

Keithley Instruments
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Assembly and Mounting Instructions

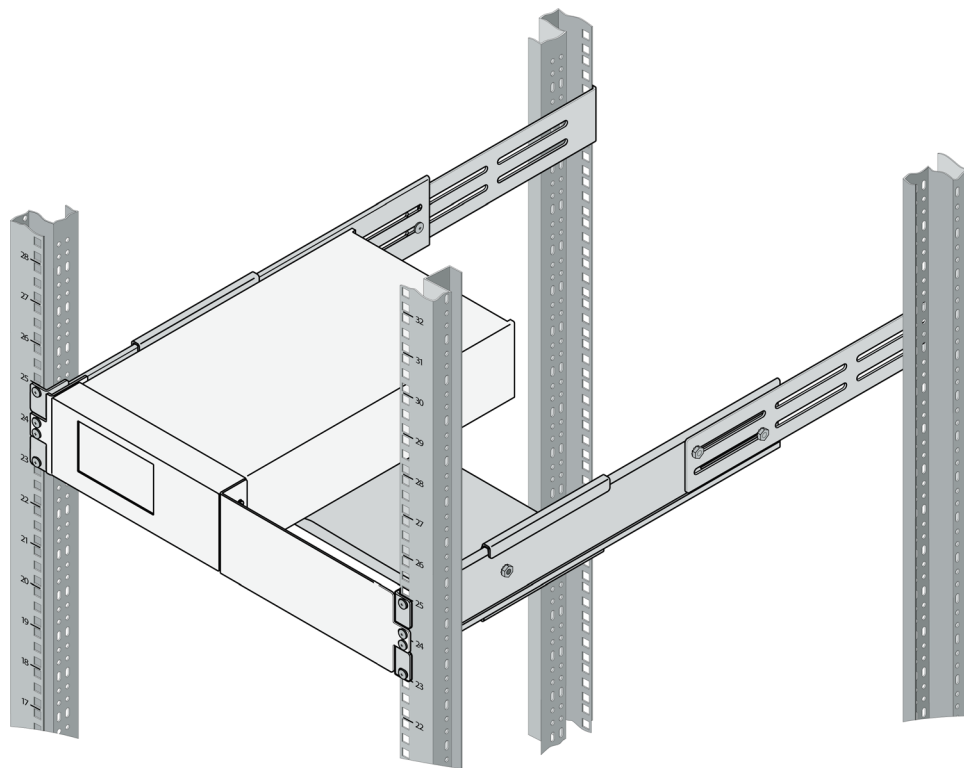
Introduction

This kit contains all the hardware you need to install a Model 2280, 2281, 2220, or 2230G half-rack instrument in a standard 19-inch equipment rack.

NOTE

1U is a standard vertical spacing that is equal to 4.45 cm (1 ³/₄-inch).

Figure 1: Typical installation (instrument and rack not included)



Tools required

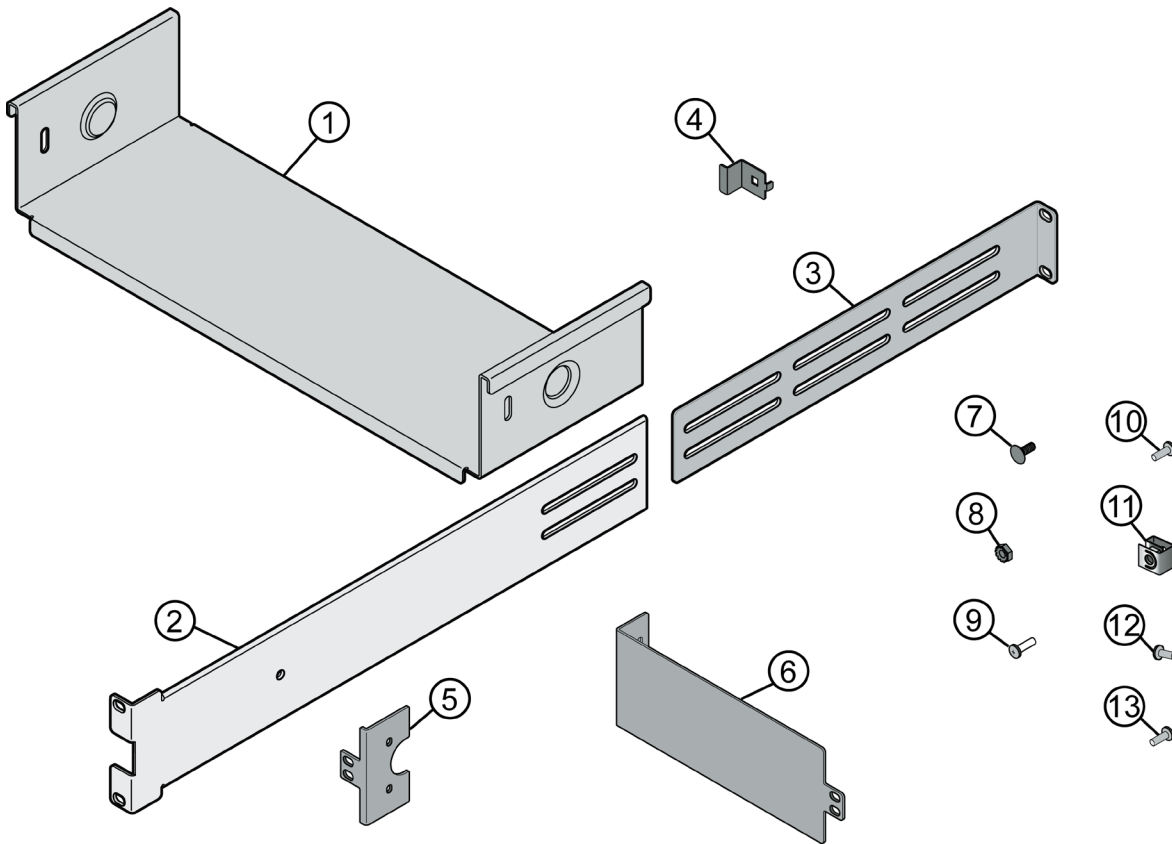
- Medium (#2) Phillips head screwdriver
- 3/8-inch wrench
- Flat-bladed screwdriver or cage nut installation tool



Parts list

The following figure shows the hardware that is supplied with this kit. The following table lists the hardware, part number, and quantity.

Figure 2: Model 4299-14 Rack Mount Kit parts



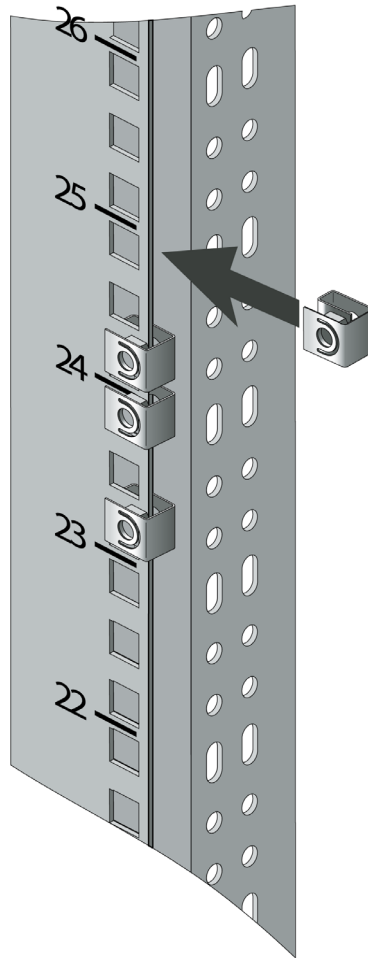
#	Description	Part number	Quantity
1	U-bracket	4299-14-301	1
2	Front bracket support	4299-14-302	2
3	Rear bracket support	4299-14-303	2
4	Unit clip	4299-14-304	2
5	Front rack ear	4299-14-305	2
6	Blank filler plate	4299-14-306	1
7	Carriage bolt	212026400	2
8	Cage nut	FA-274	12
9	10-32 x 5/8-in. Phillips truss head screw	10-32X5/8PHTRSH	12
10	10-32 x 1/2-in. Phillips pan head screw	10-32X1/2PPHSEM	6
11	10-32 Keps® washer nut	10-32KEPNUT	8
12	6-32 x 1/2-in. Phillips pan head screw	6-32x1/2PPHSEM	4
13	M4 x 1/2-in. Phillips pan head screw	M4X10PPH	4

