## About this Manual

We've added this manual to the Agilent website in an effort to help you support your product. This manual is the best copy we could find; it may be incomplete or contain dated information. If we find a more recent copy in the future, we will add it to the Agilent website.

## Support for Your Product

Agilent no longer sells or supports this product. Our service centers may be able to perform calibration if no repair parts are needed, but no other support from Agilent is available. You will find any other available product information on the Agilent Test & Measurement website, www.tm.agilent.com.

## HP References in this Manual

This manual may contain references to HP or Hewlett-Packard. Please note that Hewlett-Packard's former test and measurement, semiconductor products and chemical analysis businesses are now part of Agilent Technologies. We have made no changes to this manual copy. In other documentation, to reduce potential confusion, the only change to product numbers and names has been in the company name prefix: where a product number/name was HP XXXX the current name/number is now Agilent XXXX. For example, model number HP8648A is now model number Agilent 8648A.

# Installation Guide

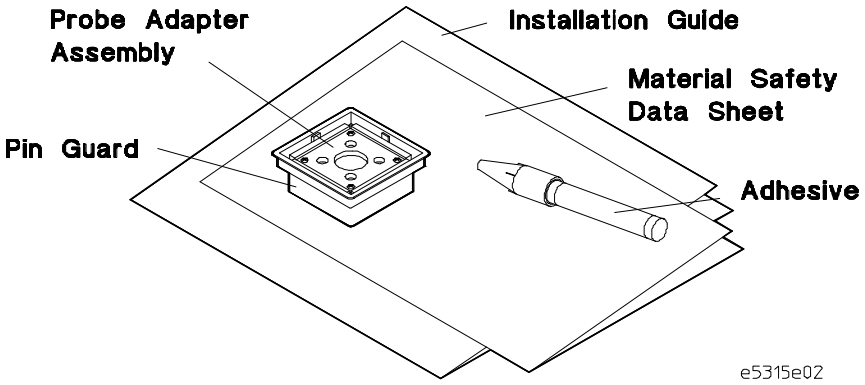
Publication number E5315-92006
March 1996

For Safety information, Warranties, and Regulatory information see the pages behind the index.



# PQFP Adapter

# Your PQFP Adapter — At a Glance




This Installation Guide provides instructions for using Hewlett-Packard's advanced probing system for 0.5-mm pitch Plastic Quad Flat Pack (PQFP) and Ceramic Quad Flat Pack (CQFP) surface-mounted integrated circuits. This probing system provides a quick and reliable connection from these devices to Hewlett-Packard oscilloscopes, logic analyzers, and emulators.

This information shows you how to use the PQFP Adapter, and also includes optional accessories that will enhance the adapter's use in particular probing situations. Drawings are also included that instruct you in laying out printed circuit boards with the proper component spacing to correctly use the adapter.

| | 160-, 184-, 208-, 240-Pin | 304-Pin |
|---|---|---|
| **Electrical Characteristics** | | |
| Operating Voltage | < 40 V (dc + Peak ac) | < 40 V (dc + Peak ac) |
| Operating Current | 0.5 Amps Maximum | 0.5 Amps Maximum |
| Insulation Resistance | > 100 MΩ | > 100 MW |
| **Model Parameters** | | |
| Capacitance between Contacts | 2 pF (Typical) | 2.5 pF (Typical) |
| Self-Inductance | 30 nH (Typical) | 45 nH (Typical) |
| Contact Resistance | < 0.1 Ω | < 0.1 Ω |
| Operating Bandwidth | dc - 600 MHz | dc - 500 MHz |
| **Environmental Characteristics** | | |
| Operating Temperature | 0 °C to 50 °C | 0 °C to 50 °C |
| Relative Humidity | 75% Maximum | 75% Maximum |

### Tools Needed for Installation

Sandpaper, 600-grit
Flux remover/degreaser
Isopropyl Alcohol
Lint-free cloth
Round toothpick
Magnifying glass or microscope
Dags/tweezers
Screwdriver, #1 Posi-Drive
Light (flash light)
Tissue
Soldering iron
Solder, 63/37 rosin core

## Prepare the target IC

**WARNING**

**Flux remover use has hazards.** Read the instructions accompanying the flux remover and carefully follow the manufacturer's directions in its use. The use of flux remover in the work place may legally require that a Material Safety Data sheet for flux remover be available.

**CAUTION**

Power off the target IC before cleaning it and installing the probe adapter.

Use grounded wrist straps and mats when preparing the target IC. Electrostatic discharge can damage electronic components.

Overly aggressive use of this cleaning procedure can result in damage or contamination of the target IC and/or adjacent components.

1. Inspect each lead of the target IC, using a microscope if available, to assess the degree of cleaning needed to remove flux or debris.
   - Remove thin oxide layers with mild sanding.

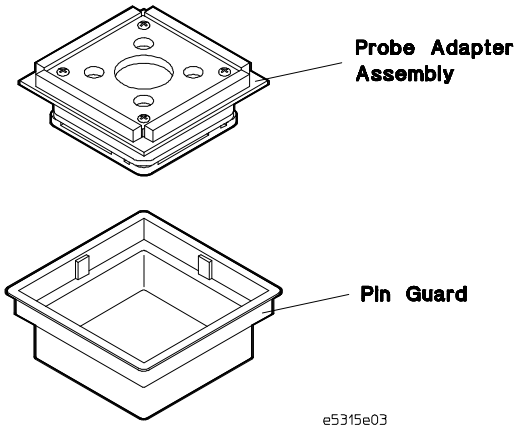
     Thin oxide layers may be transparent, but still interfere with probe operation.
   - Use more aggressive sanding to remove flux layers or other coatings.
   - Remove loose particles with precision dusting cleaner (also known as inert dusting gas or compressed air in a can).
2. Wet each lead of the target IC with flux remover, then blow dry with precision dusting cleaner (also known as inert dusting gas or compressed air in a can).
3. Using a one-inch-square piece of 600-grit sandpaper, folded with the sand side out, rub the target IC leads until they appear clean and shiny.
4. Again, wet each target IC lead with flux remover and blow dry with precision dusting cleaner (also known as inert dusting gas or compressed air in a can).
5. Inspect each lead of the target IC to assess whether the cleaning procedure should be repeated.

