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## Installation Instructions

## Introduction

The Model 4299-11 Universal Fixed Rack-Mount Kit contains all the hardware you need to install two 2U instruments, such as a Series 24XX, Series 2000, or 2U Keysight instruments, side-by-side in a standard 19-inch equipment rack.

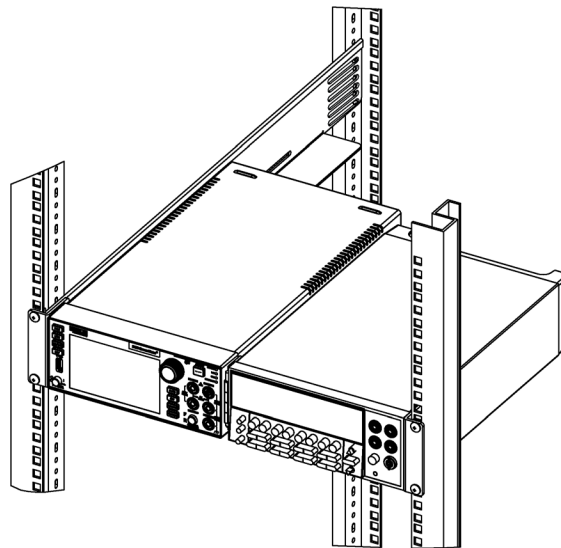
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### NOTE

1U is a standard vertical spacing that is equal to 4.45 cm (1.75 in.).

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Figure 1: Typical installation (instruments and rack are not included)



## Tools required

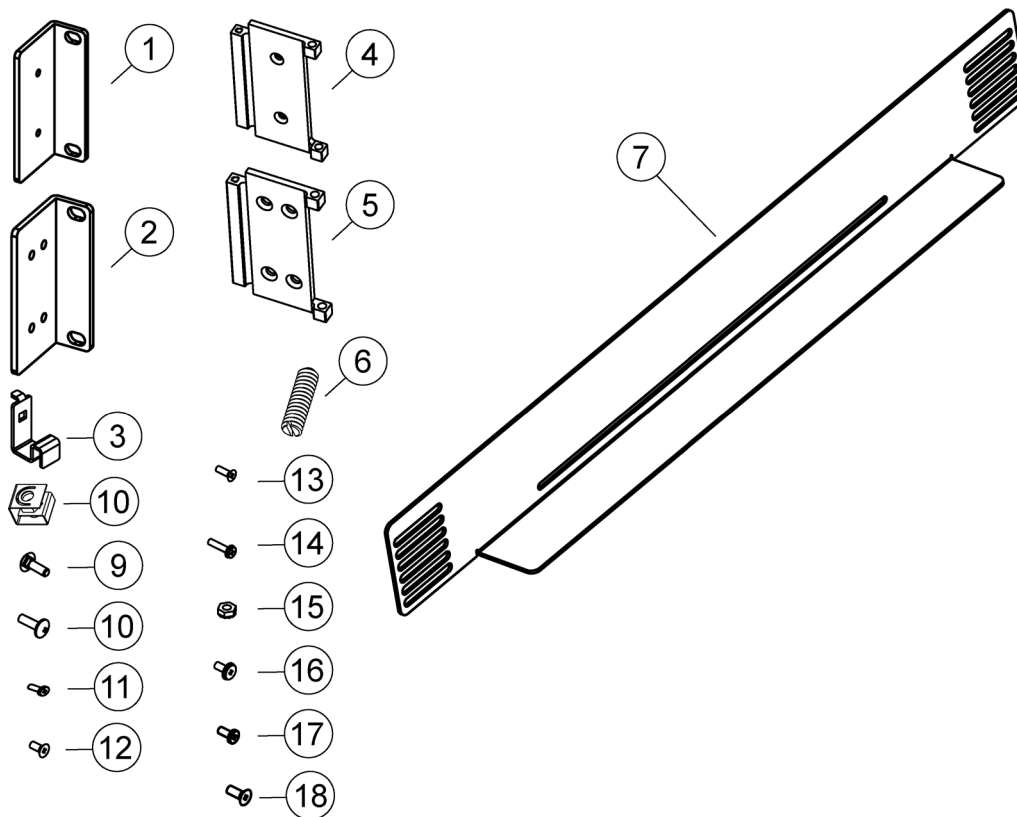
- Medium (#2) Phillips-head screwdriver
- 3/8-inch wrench
- Flat-bladed screwdriver or cage-nut installation tool



## 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 4299-11 Rack Mount Kit parts**



#	Description	Part number	Quantity
1	Front-rack ear	2450-360	1
2	Front-rack ear	2602-355	1
3	Shelf clip	407607800	1
4	Hinge	214548700	1
5	Hinge	214548800	1
6	6-32x5/8 set screw	6-32x5/8SLHLSET	4
7	Support shelf	2450-363	1
8	Cage nut	FA-148	4
9	Carriage bolt	212026400	1

