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User Manual

Tektronix

P7313 12.5 GHz, P7380 8 GHz, and P7360 6 GHz 5X/25X Differential Probes

071-1703-02

www.tektronix.com

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Contacting Tektronix

Tektronix, Inc.
14200 SW Karl Braun Drive
P.O. Box 500
Beaverton, OR 97077
USA

For product information, sales, service, and technical support:

- In North America, call 1-800-833-9200.
- Worldwide, visit www.tektronix.com to find contacts in your area.

This warranty is for the probe:

WARRANTY 2

Tektronix warrants that the product will be free from defects in materials and workmanship for a period of one (1) year from the date of shipment. If any such product proves defective during this warranty period, Tektronix, at its option, either will repair the defective product without charge for parts and labor, or will provide a replacement in exchange for the defective product. Parts, modules and replacement products used by Tektronix for warranty work may be new or reconditioned to like new performance. All replaced parts, modules and products become the property of Tektronix.

In order to obtain service under this warranty, Customer must notify Tektronix of the defect before the expiration of the warranty period and make suitable arrangements for the performance of service. Customer shall be responsible for packaging and shipping the defective product to the service center designated by Tektronix, with shipping charges prepaid. Tektronix shall pay for the return of the product to Customer if the shipment is to a location within the country in which the Tektronix service center is located. Customer shall be responsible for paying all shipping charges, duties, taxes, and any other charges for products returned to any other locations.

This warranty shall not apply to any defect, failure or damage caused by improper use or improper or inadequate maintenance and care. Tektronix shall not be obligated to furnish service under this warranty a) to repair damage resulting from attempts by personnel other than Tektronix representatives to install, repair or service the product; b) to repair damage resulting from improper use or connection to incompatible equipment; c) to repair any damage or malfunction caused by the use of non-Tektronix supplies; or d) to service a product that has been modified or integrated with other products when the effect of such modification or integration increases the time or difficulty of servicing the product.

THIS WARRANTY IS GIVEN BY TEKTRONIX WITH RESPECT TO THE PRODUCT IN LIEU OF ANY OTHER WARRANTIES, EXPRESS OR IMPLIED. TEKTRONIX AND ITS VENDORS DISCLAIM ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. TEKTRONIX' RESPONSIBILITY TO REPAIR OR REPLACE DEFECTIVE PRODUCTS IS THE SOLE AND EXCLUSIVE REMEDY PROVIDED TO THE CUSTOMER FOR BREACH OF THIS WARRANTY. TEKTRONIX AND ITS VENDORS WILL NOT BE LIABLE FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES IRRESPECTIVE OF WHETHER TEKTRONIX OR THE VENDOR HAS ADVANCE NOTICE OF THE POSSIBILITY OF SUCH DAMAGES.

This warranty is for the probe accessories:

WARRANTY 14

Tektronix warrants that the product will be free from defects in materials and workmanship for a period of three (3) months from the date of original purchase from an authorized Tektronix distributor. If the product proves defective during this warranty period, Tektronix, at its option, either will repair the defective product without charge for parts and labor, or will provide a replacement in exchange for the defective product. Batteries are excluded from this warranty. Parts, modules and replacement products used by Tektronix for warranty work may be new or reconditioned to like new performance. All replaced parts, modules and products become the property of Tektronix.

In order to obtain service under this warranty, Customer must notify Tektronix of the defect before the expiration of the warranty period and make suitable arrangements for the performance of service. Customer shall be responsible for packaging and shipping the defective product to the service center designated by Tektronix, shipping charges prepaid, and with a copy of customer proof of purchase. Tektronix shall pay for the return of the product to Customer if the shipment is to a location within the country in which the Tektronix service center is located. Customer shall be responsible for paying all shipping charges, duties, taxes, and any other charges for products returned to any other locations.

This warranty shall not apply to any defect, failure or damage caused by improper use or improper or inadequate maintenance and care. Tektronix shall not be obligated to furnish service under this warranty a) to repair damage resulting from attempts by personnel other than Tektronix representatives to install, repair or service the product; b) to repair damage resulting from improper use or connection to incompatible equipment; c) to repair any damage or malfunction caused by the use of non-Tektronix supplies; or d) to service a product that has been modified or integrated with other products when the effect of such modification or integration increases the time or difficulty of servicing the product.

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General Safety Summary

Review the following safety precautions to avoid injury and prevent damage to this product or any products connected to it.

To avoid potential hazards, use this product only as specified.

Only qualified personnel should perform service procedures.

To Avoid Fire or Personal Injury

Connect and Disconnect Properly. Connect the probe output to the measurement instrument before connecting the probe to the circuit under test. Disconnect the probe input from the circuit under test before disconnecting the probe from the measurement instrument.