## Prepare the adapter assembly

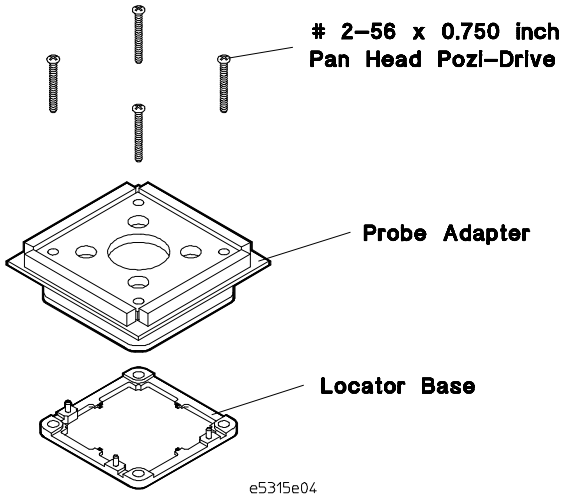
**1** Remove the pin guard.

**CAUTION**

Put the pin guard back on the probe adapter when not in use. Touching the ends of the adapter wires will contaminate them and destroy the electrical contacts. Bent adapter wires will prevent proper alignment with the package legs.




**2** Unscrew the four screws and remove the locator base.



**3** Clean the probe adapter.

**CAUTION**

Overly aggressive use of this cleaning procedure can result in damage or contamination of the probe adapter.

**a** Inspect each pin of the probe adapter, using a microscope if available, to assess the degree of cleaning needed to remove surface films or debris.

- Remove loose particles with precision dusting cleaner (also known as inert dusting gas or compressed air in a can).

**WARNING**

**Isopropyl Alcohol use has hazards.** Read the instructions accompanying the Isopropyl Alcohol and carefully follow the manufacturer's directions in it's use.
The use of Isopropyl Alcohol in the work place may legally require that a Material Safety Data sheet for Isopropyl Alcohol be available.

**b** Wrap a one-inch-square piece of lint-free cloth around a toothpick and wet the cloth with alcohol.

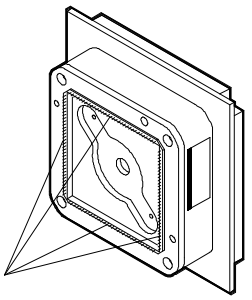
**CAUTION**

Any contact with the gold-plated pins of the probe adapter can abrade the gold plating. This can cause permanent damage to the probe or expose the underlying surface which will enable oxidation in humid environments. Hewlett Packard defines "delicately rubbing the pins" as being equal to holding a pen between two fingers without enough pressure to lift it.

**c** Delicately rub the lint-free cloth against each probe pin at the point of contact with the target IC leads.

**d** Blow dry the probe pins with ambient-temperature, high-pressure air.

**e** Inspect each pin of the probe. Each pin should display a shiny gold surface.



## Attach the locator base

**1** Check the area around the package to be probed.

The probe will work within the parameters shown in figures 1 through 4. Any dimensions outside of this window may require special adjustments in probe positioning for it to be operational.

**CAUTION** Use grounded wrist straps and mats when installing or performing any service to your probe adapter. Electrostatic discharge can damage electronic components.