Prepare the rack

To prepare the rack for installation:

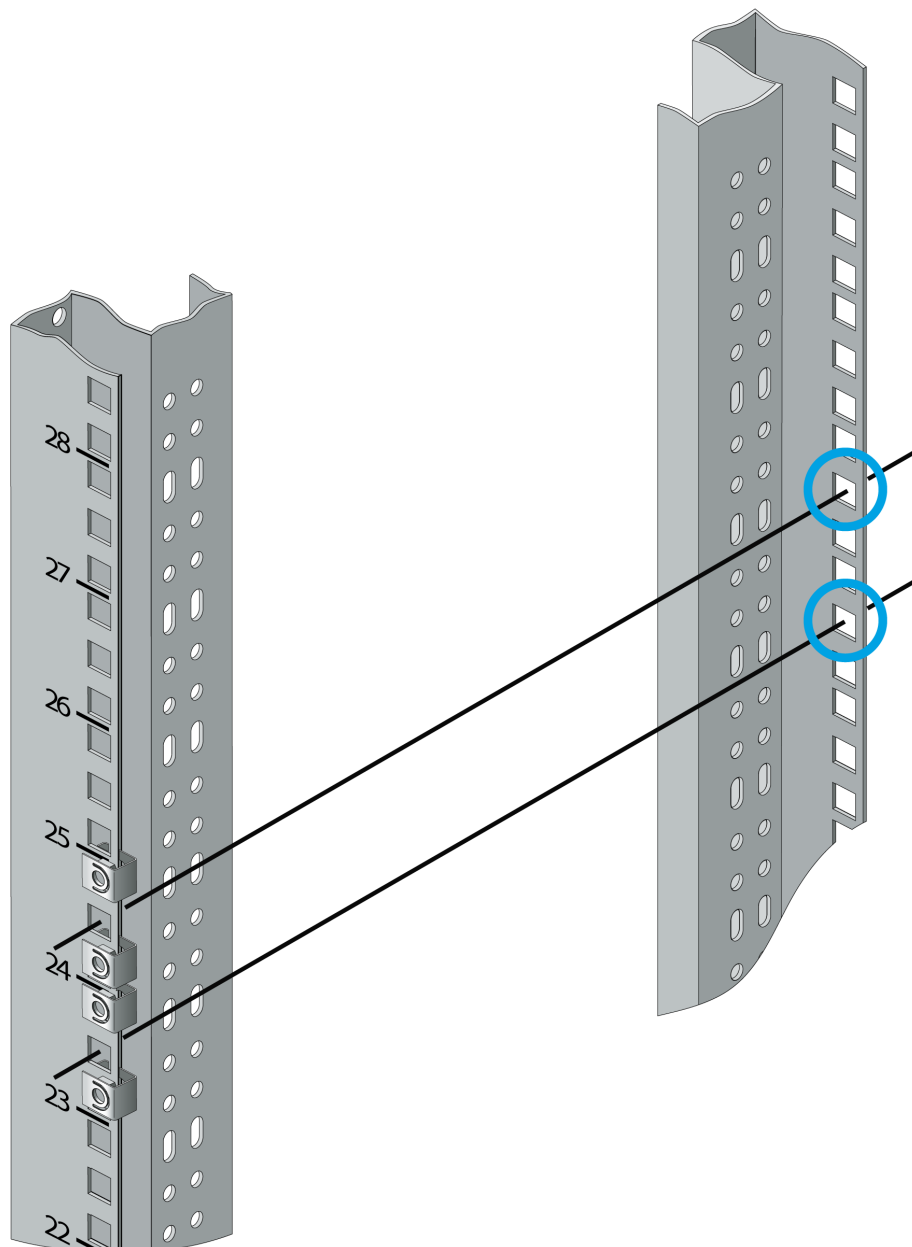
1. Determine where the instrument will be mounted.
2. Install four cage nuts on each of the front rails as shown in the following figure.

Figure 3: Intall the cage nuts on the front rails



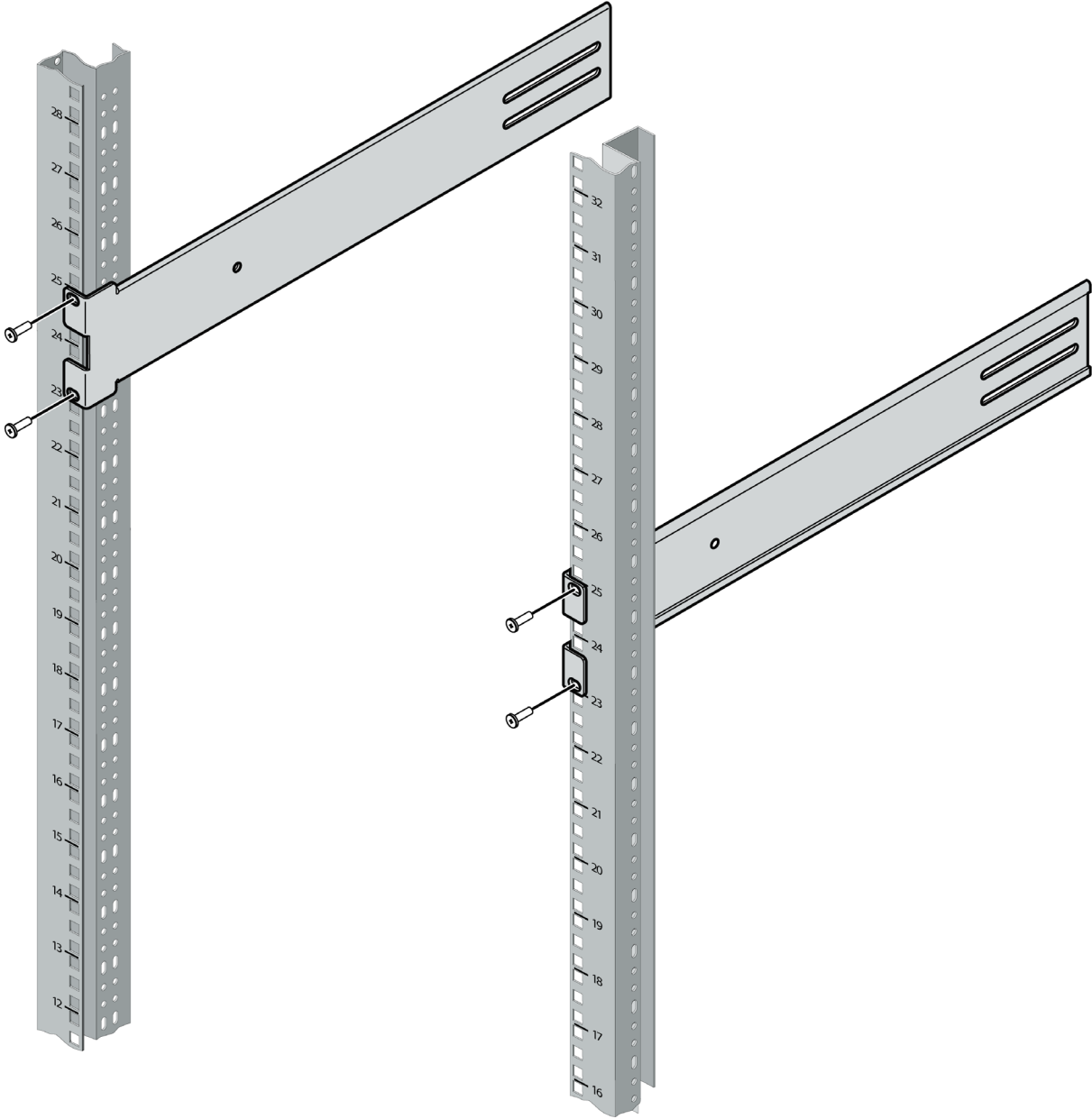
3. Install two cage nuts on each of the rear rails as shown in the following figure as shown in the following figure.