#	Description	Part number	Quantity
10	10-32 x 5/8" Phillips truss head screw	10-32X5/8PHTRSH	
11	10-32 x 1/2" Phillips pan head screw	10-32X1/2PPHSEM	4
12	8-32 x 3/8" Phillips flat head screw	8-32X3/8PFH	2
13	6-32 x 7/16" Phillips flat head screw	6-32X7/16PFH	2
14	6-32 x 1/2" Phillips pan head screw	6-32x1/2PPHSEM	2
15	10-32 Keps® washer nut	10-32KEPNUT	5
16	8-32 x 3/8" Phillips pan head screw	8-32X3/8PPH	2
17	M4 x 12 mm Phillips pan head screw	M4X12PPH	2
18	M4 x 12 mm Phillips flat head screw	M4X12MMPFH	2

## Installation

### *To install a single 2U instrument and an adjacent instrument:*

1. Review the [installation precautions](#) (on page 3).
2. Select a location in the rack.
3. Take steps to make it easier to manipulate and install the instrument:
  - Clear as much space as possible around the selected rack location
  - If practical, remove the cabinet sides from the rack
4. Perform the installation procedure beginning with [Step 1: Prepare the rack](#) (on page 4).

## Installation precautions

Observe the following safety precautions while installing instruments.

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### **⚠ WARNING**

**Turn off instrument power and unplug all cables before installing an instrument in a rack. Failure to remove power before installation may cause personal injury or death from electrical shock.**

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### **CAUTION**

**Heat sources should be mounted away from the instrument, cabling, and accessories, with sufficient space provided between the instrument and heat source for airflow and cooling.**

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## NOTE

To prevent damaging heat build-up and ensure specified performance, make sure there is adequate ventilation and air flow around the instrument to ensure proper cooling. Do not cover the ventilation holes on the sides or back of the instrument. The rear vents and both side vents must be unobstructed to properly dissipate heat.

Mount precision equipment as low as possible in the rack. Operating temperatures are cooler lower in the rack.

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## Step 1: Prepare the rack

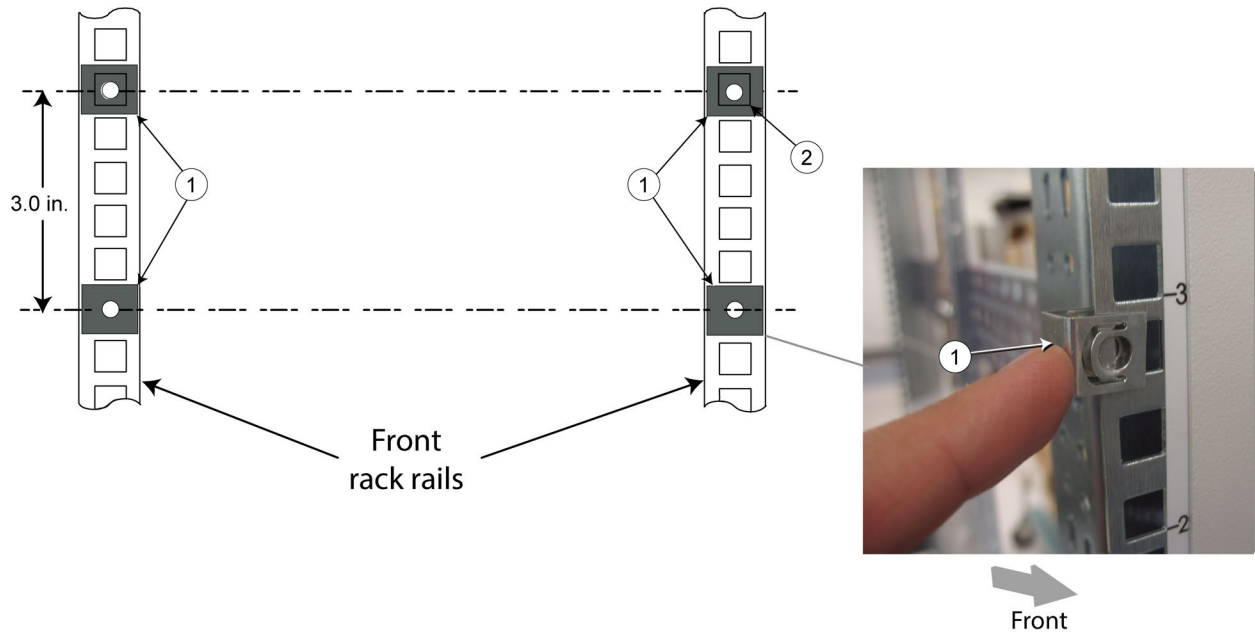
### *To prepare the rack for installation:*

1. Install the cage nuts on the rack rails.
2. Install the support shelf for the instrument in the rack.

### *To install the cage nuts on the rack rails:*

1. Using the front-rack ear (2450-360) as a guide, mark holes for the selected installation location (four places total, two for each rail).
2. Install the cage nuts (1) by sliding the cage nut onto the frame from the side of the rail at the hole (2) you marked in step 1. To install a cage nut, slide the nut into the frame with the nut attached to the clip on the inside of the frame. While sliding into the frame, pry the clip open so that the nut clears the frame and aligns in the hole on the frame. The cage nut is secured by the screw used to install the instrument.
3. Repeat for each cage nut.