**Figure 1. 160-Pin Adapter Parameters**

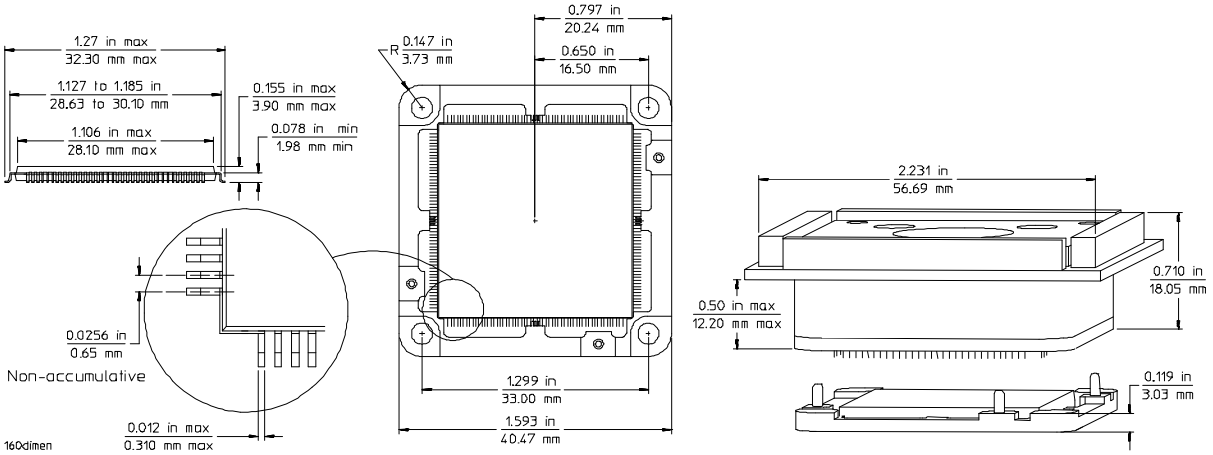


**Figure 2. 184-Pin Adapter Parameters**

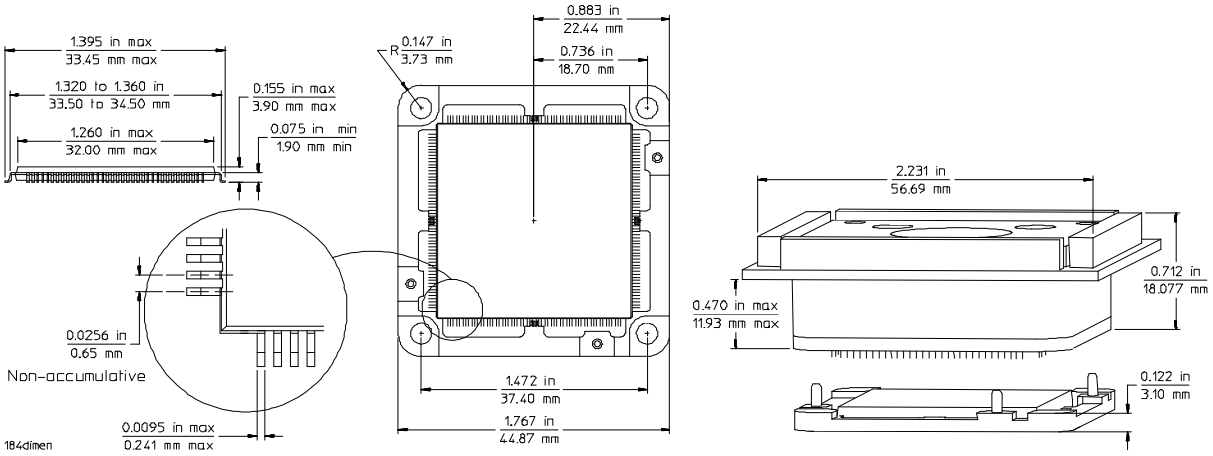



**Figure 3. 208-Pin Adapter Parameters**

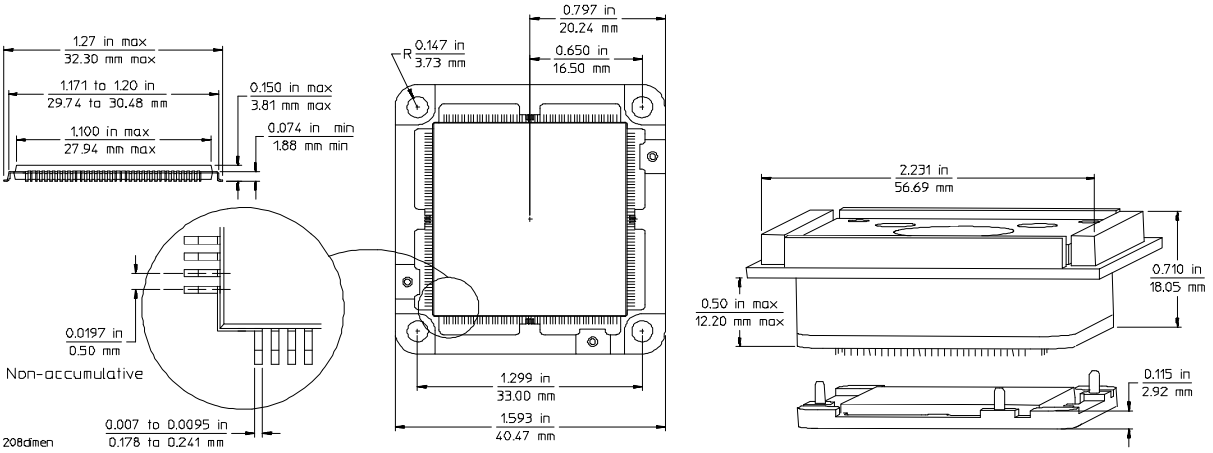


**Figure 4. 240-Pin Adapter Parameters**

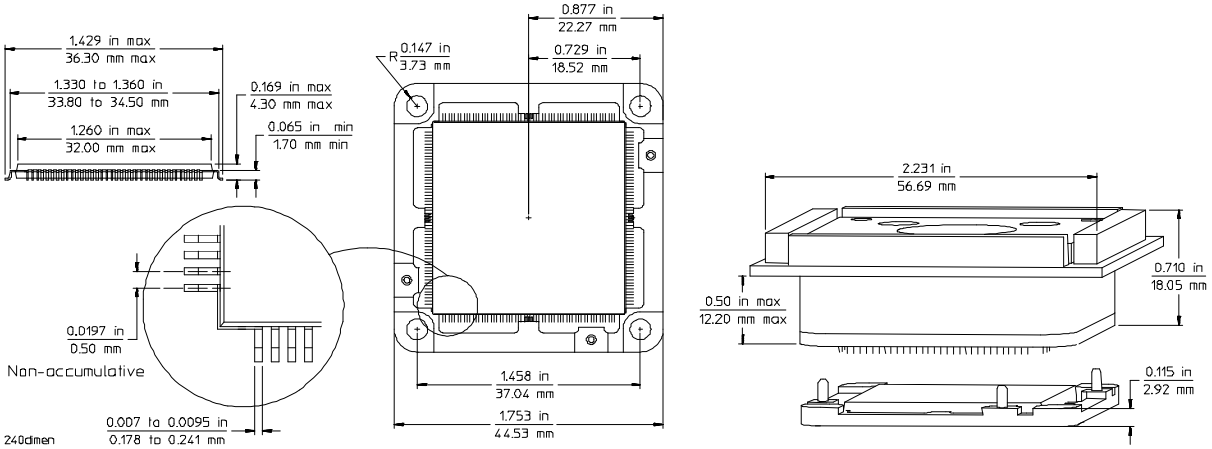
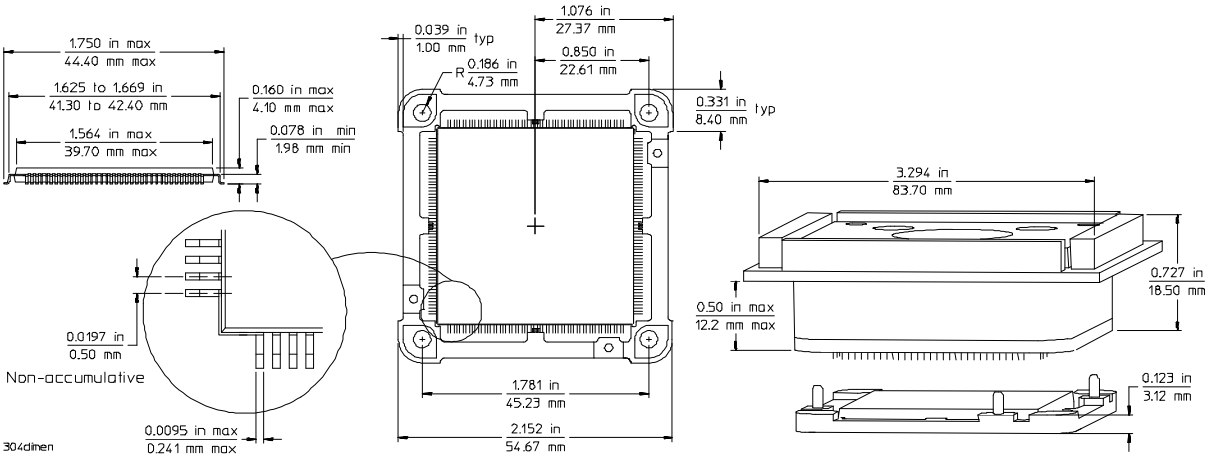
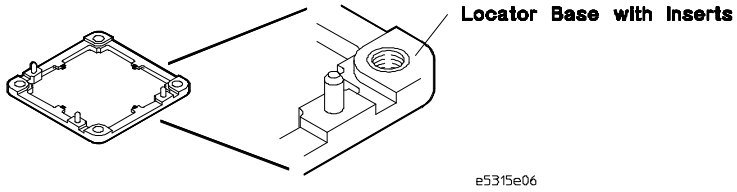



**Figure 5. 304-Pin Adapter Parameters**



**2** Use the locator base provided or mount inserts on your PC board.

- If you are using the locator base provided, it has inserts mounted in the corners for use on PC boards that do not have mounting holes designed to accept a locator base. For probing additional ICs, refer to "Additional Parts" later in this document for locator kit part numbers.




