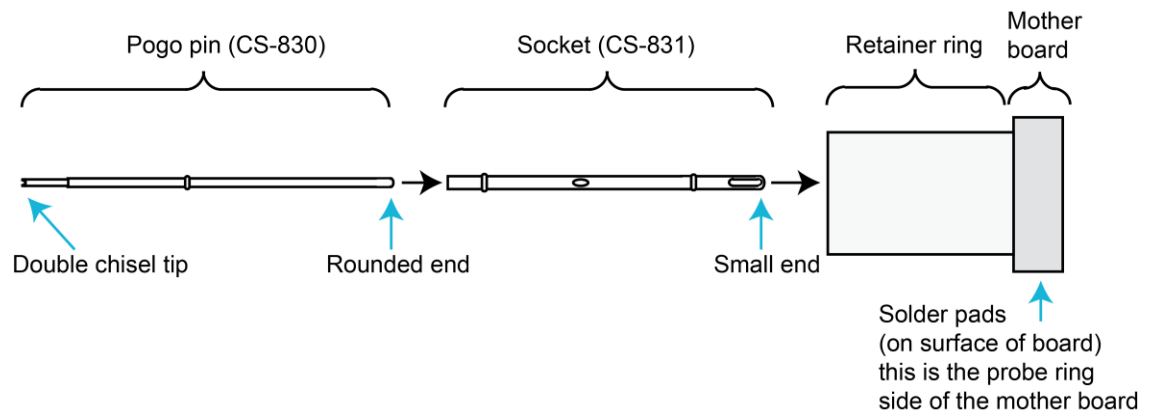
1. Reset the system hardware.
2. Remove the probe card from the probe card adapter assembly (see [Probe card removal procedure](#) (on page 3-13)).
3. Using a pair of needle-nose pliers, pull the defective pogo pin out of its socket.

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 26: Orientation of pogo pin and socket



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 a pogo pin](#) (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 a pogo pin](#) (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).

Replaceable parts

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 Instruments office, sales partner, or distributor. When ordering parts, be sure to include the following information:

1. Probe card adapter model number: 9139B-PCA
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-PCA.

Blank probe card

For a replacement blank (unpopulated) probe card, order Keithley part number 389-5226-XX².

² Where XX represents the revision; the highest number is the most recent revision.

9139B-PCA-01 and 9139B-PCA-02 parts list

The following table lists the replaceable parts for the 9139B-PCA-01 and 9139B-PCA-02 probe card adapters.

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

* XX represents the revision.

Prober information

In this section:

Standard prober requirements	6-1
Probers supported with the PCA and latest version of KTE	6-1
Compatible probers that require KTE driver development	6-4

Standard prober requirements

This section provides information about supported probers for the 9139B-PCA.

NOTE

The following list of probers is not comprehensive; prober manufacturers continuously upgrade their products and release new products. If you have a prober not listed here, contact the manufacturer to verify that it is compatible with the mechanical interface of the Keithley 9139B-PCA. For information that can help you determine if your prober is compatible, see [General installation considerations](#) (on page 3-2).

Probers supported with the PCA and latest version of KTE

The probers in the following tables are currently supported for use with the 9139B-PCA and the latest version of Keithley Test Environment (KTE).

NOTE

Standard cable routing for all supported probers is across the top of the prober and out of the back of the prober. For custom cable routing or if you are using an inTEST or Reid-Ashman top-load hinged interface, contact your field service engineer or account representative.

ACCRETECH (TSK) probers

The following ACCRETECH® probers are supported for use with the 9139B-PCA when used with the latest version of Keithley Test Environment (KTE) software. To determine compatibility of other prober models, contact your field service engineer or account manager.