**Figure 3: Install the cage nuts**



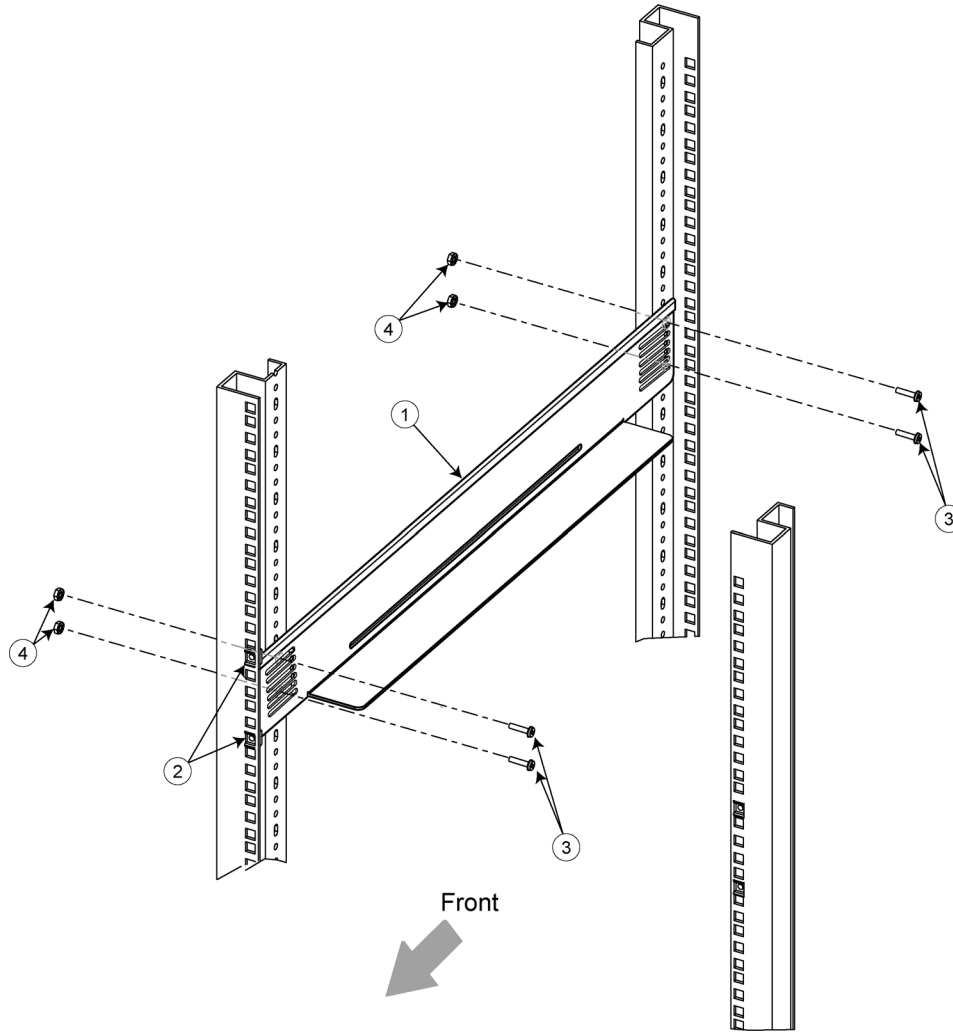
## NOTE

You can install the instrument on either side of the rack. The following steps describe installation of the instrument on the left side of the rack. To install the instrument on the other side, install the support shelf (2450-363) on the right side of the rack (not shown).

**To install the support shelf in the rack:**

1. Align the support shelf (1) with the installed cage nuts (2).
2. Secure the support shelf (1) with 10-32 x 1/2" screws (3) and nuts (4) as shown (four places).

**Figure 4: Install the support shelf**



## Step 2: Prepare the instrument

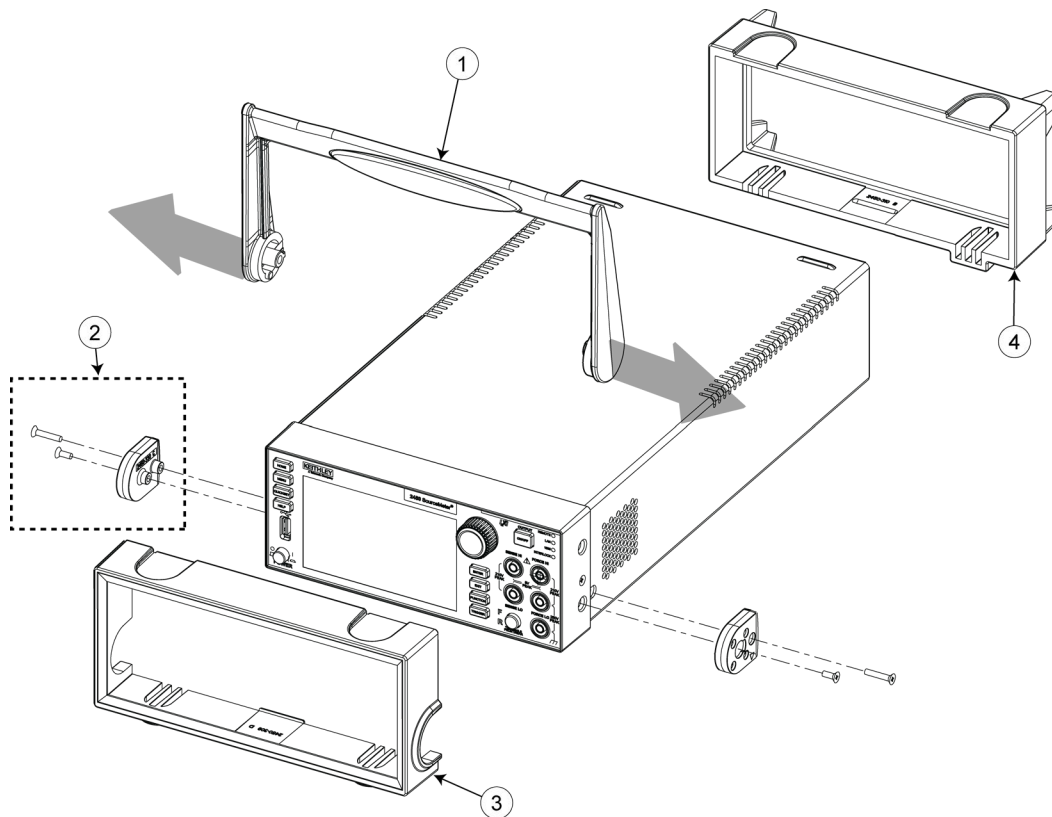
To prepare an instrument for rack mounting, remove the handle and bumpers (if installed), and then install the mounting hardware.