Figure 4: Install the cage nuts on the rear rails



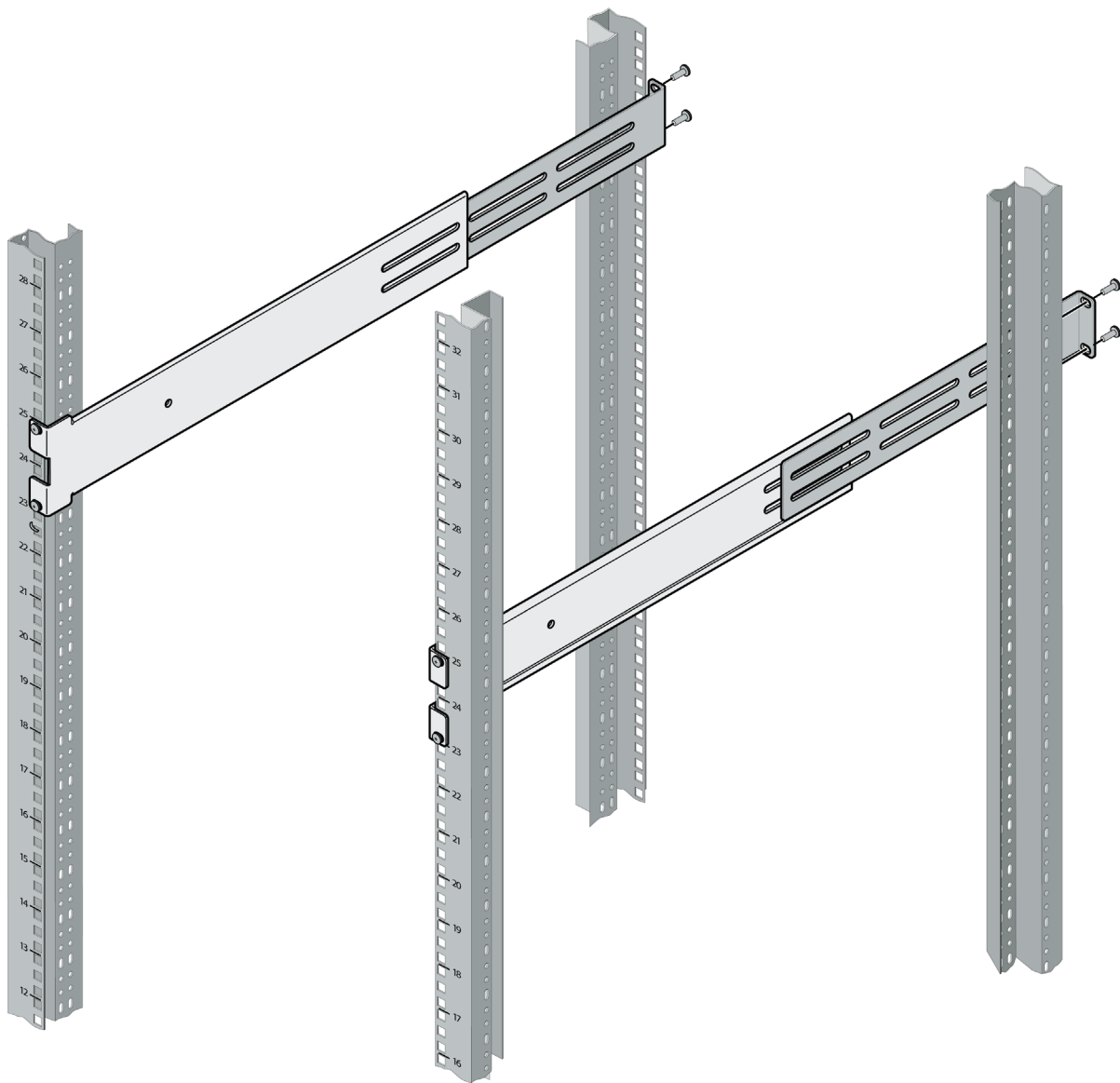
- 4. Install the two front support brackets onto the front rails using four 10-32 x 5/8-inch truss head screws as shown in the following figure.

Figure 5: Install the front support brackets



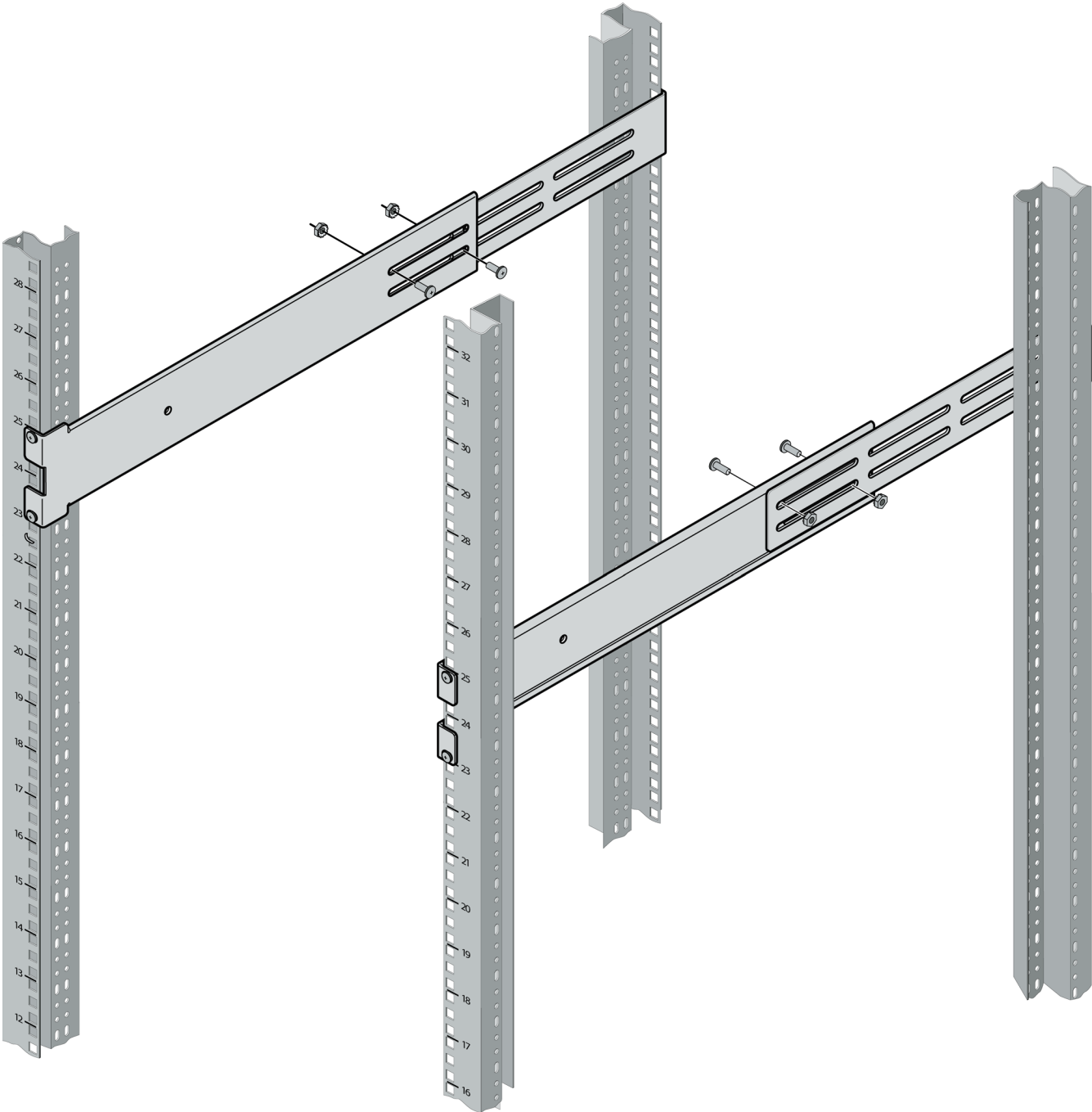
5. Install the two rear support brackets using four 10-32 x 5/8-inch truss head screws as shown in the following figure.