- If you are mounting inserts on your PC board, use an external mount kit which has a locator base without inserts and longer screws. Refer to table 1 for external mount kit part numbers. Refer to figures 1 through 4 for layout dimensions to mount four #2-56 inserts on your PC board.

  After mounting the locator base, go to "Establish the Grounding" later in this document. The locator base without inserts does not need to be glued down.

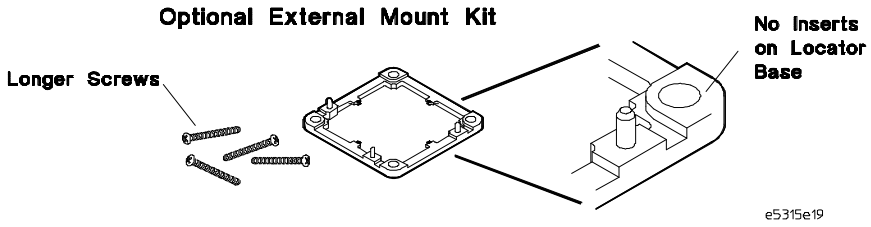



**Table 1** **Optional External Mount Kits**

| HP Prod/Part # | Use With |
|---|---|
| 5042-1707 | 160-Pin Adapter |
| 5042-1731 | 184-Pin Adapter |
| 5042-1702 | 208-Pin Adapter |
| 5041-9490 | 240-Pin Adapter |
| 5052-1717 | 304-Pin Adapter |

**3** Test the alignment before adhering the locator base.

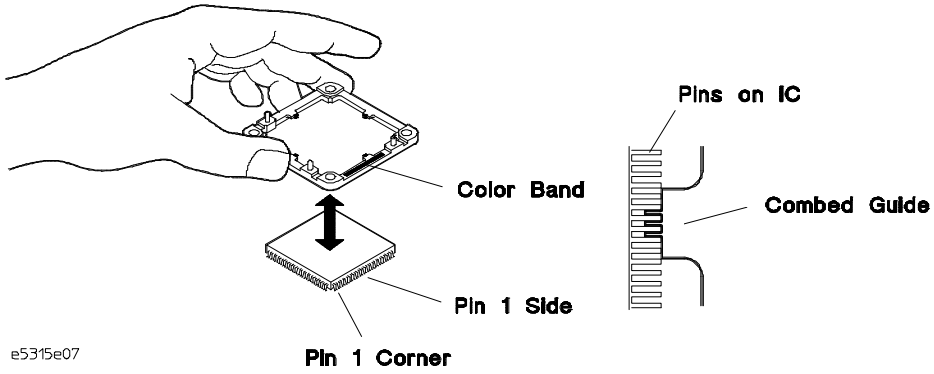
**CAUTION**

Installation of the locator base to the PC board is considered PERMANENT. Any attempt to remove the IC, locator base, or the PC board may result in damage to all three parts.

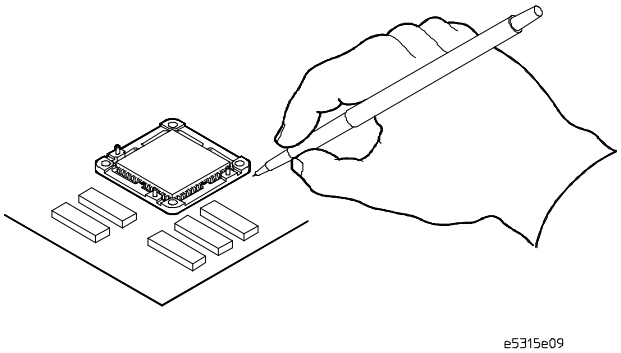
**a** Remove any flash at the corners of the IC or between pins. An excess of flash will inhibit the locator base seating on the board.

**b** Align the color band on the locator base with the Pin 1 corner or Pin 1 side of your package.

**c** Place the locator base on the package to be probed to see that it can be located properly. The combed guides on all four sides must be centered on the package sides and the base must be seated on the board.




**4** Outline the locator base to use as a guide for applying the adhesive.




**5** Remove the locator base.

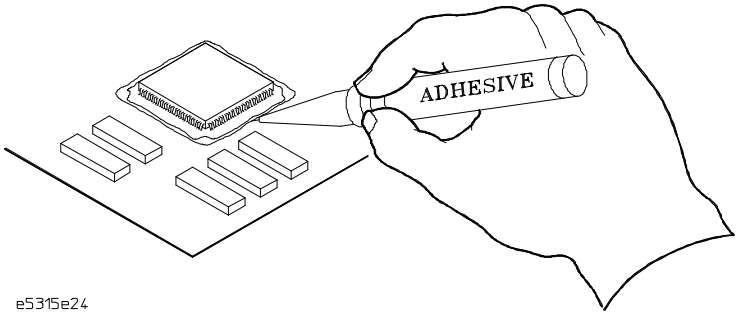
**5** Apply adhesive to your PC board. Follow the manufacturer's recommended temperature parameters for the adhesive in the enclosed Material Safety Data Sheet.