## Remove handle and bumpers from a 2450, 2460, 2461, 2470 or DMM7510 instrument

### *To remove the handle and bumpers (if installed):*

1. While pulling the ends of the handle (1) away from the sides of the instrument, swing the handle to the upright position (the upright position is illustrated in the figure).
2. With the handle aligned in the upright position, pull the ends of the handle away from the case and remove.
3. Remove the screws and the handle mounts (2) from both sides of the instrument.
4. Pull on one of the front bumper corners (3) and remove the front bumper from the instrument.
5. Remove the rear bumper (4) the same way as you removed the front bumper.
6. Store the handle, bumpers, and hardware for future benchtop use.

**Figure 5: Remove handle and bumpers**

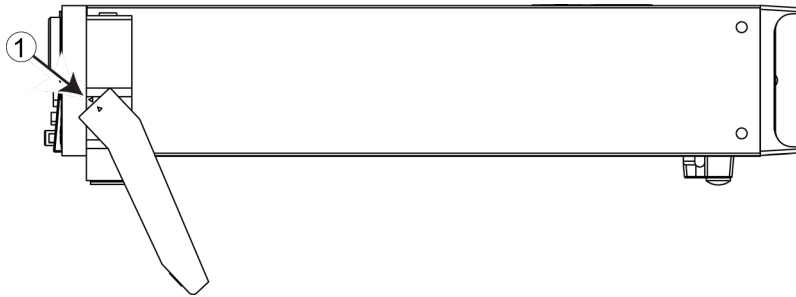


## Remove the handle, bumpers, and feet from Series 24xx or Series 2000

### *To remove the handle, mounting ears, and rear feet:*

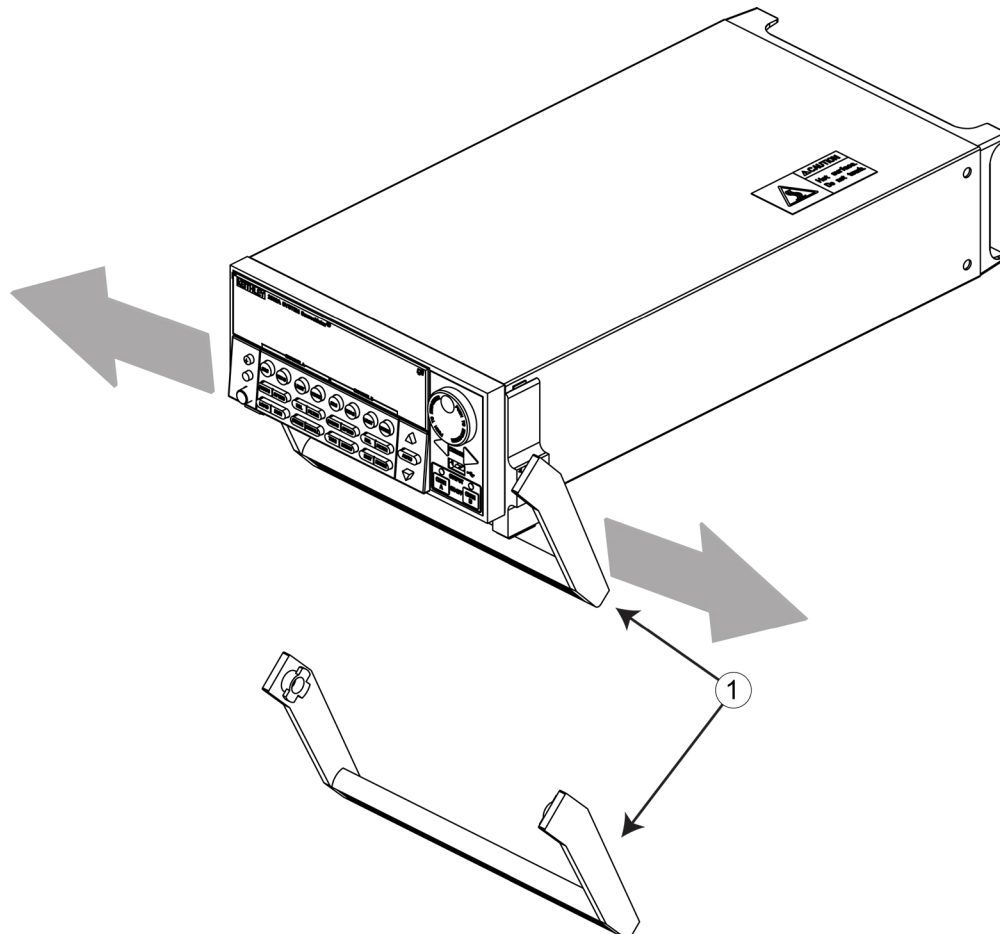
1. Gently pull the handle away from the sides of the instrument case and swing it below the bottom of the case and back until the arrows on the handles line up with the arrows on the mounting ears (1); see the figure below.