Figure 6: Install the rear support brackets



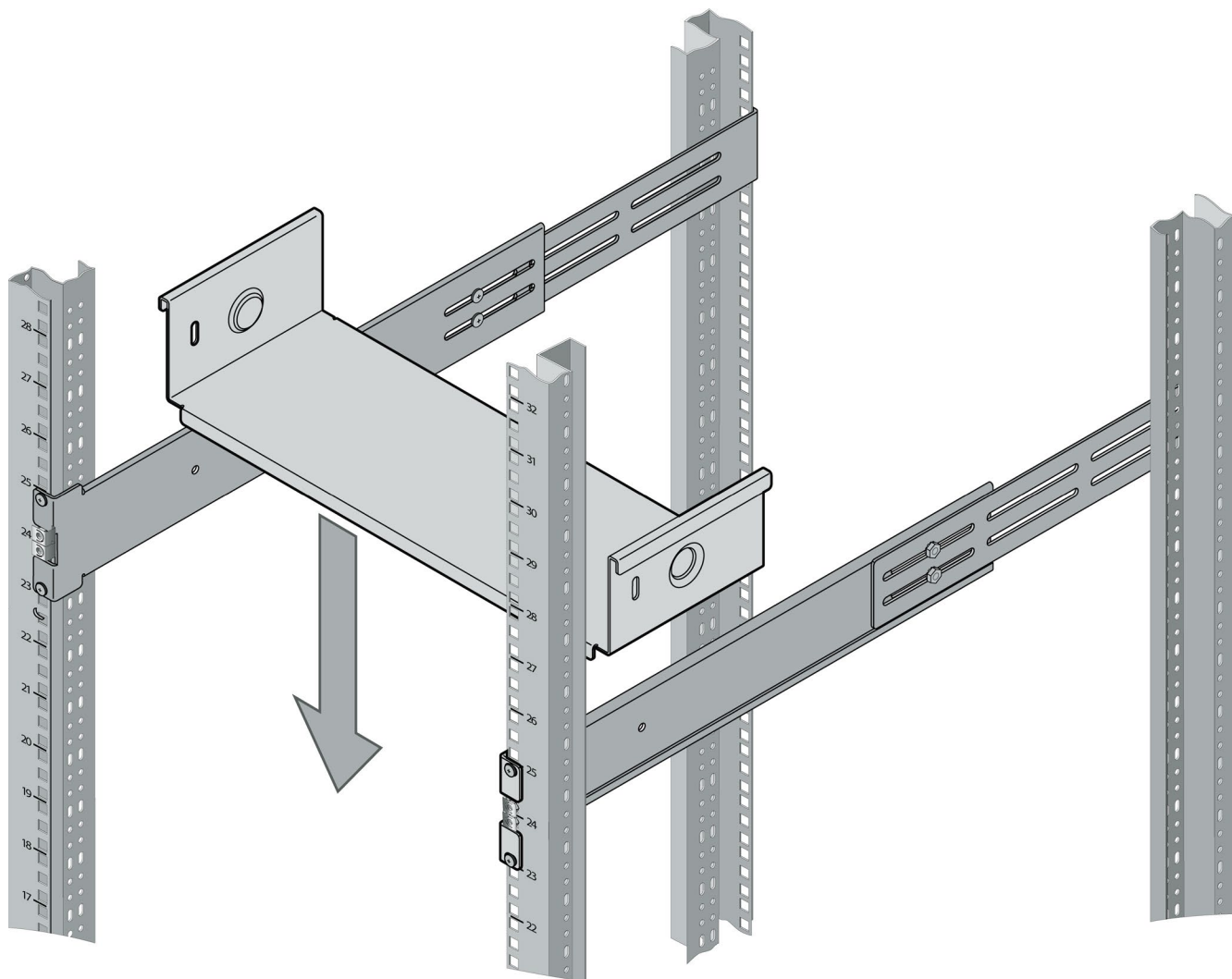
- 6. Secure the front and rear support brackets using four 10-32 x 1/2-inch pan head screws and four 10-32 washer nuts as shown in the following figure.

Figure 7: Secure the front and rear support brackets



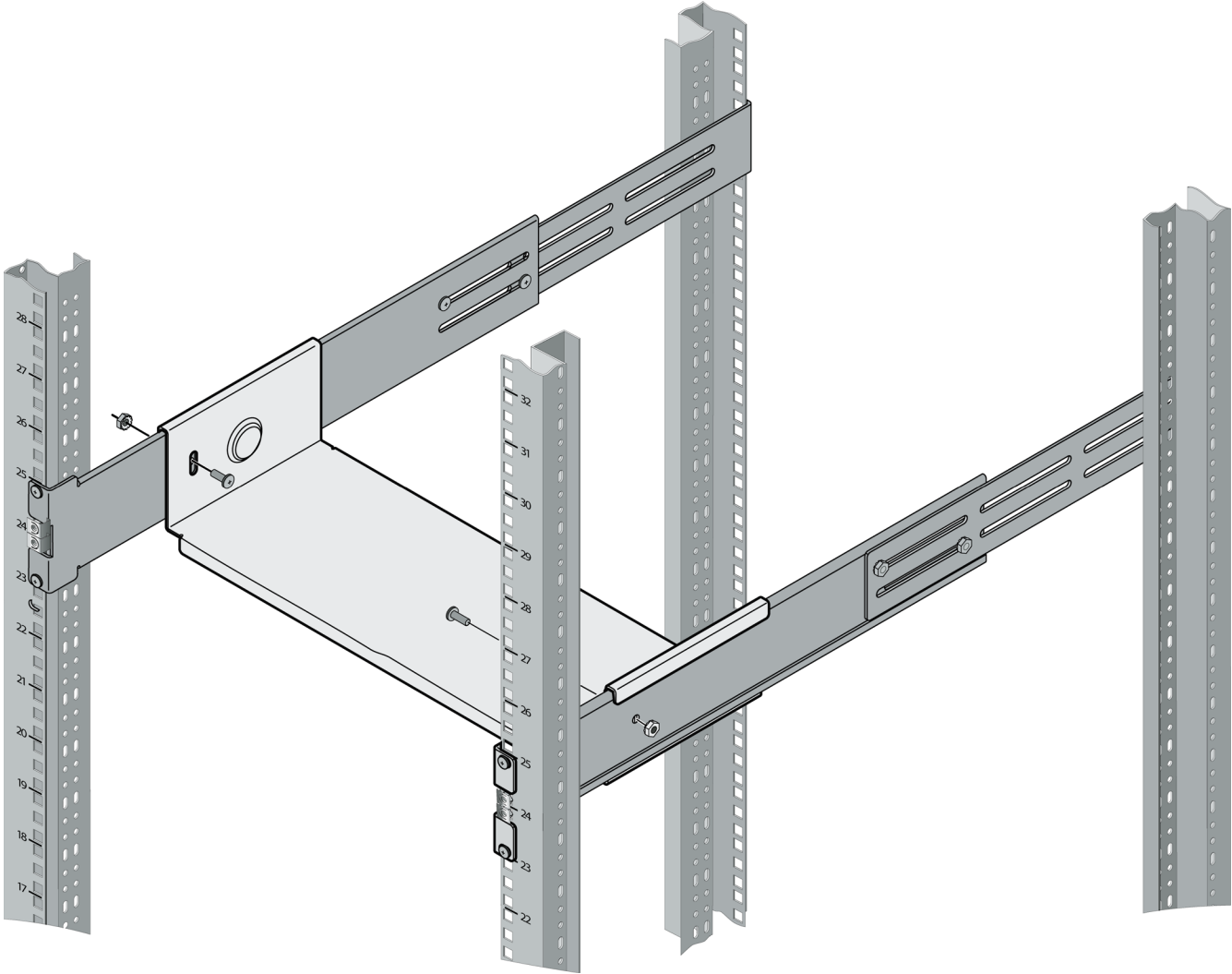
7. Install the U-bracket as shown in the following figure.

Figure 8: Install the U-bracket



- 8. Secure the U-bracket to the front support brackets using two 10-32 x 1/2-inch pan head screws and two 10-32 washer nuts as shown in the following figure.