**WARNING**

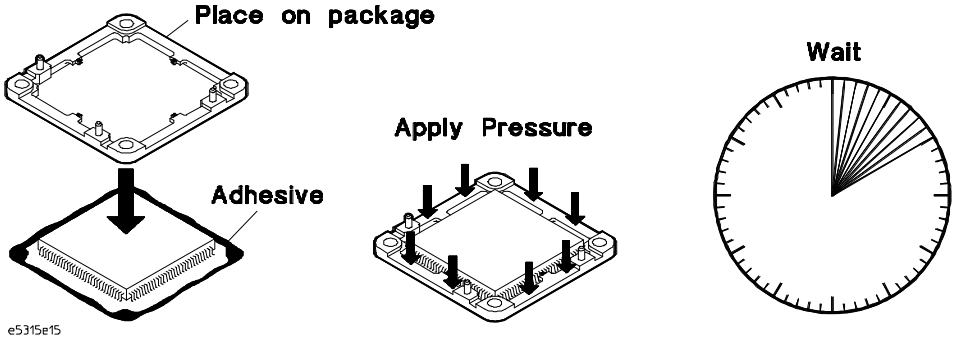
Read the Material Safety Data Sheet enclosed for handling precautions on the Loctite Superbonder495 or call Loctite Corporation at (203) 571-5100.

Loctite Instant Adhesives are non toxic. The vapors can cause eye irritation in poorly ventilated areas or low-humidity environments.

Accidental skin bonding is best handled by passive, non surgical first aid. Hot soapy water aids separation of skin tissue. Use peeling, not pulling action to separate bonded tissue.




**6** Place the locator base on the package to be probed, and apply downward pressure to ensure that the locator base adheres to the PC board. Allow the adhesive to set at least 10 minutes before attaching the probe adapter.



## Establish the grounding

Establish the grounding before the probe adapter is installed on the locator base. The ground plane of the probe adapter is common to the ground ring on the under side of the PC board mounted on top of the probe adapter. You can tie this ground ring to any ground reference on the package.

When probing an address bus, a data bus, or control lines, you must return the probing currents back to the PQFP via the ground pins that are physically near these probe points. Typically, there is a ground pin for every five to eight other pins.

> For example, one side of a 240-pin PQFP may have eight to ten ground pins. When using the probe adapter, you must tie the probe adapter ground ring to the PQFP ground pins on the side of the package that is being probed. If all the pins are being probed, you should attempt to tie all the ground pins on that side to the probe adapter ground ring. A good rule of thumb is to tie one ground pin for every four or five probes that are attached.

1. Refer to the data sheet for your PQFP to determine which pins will be used as grounds. A diagram of the top view of the PQFP chip is on the following page.
2. Translate the PQFP pin numbers to the pin numbers of the socket on the top of the adapter. See the diagram of the top view of the sockets on the following page.
3. Translate the socket pin numbers to the socket legs underneath the adapter. The socket leg numbers are printed on the PC by the socket legs.

## Top View of Sockets on Probe Adapter Assembly

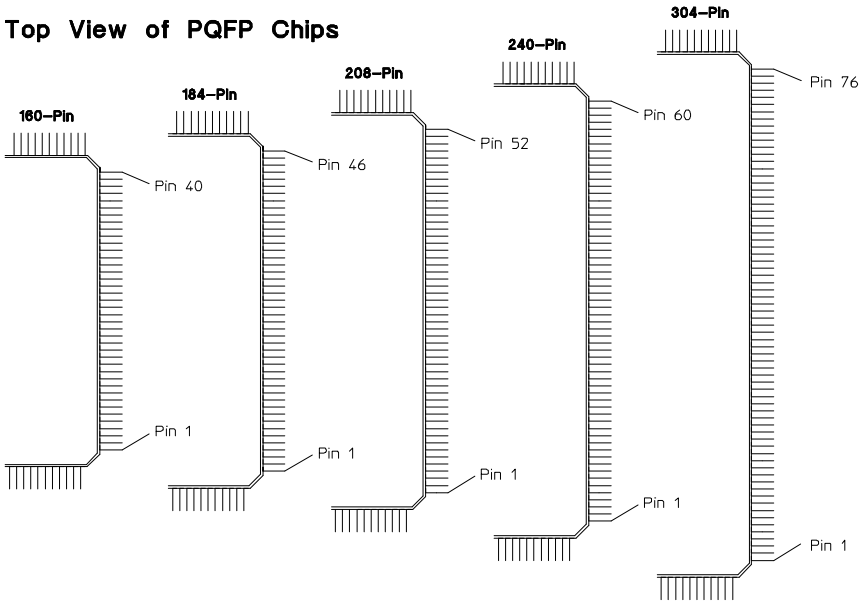
| 160–Pin | 184–Pin | 208–Pin | 240–Pin | | 240–Pin | 208–Pin | 184–Pin | 160–Pin |
|---|---|---|---|---|---|---|---|---|
| NC | NC | NC | 60 | | 59 | NC | NC | NC |
| NC | NC | NC | 58 | | 57 | NC | NC | NC |
| NC | NC | 52 | 56 | | 55 | 51 | NC | NC |
| NC | 46 | 50 | 54 | | 53 | 49 | NC | NC |
| | | | GND | | GND | | | |
| NC | 44 | 48 | 52 | | 51 | 47 | 45 | NC |
| 40 | 42 | 46 | 50 | | 49 | 45 | 43 | 39 |
| 38 | 40 | 44 | 48 | | 47 | 43 | 41 | 37 |
| 36 | 38 | 42 | 46 | | 45 | 41 | 39 | 35 |
| 34 | 36 | 40 | 44 | | 43 | 39 | 37 | 33 |
| 32 | 34 | 38 | 42 | | 41 | 37 | 35 | 31 |
| 30 | 32 | 36 | 40 | | 39 | 35 | 33 | 29 |
| | | | GND | | GND | | | |
| 28 | 30 | 34 | 38 | | 37 | 33 | 31 | 27 |
| 26 | 28 | 32 | 36 | | 35 | 31 | 29 | 25 |
| 24 | 26 | 30 | 34 | | 33 | 29 | 27 | 23 |
| 22 | 24 | 28 | 32 | | 31 | 27 | 25 | 21 |
| NC | NC | NC | NC | | NC | NC | NC | NC |
| 20 | 22 | 26 | 30 | | 29 | 25 | 23 | 19 |
| 18 | 20 | 24 | 28 | | 27 | 23 | 21 | 17 |
| 16 | 18 | 22 | 26 | | 25 | 21 | 19 | 15 |
| 14 | 16 | 20 | 24 | | 23 | 19 | 17 | 13 |
| | | | GND | | GND | | | |
| 12 | 14 | 18 | 22 | | 21 | 17 | 15 | 11 |
| 10 | 12 | 16 | 20 | | 19 | 15 | 13 | 9 |
| 8 | 10 | 14 | 18 | | 17 | 13 | 11 | 7 |
| 6 | 8 | 12 | 16 | | 15 | 11 | 9 | 5 |
| 4 | 6 | 10 | 14 | | 13 | 9 | 7 | 3 |
| 2 | 4 | 8 | 12 | | 11 | 7 | 5 | 1 |
| NC | 2 | 6 | 10 | | 9 | 5 | 3 | NC |
| | | | GND | | GND | | | |
| NC | NC | 4 | 8 | | 7 | 3 | 1 | NC |
| NC | NC | 2 | 6 | | 5 | 1 | NC | NC |
| NC | NC | NC | 4 | | 3 | NC | NC | NC |
| NC | NC | NC | 2 | | 1 | NC | NC | NC |