Observe All Terminal Ratings. To avoid fire or shock hazard, observe all ratings and markings on the product. Consult the product manual for further ratings information before making connections to the product.

Do not apply a potential to any terminal, including the common terminal, that exceeds the maximum rating of that terminal.

Do Not Operate Without Covers. Do not operate this product with covers or panels removed.

Avoid Exposed Circuitry. Do not touch exposed connections and components when power is present.

Do Not Operate With Suspected Failures. If you suspect there is damage to this product, have it inspected by qualified service personnel.

Do Not Operate in Wet/Damp Conditions.

Do Not Operate in an Explosive Atmosphere.

Keep Product Surfaces Clean and Dry.

Symbols and Terms

Terms in this Manual. These terms may appear in this manual:



WARNING. *Warning statements identify conditions or practices that could result in injury or loss of life.*



CAUTION. *Caution statements identify conditions or practices that could result in damage to this product or other property.*

Symbols on the Product. The following symbol may appear on the product:



CAUTION
Refer to Manual

Preface

This manual describes the installation and operation of the P7313, P7380, and P7360 Differential Probes. Basic probe operations and concepts are presented in this manual. All documents listed below are located on the Documentation CD that came with your product. You can also access the Tektronix Web site (see next page) for these documents.

Conventions Used in this Manual

The following icon is used throughout this manual to indicate a step sequence.



Documentation

To read about	Use these documents
Installation and Operation (overviews)	Read the user manual for general information about how to use your probe.
In-Depth Operation	Use the technical reference manual (located on your documentation CD-ROM) along with the user manual.
Performance Verification and Specifications	Use the technical reference manual.
Applications	Read the *Application Examples* in the user manual.
Reordering Tip-Clip Assemblies and Tip-Clip Performance	Use the Probe Accessory Reorder sheet (located on your documentation CD-ROM) when reordering Tip-Clip accessories and checking Tip-Clip performance. This sheet is located in a pocket of the probe soft case.

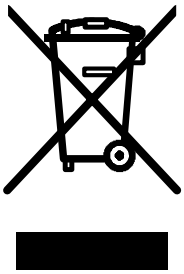
Environmental Considerations

This section provides information about the environmental impact of the product.

Product End-of-Life Handling

Observe the following guidelines when recycling an instrument or component:

Equipment Recycling. Production of this equipment required the extraction and use of natural resources. The equipment may contain substances that could be harmful to the environment or human health if improperly handled at the product's end of life. In order to avoid release of such substances into the environment and to reduce the use of natural resources, we encourage you to recycle this product in an appropriate system that will ensure that most of the materials are reused or recycled appropriately.



The symbol shown to the left indicates that this product complies with the European Union's requirements according to Directive 2002/96/EC on waste electrical and electronic equipment (WEEE). For information about recycling options, check the Support/Service section of the Tektronix Web site (www.tektronix.com).

Restriction of Hazardous Substances

This product has been classified as Monitoring and Control equipment, and is outside the scope of the 2002/95/EC RoHS Directive. This product is known to contain lead, cadmium, mercury, and hexavalent chromium.

Getting Started

Key Features



The P7313, P7380, and P7360 differential probes can help you probe in tight places while preserving high bandwidth and improving connectivity with low loading. Key features include:

- Bandwidth >12.5 GHz (typical) P7313
>8.0 GHz (typical) P7380
>6.0 GHz (typical) P7360
- Rise time 10-90% <40 ps (guaranteed) P7313
<55 ps (guaranteed) P7380
<70 ps (guaranteed) P7360
- Input resistance
  - 100 KΩ differential
  - 50 KΩ per side
  - AC loading (see Technical Reference)
- Interchangeable probe Tip-Clip assemblies
- Solder down and Square Pin capability
- Variable space compliant handheld adapter
- Fixturing with an adapter
- Small probe head for easy probing of SMDs
- TekConnect Interface

Handling the Probe

This probe is a precision high-frequency device; exercise care when you use and store the probe. The probe and cable are susceptible to damage caused by careless use. Always handle the probe at the compensation box and probe head, to avoid undue physical strain to the probe cable, such as kinking, excessive bending, or pulling. Visible dents in the cable will increase signal aberrations. Do not drop the probe or subject it to physical shock. Damage to the probe may result.



CAUTION. *To prevent damage to the probe, always use an anti-static wrist strap connected to a static-controlled workstation when you handle the probe. The probe input contains electronic components that can be damaged by contact with high voltages, including static discharge.*

Cleaning

Protect the probe from adverse weather conditions. The probe is not waterproof.



CAUTION. *To prevent damage to the probe, do not expose it to sprays, liquids, or solvents. Avoid getting moisture inside the probe during exterior cleaning.*

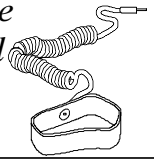
Do not use chemical cleaning agents; they may damage the probe. Avoid using chemicals that contain benzine, benzene, toluene, xylene, acetone, or similar solvents.