**Figure 6: Line up arrows on handle**



2. After you align the arrows, pull the ends of the handle (1) away from the case.

**Figure 7: Removing the handle**





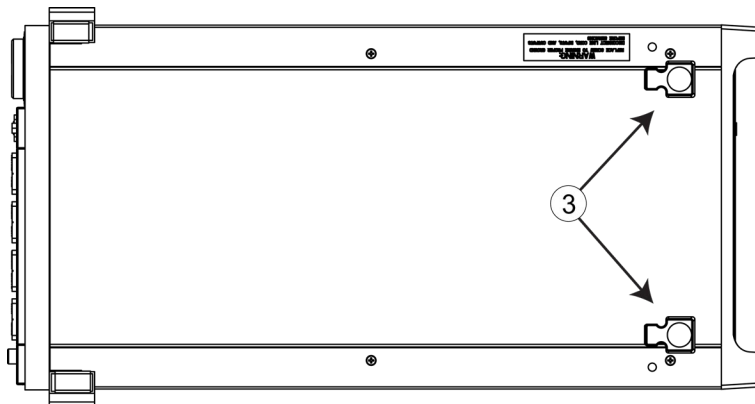
3. Remove the screw that secures each mounting ear (2).

**Figure 8: Remove mounting ears**



4. Pull down and out to remove each ear.
5. From the bottom of the instrument, pull out the rubber feet (3) and remove the screws.

**Figure 9: Remove rubber feet**



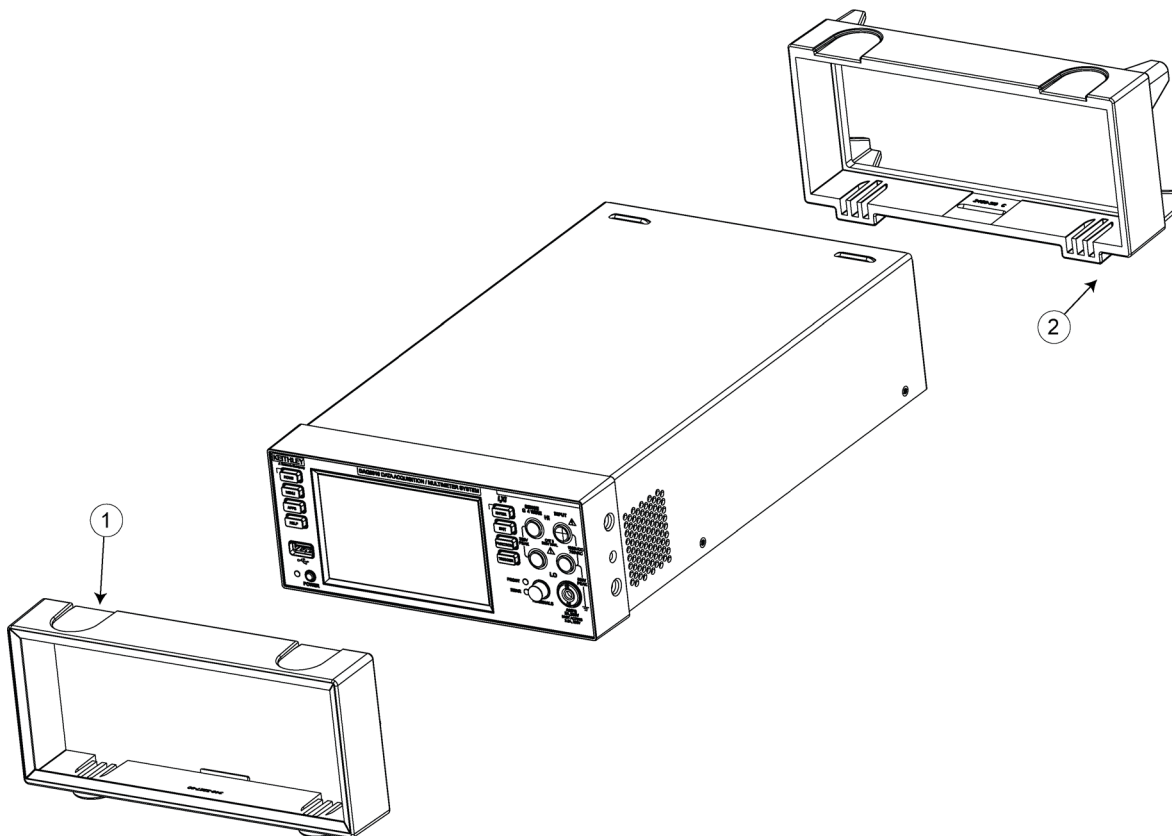
6. Store the handle, bumpers, rubber feet, and hardware for future use.