Figure 9: Secure the U-bracket to the front support bracket



Prepare the instrument

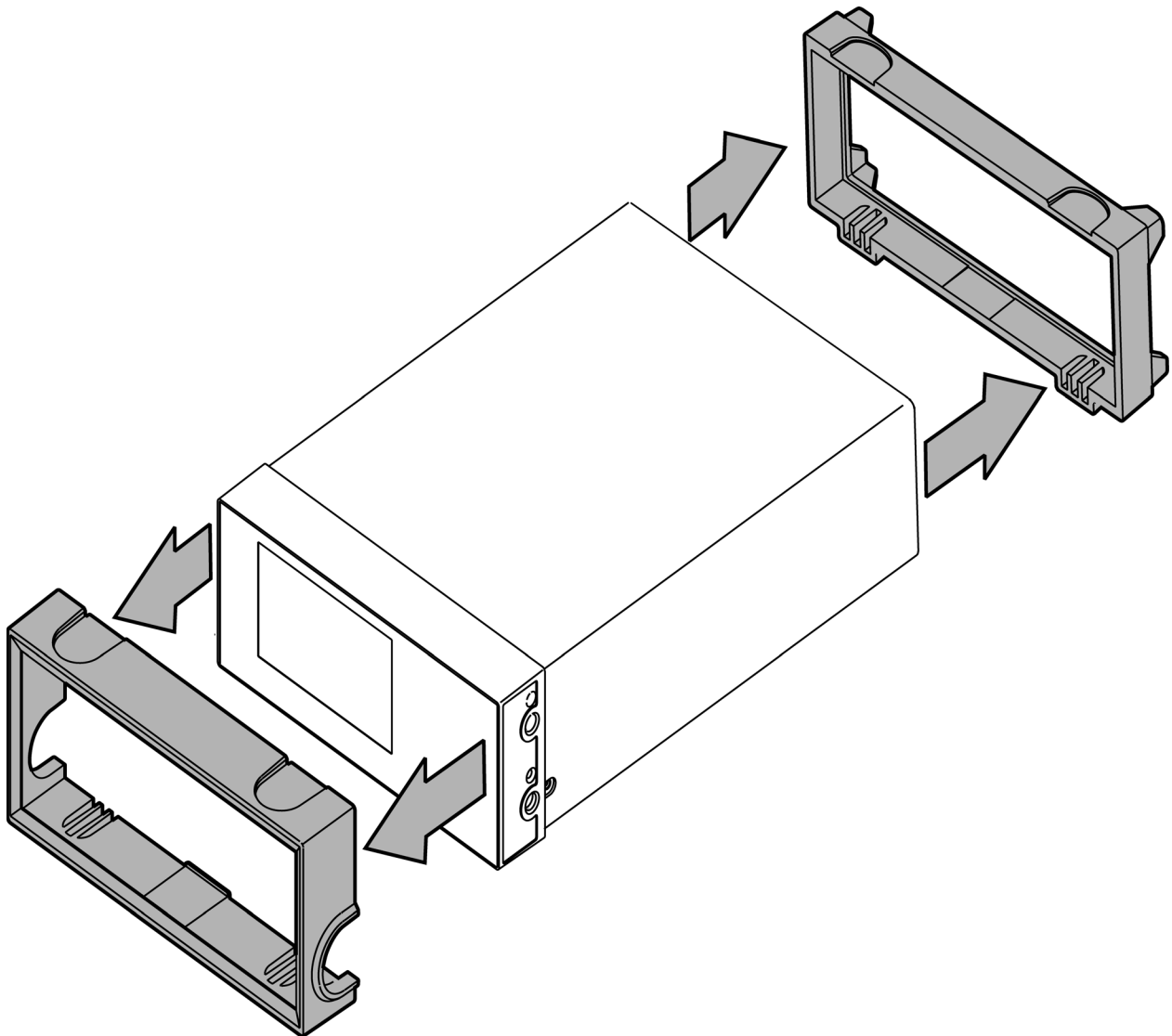
The following instructions explain the preparation and installation of instruments on the 4299-14 Rack Mount Kit.

Remove the bumpers

To remove the front and rear bumpers (if installed):

1. Pull on one of the bumper corners and remove the bumper from the instrument as shown in the following figure.

Figure 10: Remove the bumpers

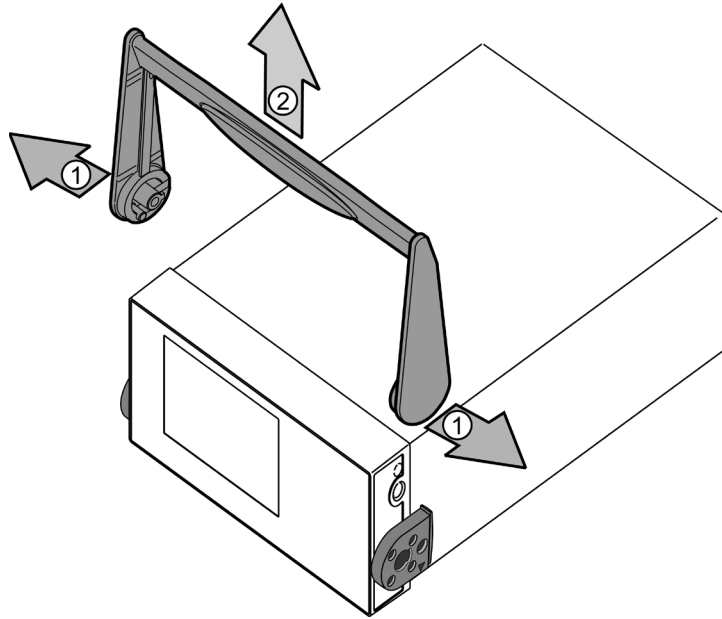


Remove the handle

To remove the handle (if installed):

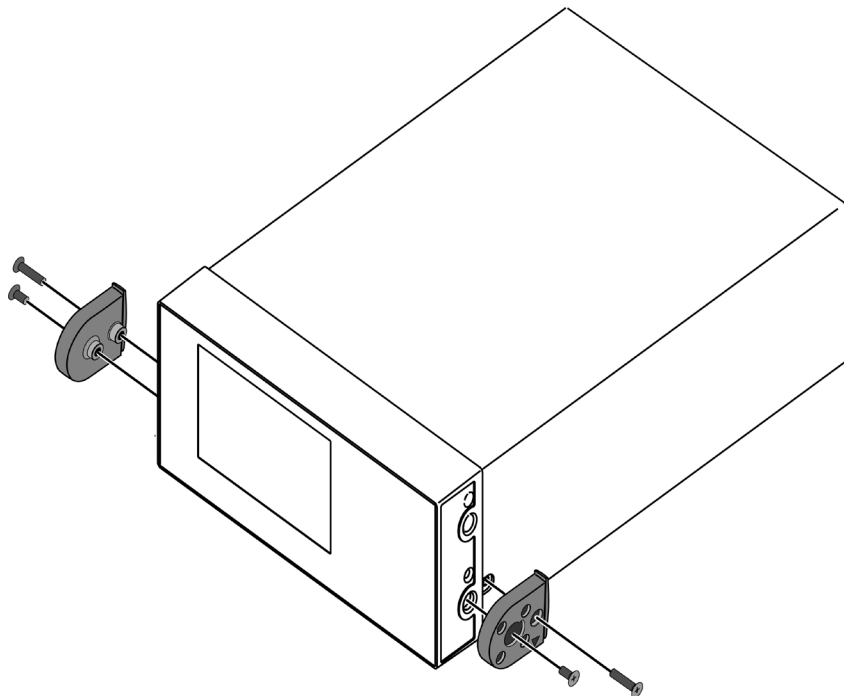
1. Swing the handle to the upright position as shown in the following figure.
2. Pull the ends of the handle away from the instrument (1) and remove (2).