70-Pin Connector, 0.05 in x 0.05 in

| 304–Pin | | 304–Pin |
|---|---|---|
| 76 | | 75 |
| 74 | | 73 |
| 72 | | 71 |
| | GND | GND |
| 70 | | 69 |
| 68 | | 67 |
| 66 | | 65 |
| 64 | | 63 |
| | GND | GND |
| 62 | | 61 |
| 60 | | 59 |
| 58 | | 57 |
| 56 | | 55 |
| | GND | GND |
| 54 | | 53 |
| 52 | | 51 |
| 50 | | 49 |
| 48 | | 47 |
| | GND | GND |
| 46 | | 45 |
| 44 | | 43 |
| 42 | | 41 |
| 40 | | 39 |
| | GND | GND |
| NC | | NC |
| NC | | NC |
| | GND | GND |
| 38 | | 37 |
| 36 | | 35 |
| 34 | | 33 |
| 32 | | 31 |
| | GND | GND |
| 30 | | 29 |
| 28 | | 27 |
| 26 | | 25 |
| 24 | | 23 |
| | GND | GND |
| 22 | | 21 |
| 20 | | 19 |
| 18 | | 17 |
| 16 | | 15 |
| GND | | GND |
| 14 | | 13 |
| 12 | | 11 |
| 10 | | 9 |
| 8 | | 7 |
| GND | | GND |
| 6 | | 5 |
| 4 | | 3 |
| 2 | | 1 |

100-Pin Connector, 0.05 in x 0.05 in

## Top View of PQFP Chips




e5315e17

4 Bend and solder the socket legs to the ground ring.

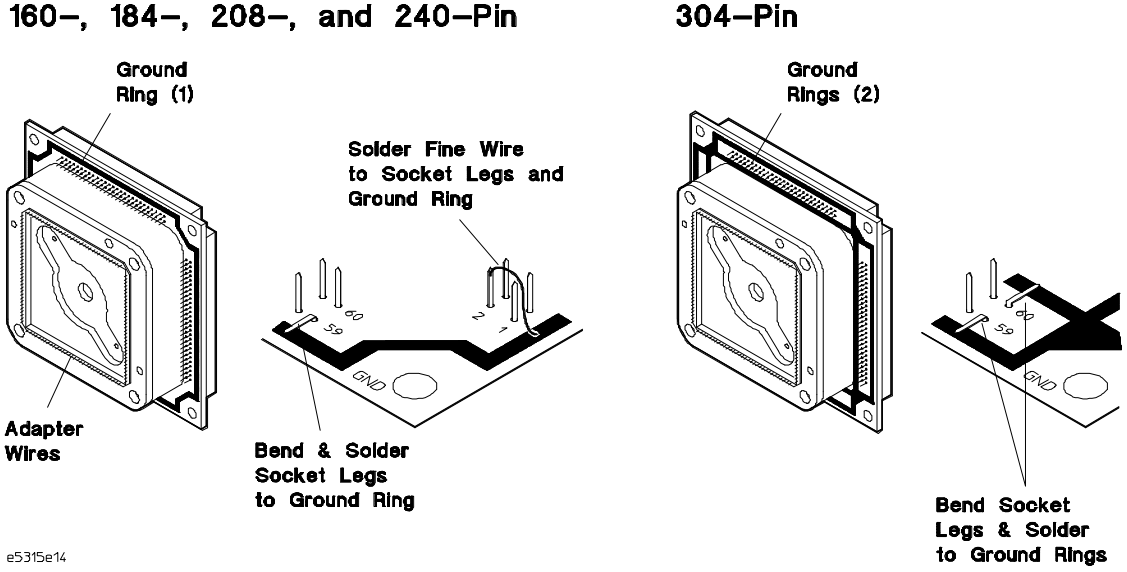
**a** Bend the socket legs down to touch the ground ring, then solder them.

The 304-pin adapter has ground rings on the inside and outside. The 160-, 184-, 208-, and 240-pin adapters have a ground ring on the outside only. If you have a 160-, 184-, 208-, or 240-pin adapter, use as many of the outside legs as possible.

**b** If you still need more grounds on your 160-, 184-, 208-, or 240-pin adapter, solder a fine wire to the ground ring and then to the leg to be grounded. Allow enough length in the wire so that it can be kept away from adjacent legs that might cause it to short.

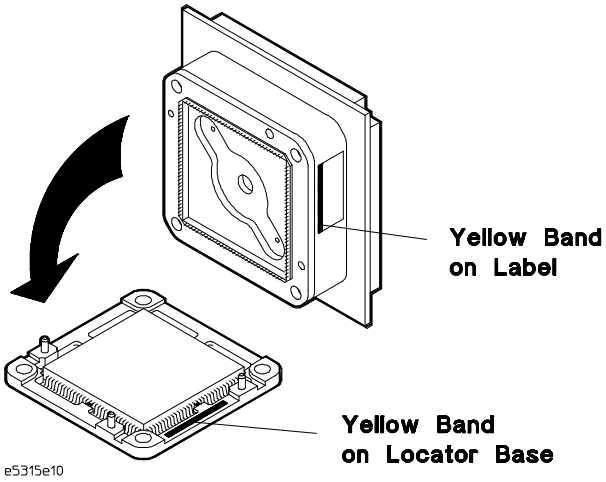
**CAUTION**

Handle the probe adapter carefully. Any contact with the gold-plated pins of the probe adapter can abrade the gold plating. This can cause permanent damage to the probe or expose the underlying surface which will enable oxidation in humid environments.