## Remove bumpers from the DMM6500 or DAQ6510 instrument

*To remove the handle and bumpers (if installed) from the DMM6500 or DAQ6510 instrument:*

1. Pull on one of the front bumper corners (1) and remove the front bumper from the instrument.
2. Remove the rear bumper (2) the same way you removed the front bumper.

**Figure 10: Remove bumpers**

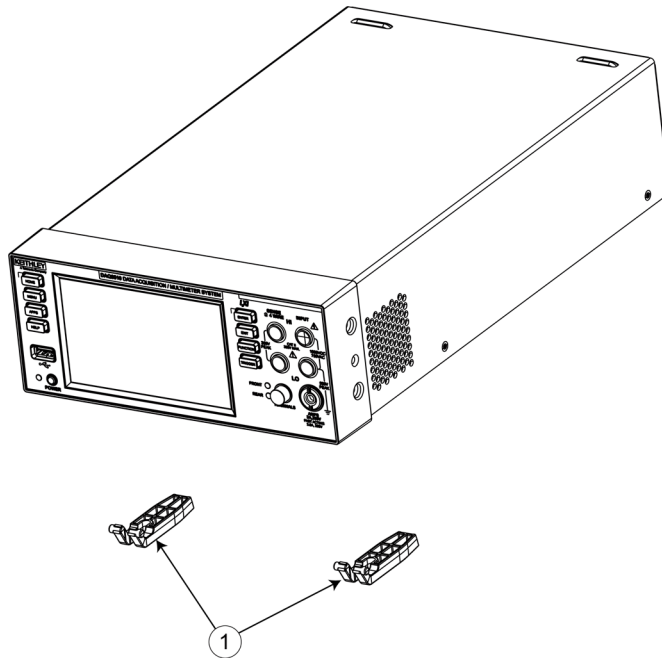


## Remove the tilt feet

*To remove the tilt feet (if installed) from the DMM6500 or DAQ6510 instrument:*

1. Squeeze the sides of one tilt foot (1) near where it attaches to the instrument and twist the foot until it detaches.
2. Repeat for other foot.
3. Store the feet for future use.

**Figure 11: Remove feet**



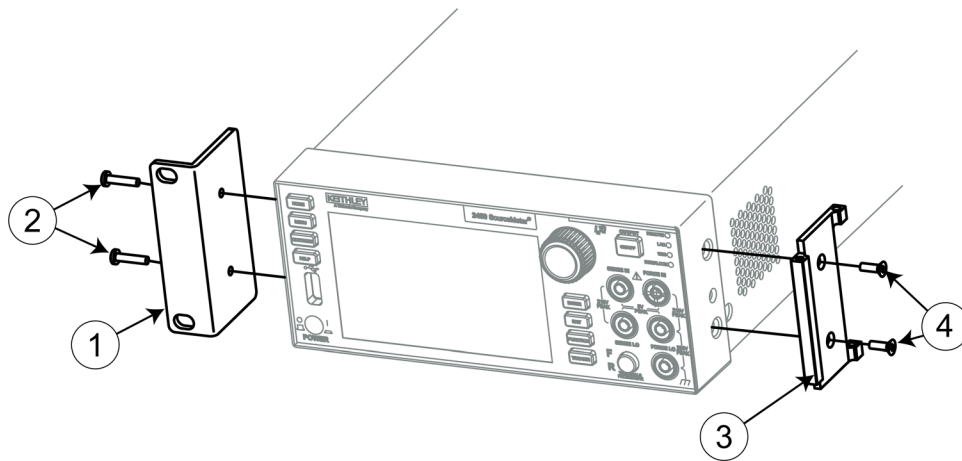
## NOTE

You can install the instrument on either side of the rack. The following steps outline installation of the instrument on the left side of the rack. To locate the instrument on the right side, switch the location of the front-rack ear (2450-360) with the other front-rack ear (2602-355), and switch the hinges (2450-361 with 2602-328).

### To install the Keithley instrument on the left side:

1. Secure the front-rack ear (1) (2450-360) to the instrument using two 6-32 x 1/2" pan head screws (2) as shown in the following figure.
2. Orient the hinge (3) so that the knuckles are toward the rear of the instrument.
3. Secure the hinge (3) to the instrument with two 6-32 x 7/16" flat head screws (4).