Figure 11: Remove the handle



3. Remove the screws and the handle mounts from the instrument as shown in the following figure.

Figure 12: Remove the handle mounts

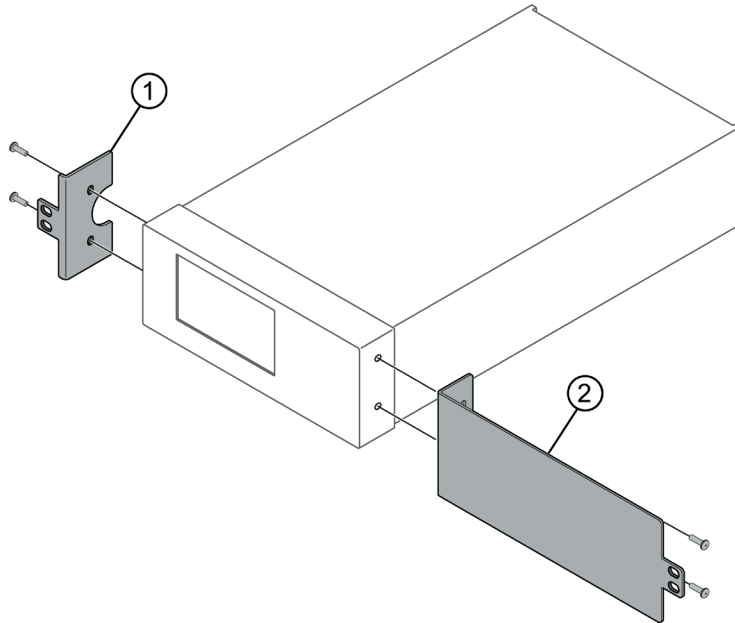


Install the mounting hardware

To install the mounting hardware on a single 2280 or 2281 instrument:

1. Secure the front rack ear (1) to the instrument using two 6-32 x 1/2-inch pan head screws as shown in the following figure.
2. Secure the filler plate (2) to the instrument using two 6-32 x 1/2-inch pan head screws as shown in the following figure.

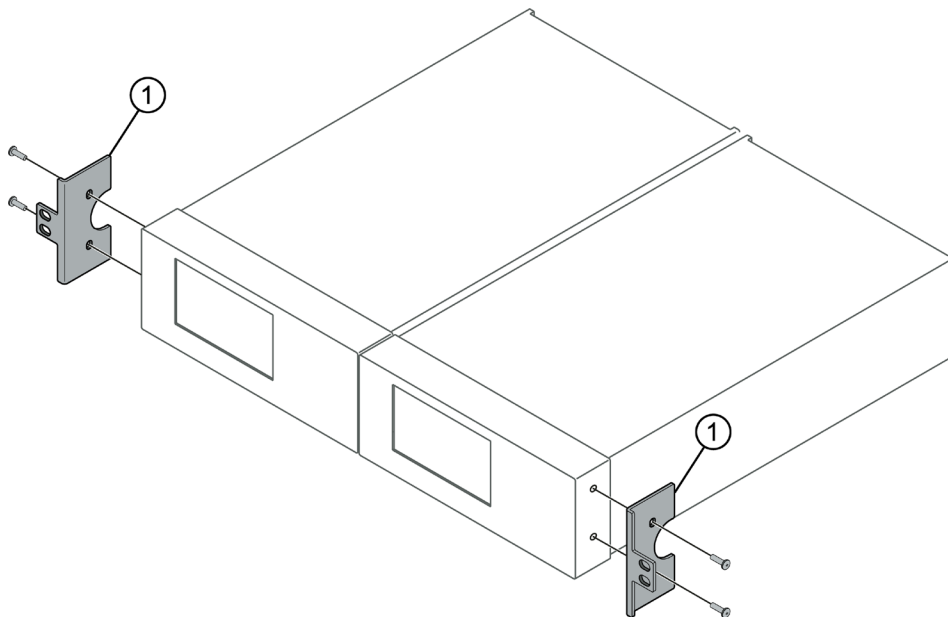
Figure 13: Mount the brackets on the instrument



To install the mounting hardware on two 2280 or 2281 instruments:

1. Secure a front rack ear (1) to each instrument using two 6-32 x 1/2-inch pan head screws as shown in the following figure.

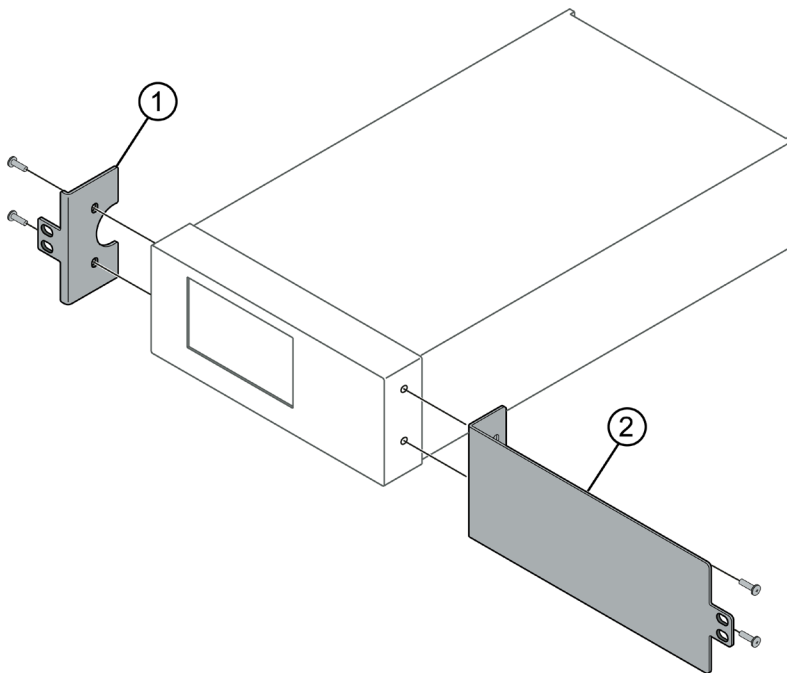
Figure 14: Install the mounting hardware on the two units



To install the mounting hardware on a single 2220 or 2230 instrument:

1. Secure the front rack ear (1) to the instrument using two M4 x 10 pan head screws.
2. Secure the filler plate (2) to the instrument using two M4 x 10 pan head screws.

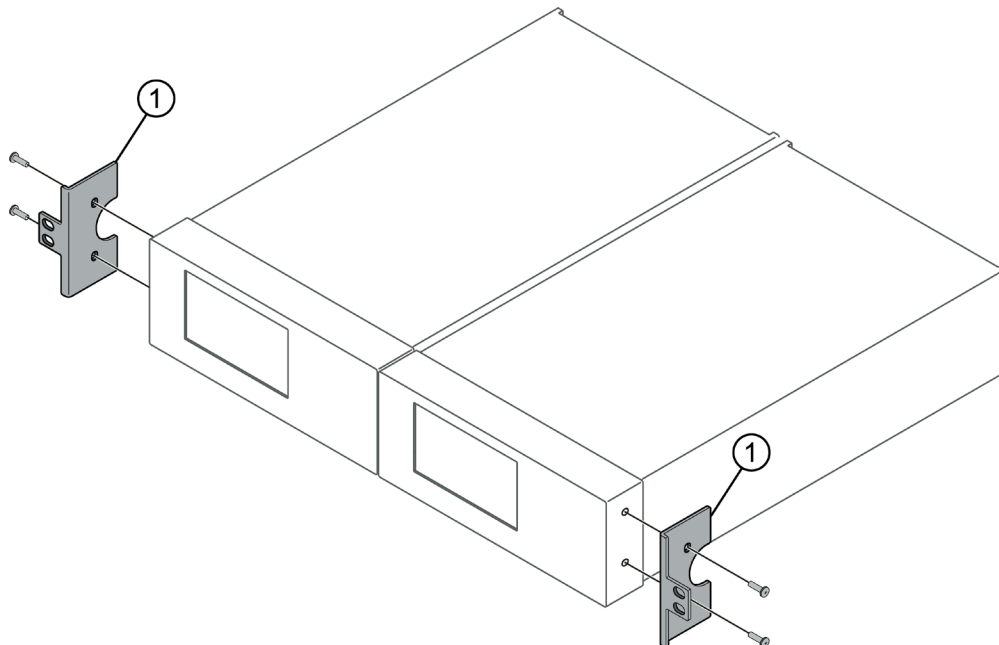
Figure 15: Mount the brackets on the instrument



To install the mounting hardware on two 2220 or 2230 instruments:

1. Secure a front rack ear (1) to each instrument using two M4 x 10 pan head screws as shown in the following figure.

Figure 16: Install the mounting hardware on the two units

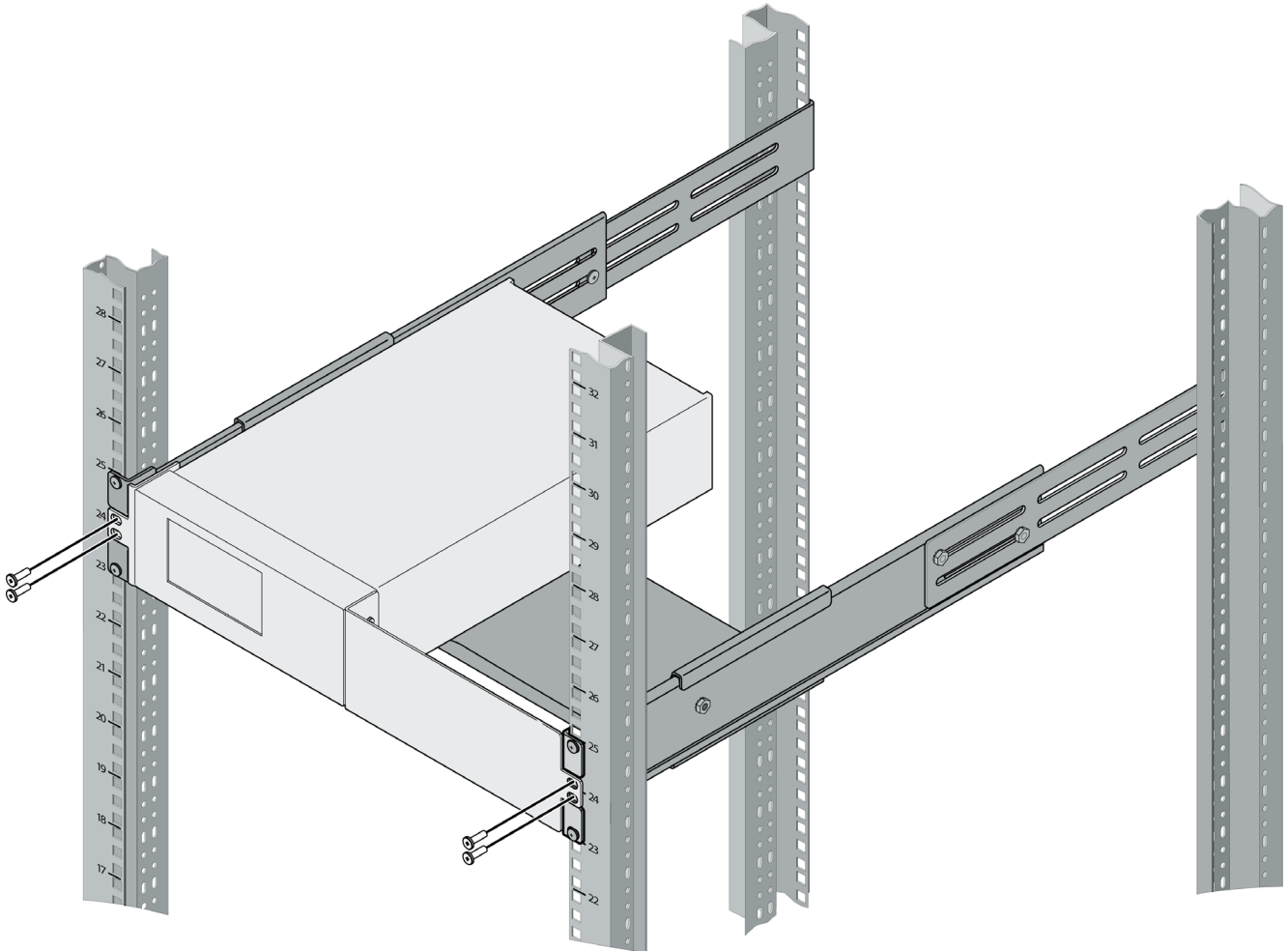


Install instrument assembly

To install a single instrument assembly in the rack:

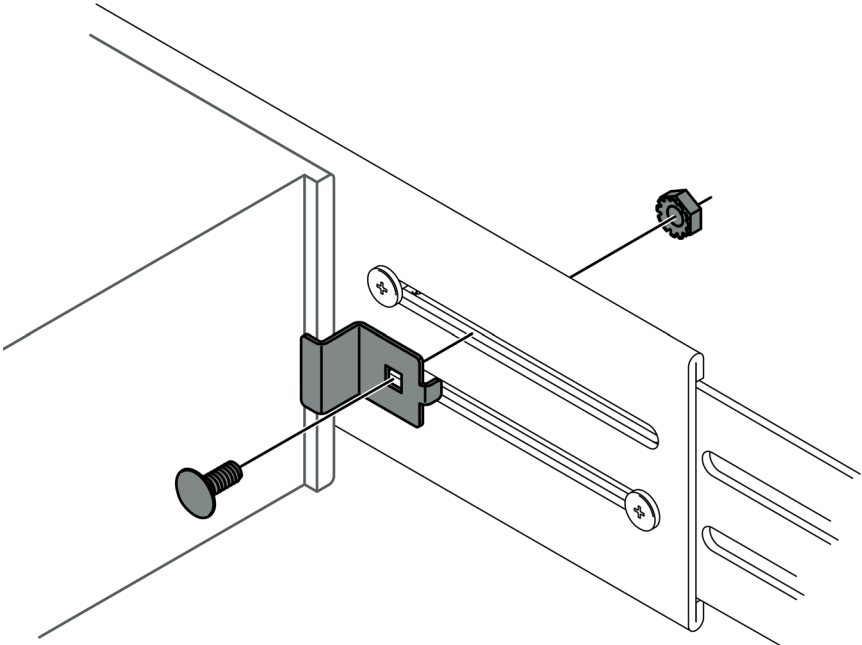
1. Place the instrument assembly on the support shelf. Continue supporting the instrument assembly until it is secured
2. Make sure that the instrument assembly is fully seated.
3. Secure the instrument assembly using four 10-32 x 5/8-inch truss head screws as shown in the following figure.

Figure 17: Install the instrument on the shelf



- 4. Secure the rear of the instrument to the support shelf with the unit clip, carriage bolt, and nut as shown in the following figure.