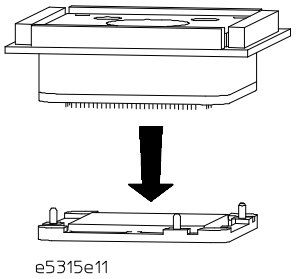


## Install the probe adapter

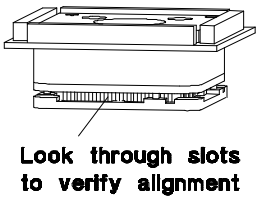
**1** Align the yellow band on your probe adapter with the one on the locator base.



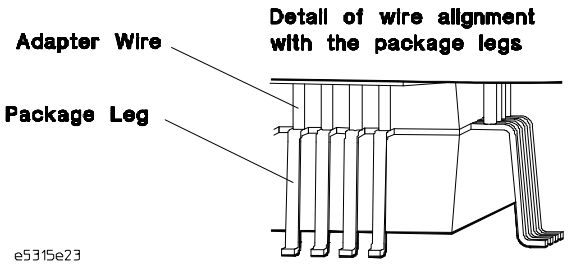

**2** Press the adapter down on the pins until the adapter wires touch the package legs.




**3** Use a magnifying glass and light to make sure that the wires align with the package legs around the entire package.



4 Ensure that every wire is directly above a leg, or not more than one-half of a wire diameter off to one side.

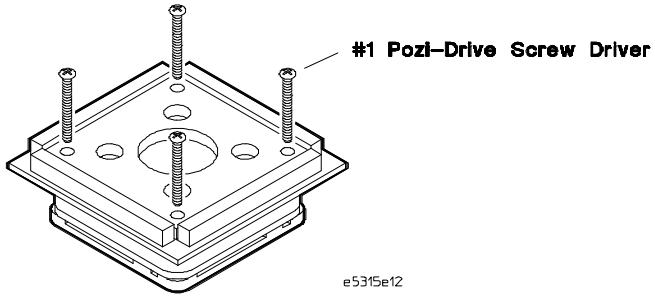



5 Insert the four corner mounting screws through the adapter and into the locator base corner inserts.

**CAUTION**

Optimum torque is 2.5 inch pounds. Excessive torque in tightening the four corner mounting screws can damage the screws. Insufficient torque can result in poor electrical contact to the target.

6 Turn the corner mounting screws until there is no slack. Then turn each screw a half turn, alternating between all four screws in a clockwise sequence until all screws are snug and the gap between the adapter and the locator base is closed. Check the alignment of the wires around the entire package again.



# Attach the flexible or rigid adapters

Flexible and rigid adapters are available to connect to your logic analyzer or oscilloscope probe. Their characteristics are in the table below.

**Table 2 - Characteristics of Optional Circuit Adapters**

| | **HP E5316A 60-Pin Flexible Adapter** | **HP E5330A 60-Pin Rigid Adapter** | **HP E5333A 76-Pin Flexible Adapter** |
|---|---|---|---|
| **Used With** | HP E5319A 160-Pin<br>HP E5343A 184-Pin<br>HP E5318A 208-Pin<br>HP E5315A 240-Pin | HP E5319A 160-Pin<br>HP E5343A 184-Pin<br>HP E5318A 208-Pin<br>HP E5315A 240-Pin | HP E5331A 304-Pin |
| **Electrical Characteristics** | | | |
| Operating Voltage | < 40 V (dc + Peak ac) | < 40 V (dc + Peak ac) | < 40 V (dc + Peak ac) |
| Operating Current | 0.5 Amps Maximum | 0.5 Amps Maximum | 0.5 Amps Maximum |
| Insulation Resistance | > 100 MΩ | > 100 MΩ | > 100 MΩ |
| **Model Parameters** | | | |
| Pin-to-Ground Capacitance* | 2.5 pF Typical First Row<br>3.5 pF Typical Second Row<br>4.5 pF Typical Third Row<br>5.5 pF Typical Fourth Row | 2.0 pF Typical First Row<br>2.0 pF Typical Second Row<br>2.5 pF Typical Third Row<br>3.0 pF Typical Fourth Row | 3.0 pF Typical First Row<br>3.5 pF Typical Second Row<br>4.5 pF Typical Third Row<br>5.0 pF Typical Fourth Row |
| Pin-to-Pin Capacitance | 2 pF Typical | 1.2 pF Typical | 2 pF Typical |
| Self-Inductance | 15 nH Typical First Row<br>25 nH Typical Second Row<br>35 nH Typical Third Row<br>45 nH Typical Fourth Row | 10 nH Typical First Row<br>10 nH Typical Second Row<br>20 nH Typical Third Row<br>30 nH Typical Fourth Row | 15 nH Typical First Row<br>25 nH Typical Second Row<br>35 nH Typical Third Row<br>45 nH Typical Fourth Row |
| Operating Bandwidth | 350 MHz | 350 MHz | 350 MHz |
| **Environmental Characteristics** | | | |
| Operating Temperature | 0 °C to 50 °C | 0 °C to 50 °C | 0 °C to 50 °C |
| Relative Humidity | 75% Maximum | 75% Maximum | 75% Maximum |

* Add these values to the value of the probe adapter assembly for your total capacitance.

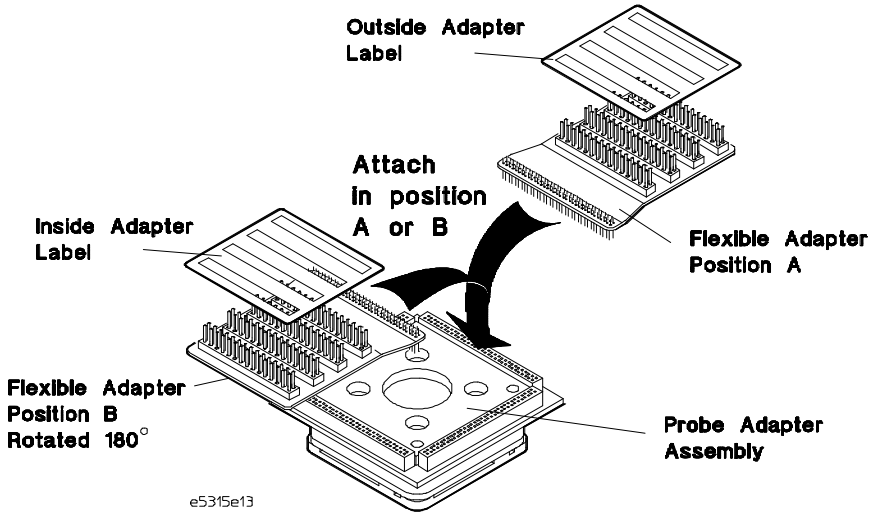
**Attaching flexible adapters**

1. Determine the direction of the flexible adapter. This will depend on the location of your PQFP and any components that may obstruct the flexible adapter.
2. Plug the flexible adapter into a socket on top of the probe adapter assembly.