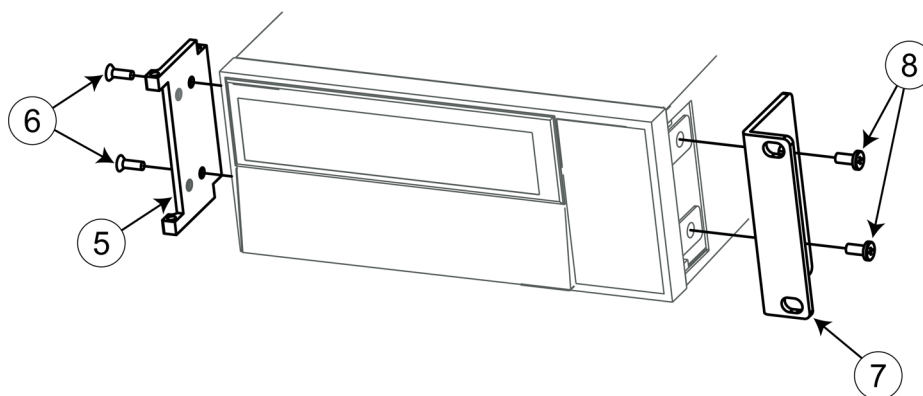
Figure 12: Install Keithley hardware



### To install the Keithley instrument on the right side:

1. Orient the hinge (5) so that the knuckles are toward the front of the instrument.
2. To secure the hinge (5) to the instrument, use the 8-32 x 3/8" flat head screws (6) through the holes toward the rear of the instrument.
3. To secure the front-rack ear (7) (2602-355) to the instrument, secure with two 8-32 x 3/8" pan head screws (8) through the holes toward the rear of the instrument.

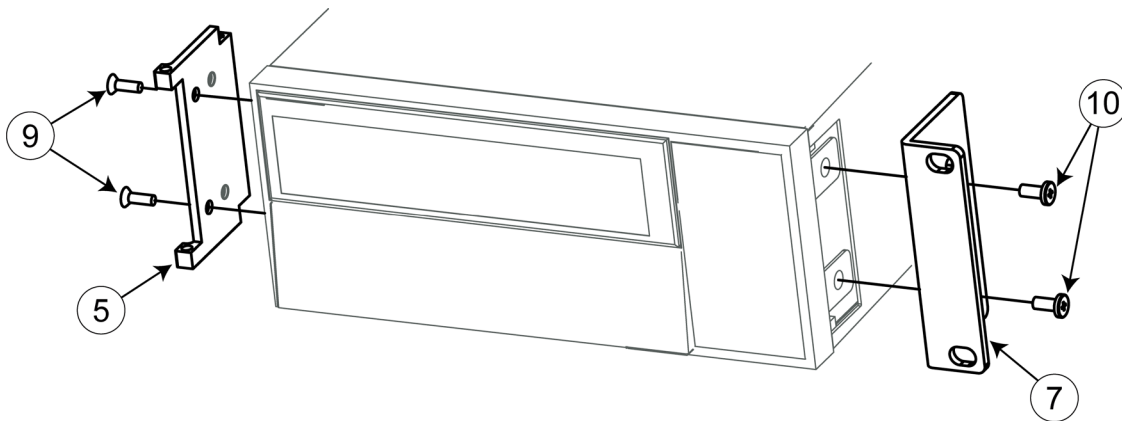
Figure 13: Install variable hardware



**To install the Keysight instrument on the right side:**

1. Orient the hinge (5) so that the knuckles are toward the front of the instrument.
2. To secure the hinge (5) to the instrument, use the M4 x 12 mm flat head screws (6) through the holes toward the front of the instrument.
3. To secure the front-rack ear (7) (2602-355) to the instrument, secure with two M4 x 12 mm pan head screws (10) through the holes toward the front of the instrument.

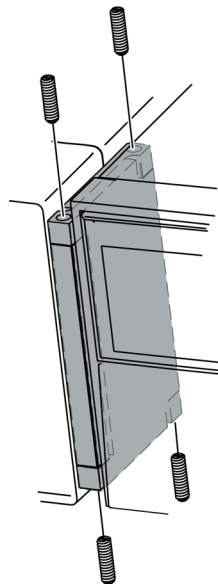
**Figure 14: Install variable hardware on Keysight instrument**