Prober model	Compatible PCA version	Stack height	Cable routing	Cable exit	Ring insert diameter	Parts from prober vendor (customer supplied)
A-PM-90A	9139B-PCA-01	3.789 cm (1.492 in.)	Top only	Rear and left only	24.764 cm (9.75 in.)	Ring insert (part number FM01275-D001-00)
UF190 UF190R UF200 UF200R UF300 UF2000 UF3000 UF3000EX UF3000EX-e UF3000LX	9139B-PCA-01	3.789 cm (1.492 in.)	Top only	Rear and left only	24.764 cm (9.75 in.)	NA

Electroglas probers

The following Electroglas™ probers are supported for use with the 9139B-PCA when used with the latest version of Keithley Test Environment (KTE) software. To determine compatibility of other prober models, contact your field service engineer or account manager.

Prober models	Compatible PCA version	Stack height	Cable routing	Cable exit	Ring insert diameter	Parts from prober vendor (customer supplied)
EG2001 EG2010 EG3001 EG4060 EG4085	9139B-PCA-01	3.789 cm (1.492 in.)	Over top plate of prober only	Over top plate of prober only	24.764 cm (9.75 in.)	NA
EG4070 EG4080	9139B-PCA-01	3.789 cm (1.492 in.)	Over top plate of prober only	Over top plate of prober only	24.764 cm (9.75 in.)	Ring insert (part number 254635-001)

KLA probers

The following KLA™ probers are supported for use with the 9139B-PCA when used with the latest version of Keithley Test Environment (KTE) software. To determine compatibility of other prober models, contact your field service engineer or account manager.

Prober model	Compatible PCA version	Stack height	Cable routing	Cable exit	Ring insert diameter	Parts from prober vendor (customer supplied)
1007 1220	9139B-PCA-02	3.378 cm (1.330 in.)	Top only	Any direction except from front of prober	24.764 cm (9.75 in.)	HF prober ring insert adapter (part number 780-910804-00)

TEL probers

The following Tokyo Electron (TEL™) probers are supported for use with the 9139B-PCA when used with the latest version of Keithley Test Environment (KTE) software. To determine compatibility of other prober models, contact your field service engineer or account manager.

Prober model	Compatible PCA version	Stack height	Cable routing	Cable exit	Ring insert diameter	Parts from prober vendor (customer supplied)
P8 P8-XL P8-XLm	9139B-PCA-02	3.378 cm (1.330 in.) standard head plate	Top only	Any direction except from front of prober	24.764 cm (9.75 in.)	Ring insert adapter (part number U261-Z30003-XX)
P8 P8-XL (with semiautomatic probe card changer (SACC); requires modification of 9139B-PCA)	9139B-PCA-02	3.378 cm (1.330 in.) standard head plate	Top only	Any direction except from front of prober	24.764 cm (9.75 in.)	Ring insert adapter (part number U261-Z30003-XX)
P-12 P-12XL P-12XLn P-12XLn+ P-12XLm Precio Precio Nano Precio Octo Precio XL	9139B-PCA-02	3.378 cm (1.330 in.) standard head plate	Top only	Any direction except from front of prober	24.764 cm (9.75 in.)	NA

Compatible probers that require KTE driver development

The probers in the following table are supported mechanically for use with the 9139B-PCA, but have not been tested with the latest version of Keithley Test Environment (KTE) software.

NOTE

These probers may require driver development and testing for compatibility; this service is available for an additional fee.

Prober model	Compatible PCA version	Stack height	Cable routing	Cable exit	Ring insert diameter	Parts from prober vendor (customer supplied)
Alessi probers	9139B-PCA-02	3.378 cm (1.330 in.)	Top only	Any direction	24.764 cm (9.75 in.)	Adapter ring
Pacific Western PW2	9139B-PCA-01	3.378 cm (1.330 in.)	Top or bottom	Any direction	24.447 cm (9.625 in.)	NA
Teledyne TAC PR8100	9139B-PCA-01	3.789 cm (1.492 in.)	Top only	Any direction	24.764 cm (9.75 in.)	Special adapter ring from Teledyne TAC
Ultraprecision 680	9139B-PCA-01	3.789 cm (1.492 in.)	Top or bottom	Any direction	24.764 cm (9.75 in.)	NA

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