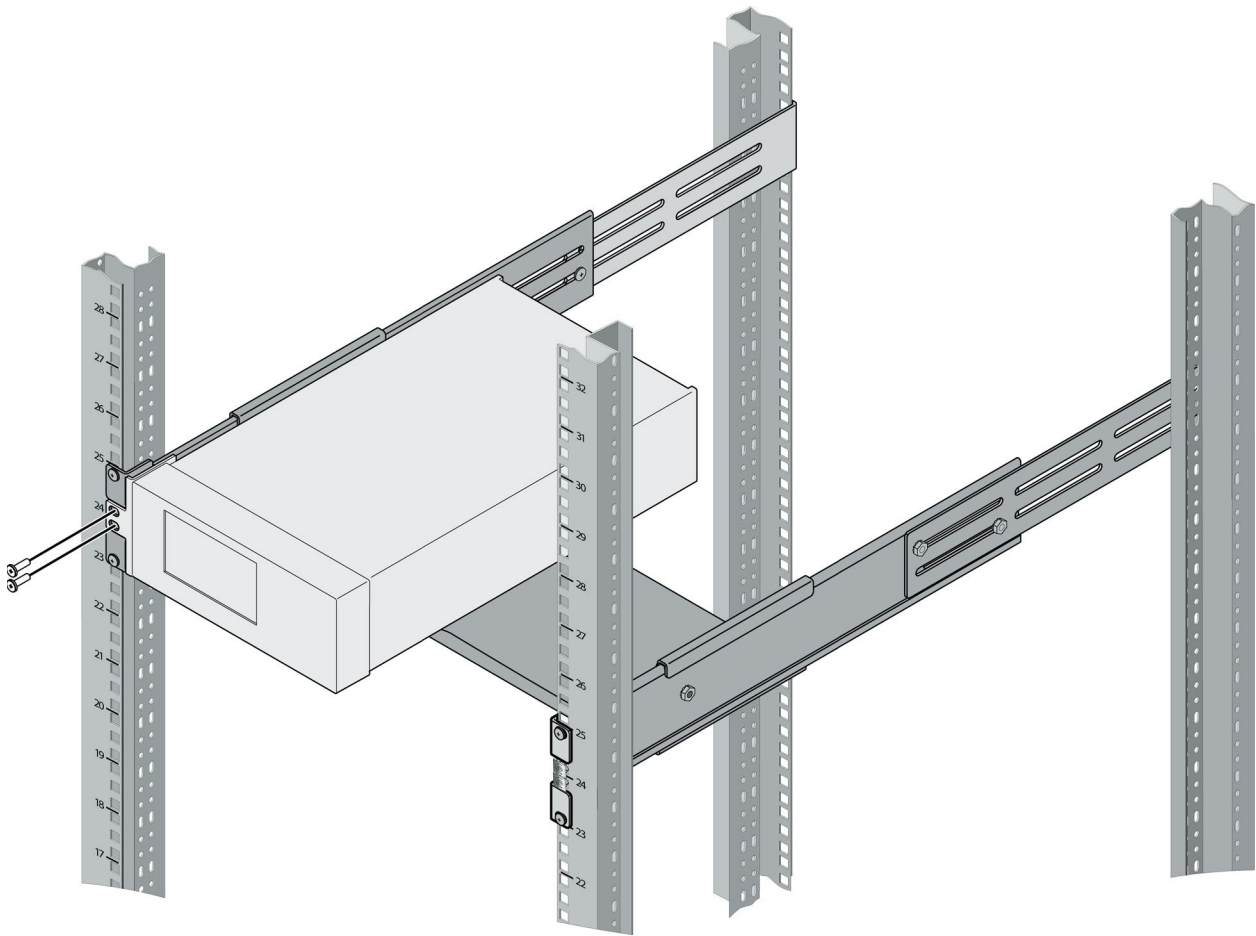
Figure 18: Install the unit clip



To install multiple instrument assemblies in the rack:

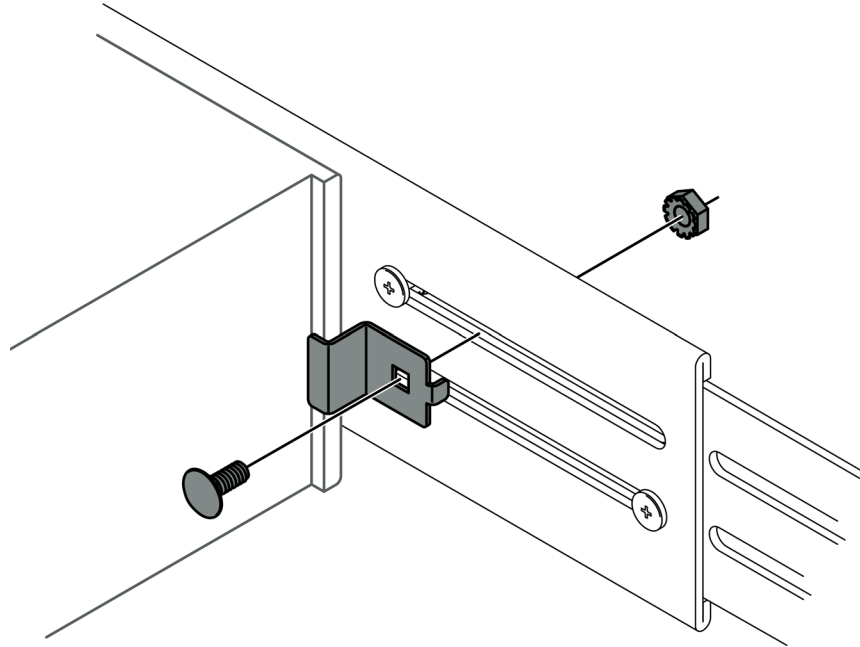
1. Place one instrument assembly on the support shelf. Continue supporting the instrument assembly until it is secured
2. Make sure that the instrument assembly is fully seated.
3. Secure the instrument assembly using two 10-32 x 5/8-inch truss head screws as shown in the following figure.

Figure 19: Install a single instrument



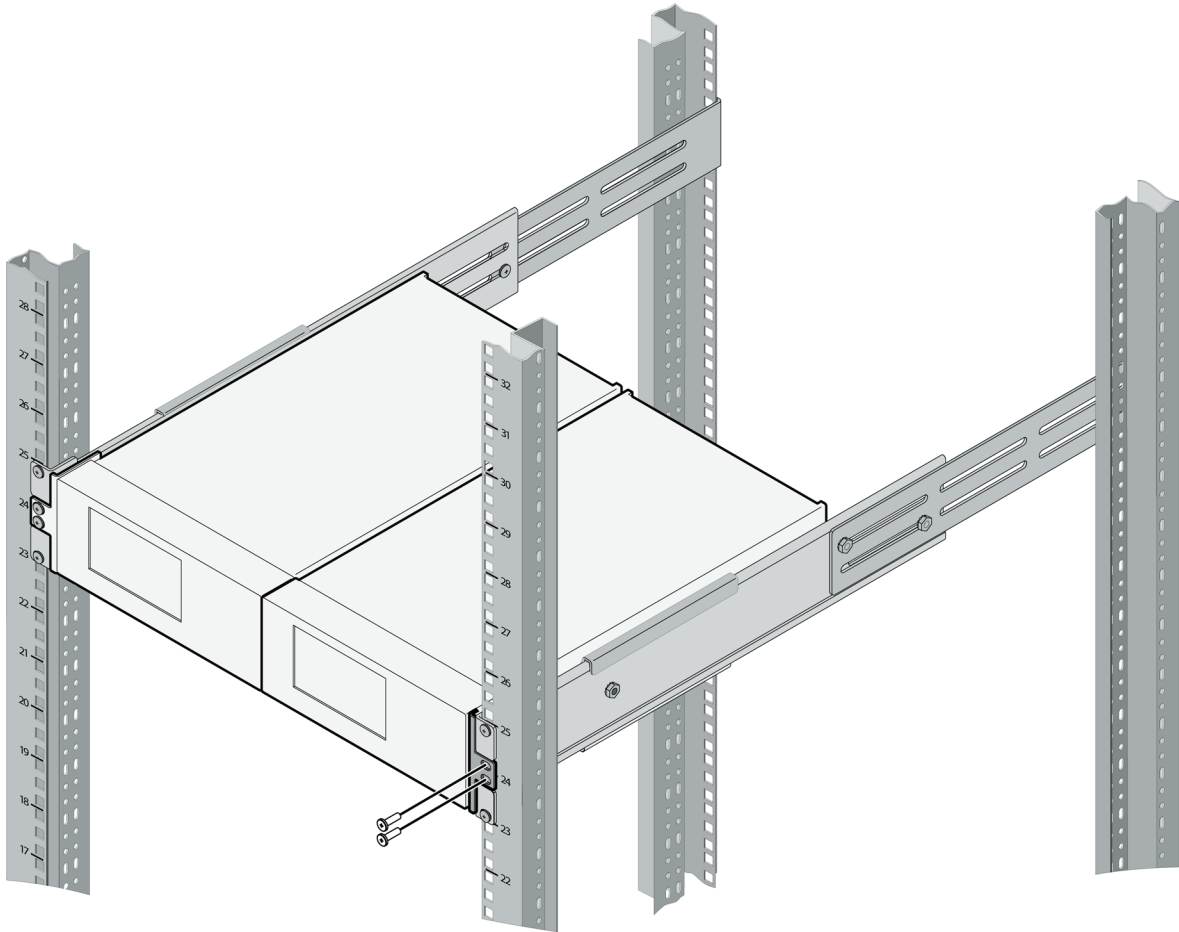
4. Secure the rear of the instrument to the support shelf with the unit clip, carriage bolt, and nut as shown in the following figure.

Figure 20: Install the unit clip



- Repeat steps the previous steps for the second unit.

Figure 21: Install the second instrument



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.

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.

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

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.