**To install the set screws:**

1. Set the instruments next to each other.
2. Secure using set screws as shown in the following figure.

**Figure 15: Insert set screws**

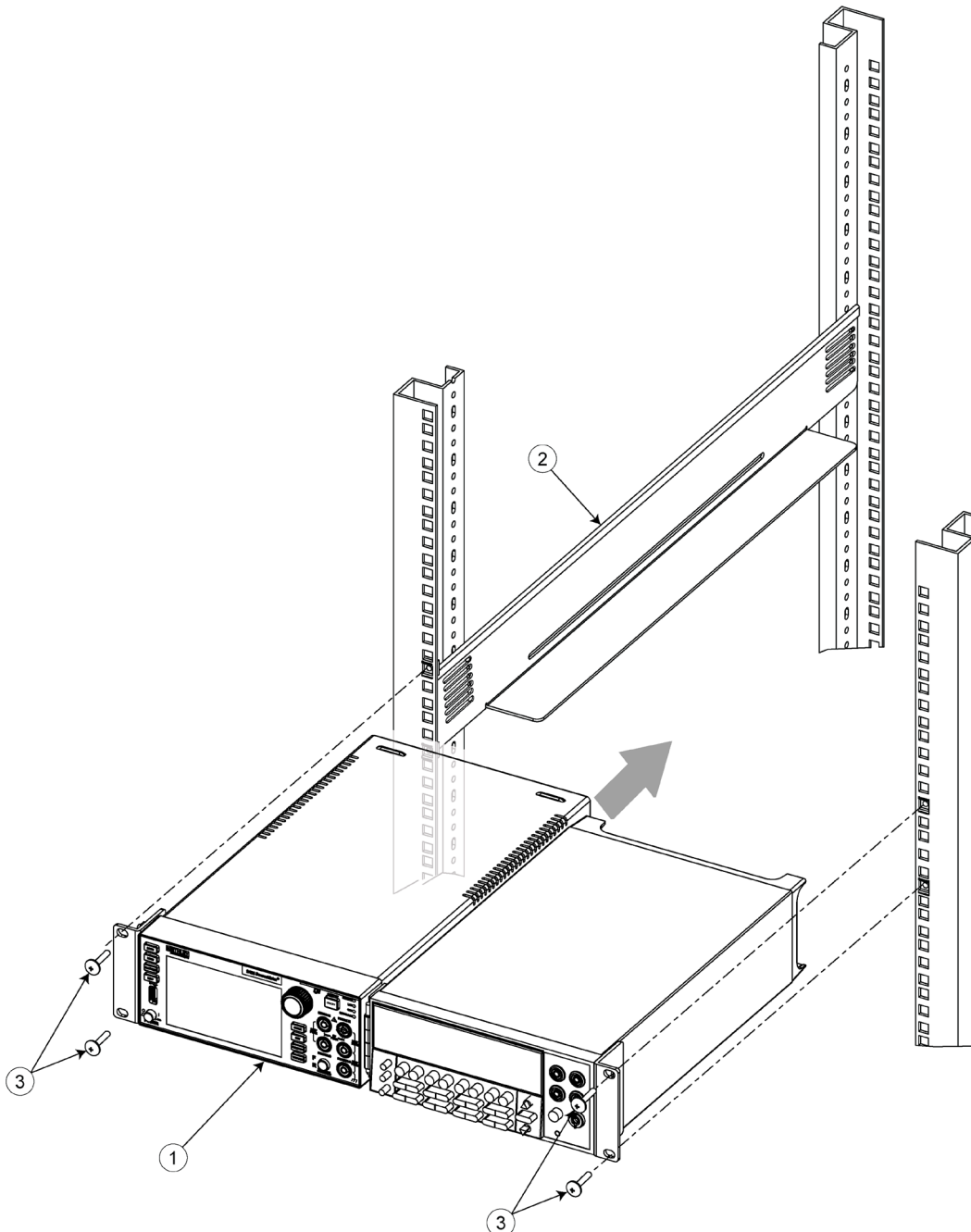


## Step 3. Install the instrument assembly

*To install the instrument assembly in the rack:*

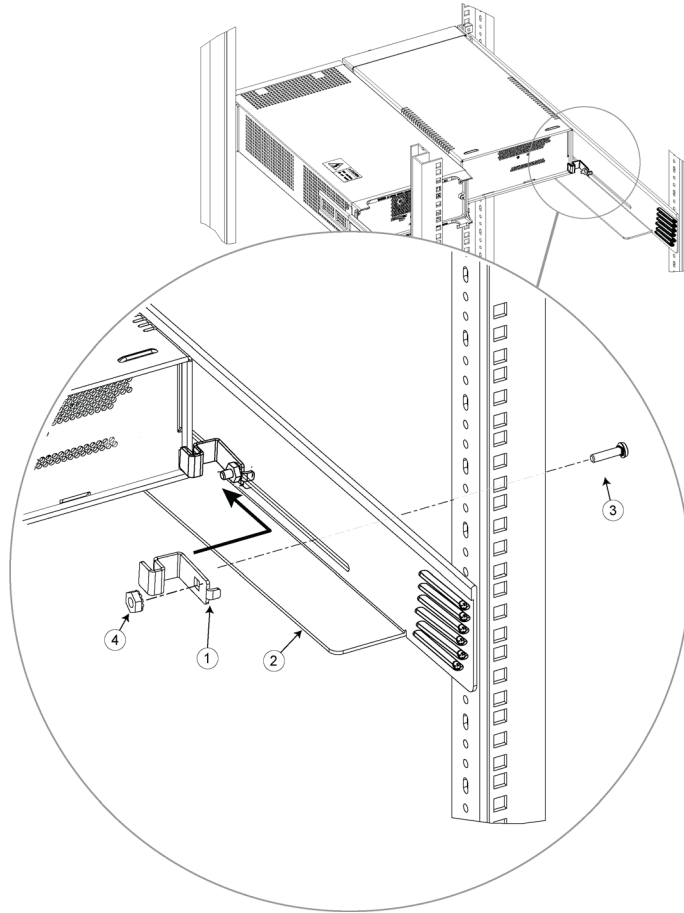
1. Place the instrument assembly (1) in the rack and on the support shelf (2). Support the instrument assembly until it is secured.
2. Check that the instrument assembly (1) is fully seated.
3. Secure the instrument assembly (1) using 10-32 x 5/8" screws (3) (four places).

**Figure 16: Install the instrument assembly in the rack**



4. Place the shelf clip (1) on the shelf (2) and lightly secure it with the carriage bolt (3) and nut (4).
5. Slide the shelf clip (1) toward the instrument and then fully tighten the nut (4).

**Figure 17: Install the shelf clip**



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.