**CAUTION**

To prevent pin damage and ensure a proper connection, make sure the adapter pins are aligned and seated correctly in the socket.

3. Add the appropriate label. There are separate labels for 160-pin, 184-pin, 208-pin, 240-pin, and 304-pin. Use an outside adapter label for position A and an inside adapter label for position B.
4. Repeat the above steps for all sockets.
5. Connect the appropriate logic analyzer or oscilloscope probe to the adapter as indicated by the adapter label.



### Attaching rigid adapters

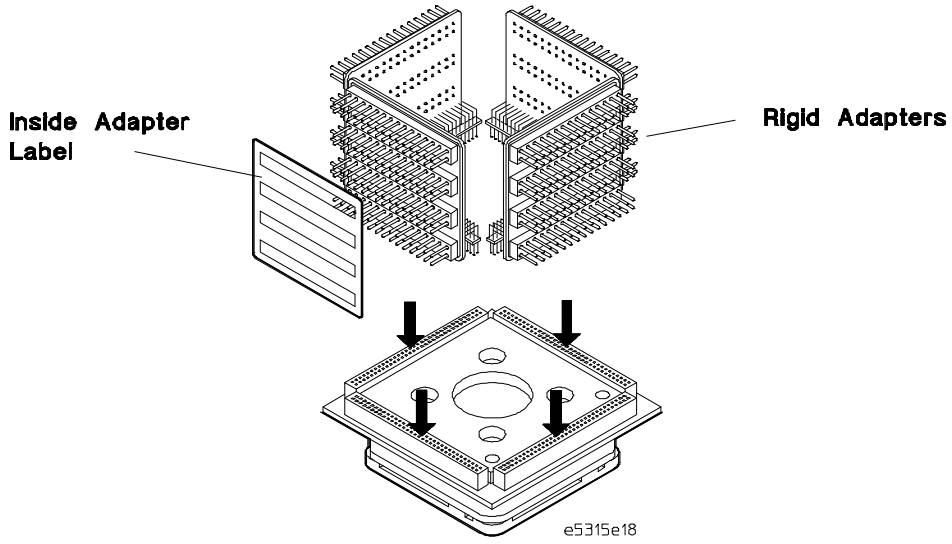
Rigid adapters are available for the 160-pin, 184-pin, 208-pin, and 240-pin PQFP adapters.

1. Plug your rigid adapters into the sockets on the top of the probe adapter assembly as shown in the following illustration.

**CAUTION**

To prevent pin damage and ensure a proper connection, make sure the adapter pins are aligned and seated correctly in the socket.

2. Add the appropriate labels. There are separate labels for 160-pin, 184-pin, 208-pin, and 240-pin. Use an inside adapter label.
3. Connect the appropriate logic analyzer or oscilloscope probe to the adapter as indicated by the adapter label.



# Additional parts

For probing additional ICs, order the following locator kits, flexible adapters, or rigid adapters.

**Table 5 – Additional parts**

| | 160-Pin Adapter | 184-Pin Adapter | 208-Pin Adapter | 240-Pin Adapter | 304-Pin Adapter |
|---|---|---|---|---|---|
| **Flexible Adapter** | E5316A | E5316A | E5316A | E5316A | E5333A |
| **Rigid Adapter** | E5330A | E5330A | E5330A | E5330A | Not applicable |
| **Locator Kit - No Inserts** | 5042-1707 | 5042-1731 | 5042-1702 | 5041-9490 | 5052-1717 |
| **Locator Kit w/Inserts** | 5042-1706 | 5042-1730 | 5042-1701 | 5041-9489 | 5052-1716 |

# Index

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**Warning**

- Before turning on the instrument, you must connect the protective earth terminal of the instrument to the protective conductor of the (mains) power cord. The mains plug shall only be inserted in a socket outlet provided with a protective earth contact. You must not negate the protective action by using an extension cord (power cable) without a protective conductor (grounding). Grounding one conductor of a two-conductor outlet is not sufficient protection.
- Only fuses with the required rated current, voltage, and specified type (normal blow, time delay, etc.) should be used. Do not use repaired fuses or short-circuited fuseholders. To do so could cause a shock of fire hazard.
- Service instructions are for trained service personnel. To avoid dangerous electric shock, do not perform any service unless qualified to do so. Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.
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- Whenever it is likely that the ground protection is impaired, you must make the instrument inoperative and secure it against any unintended operation.
- Do not operate the instrument in the presence of flammable gasses or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.
- Do not install substitute parts or perform any unauthorized modification to the instrument.
- Capacitors inside the instrument may retain a charge even if the instrument is disconnected from its source of supply.
- Use caution when exposing or handling the CRT. Handling or replacing the CRT shall be done only by qualified maintenance personnel.

**Safety Symbols**

Instruction manual symbol: the product is marked with this symbol when it is necessary for you to refer to the instruction manual in order to protect against damage to the product.

Hazardous voltage symbol.

Earth terminal symbol: Used to indicate a circuit common connected to grounded chassis.

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The Warning sign denotes a hazard. It calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in personal injury. Do not proceed beyond a Warning sign until the indicated conditions are fully understood and met.

**CAUTION**

The Caution sign denotes a hazard. It calls attention to an operating procedure, practice, or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the product. Do not proceed beyond a Caution symbol until the indicated conditions are fully understood or met.

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**About this edition**

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New editions are complete revisions of the manual. Update packages, which are issued between editions, contain additional and replacement pages to be merged into the manual by you. The dates on the title page change only when a new edition is published.

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All pages original edition