Clean the exterior surfaces of the probe with a dry, lint-free cloth or a soft-bristle brush. If dirt remains, use a soft cloth or swab dampened with a 75% isopropyl alcohol solution and rinse with deionized water. A swab is useful to clean narrow spaces on the probe, use only enough solution to dampen the swab or cloth. Do not use abrasive compounds on any part of the probe.

Operation Basics

Connecting to the Host Instrument

CAUTION. *To avoid ESD damage to the probe, always use an antistatic wrist strap (provided with your probe), and work at a static-approved workstation when you handle the probe.*



The TekConnect interface features a spring-loaded latch that provides audible and tactile confirmation that a reliable connection has been made to the host instrument.

Follow these steps to connect the TekConnect interface and set the probe to 5X or 25X probe attenuation.

1. Slide the probe into the TekConnect receptacle on the host instrument. The probe snaps into the receptacle when fully engaged.

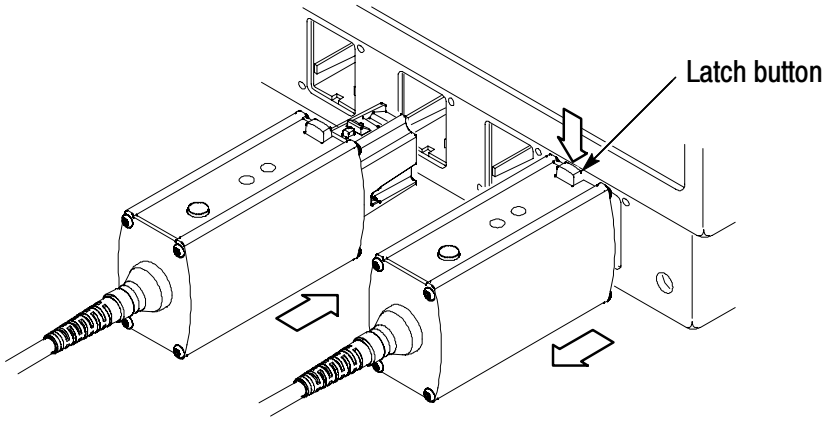


Figure 1: Connect TekConnect to instrument

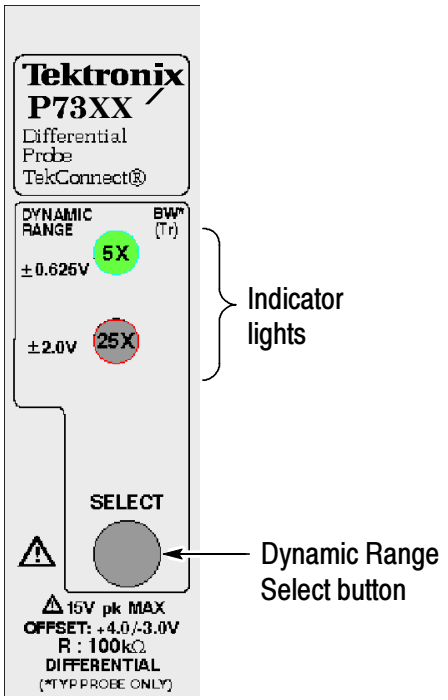
When the probe is connected, the host instrument reads information from the probe, identifies the device, and powers on the appropriate

power supplies. The preamp inputs on the host instrument are ESD protected by remaining grounded until a valid TekConnect device is detected.

Selecting the Probe Attenuation (Scaling)

When powered on, the indicator LEDs light briefly, and indicate that the attenuation is selected.

2. Press the Dynamic Range Select button to choose between 5X and 25X probe attenuation settings. Note that the dynamic range changes when the attenuation setting is changed. See Figure 2.



Quick Tip. Flashing indicator lights during or after the probe power on indicates that an internal probe diagnostic fault exists. Disconnect and reconnect the probe to restart the power-on diagnostic sequence. If the LEDs continue to flash, the probe is defective, and must be returned to Tektronix for repair.

Quick Tip. For the best noise performance, choose the 5X attenuator setting if it meets the dynamic range requirements for the signal.

Figure 2: Probe (front)

Connecting a Tip-Clip Assembly

To connect a Tip-Clip assembly to your probe, refer to *Installing a Tip-Clip assembly* on page 7, *Connecting to a Circuit Board* on page 14, and the *Accessory* section on page 33.

Functional Check

After installing the probe on the oscilloscope, you can perform a functional check using the PROBE COMPENSATION or FAST EDGE connection on the front panel of the oscilloscope, depending on the model of oscilloscope used.

For more information about accessories, see the *Accessories* section starting on page 29.

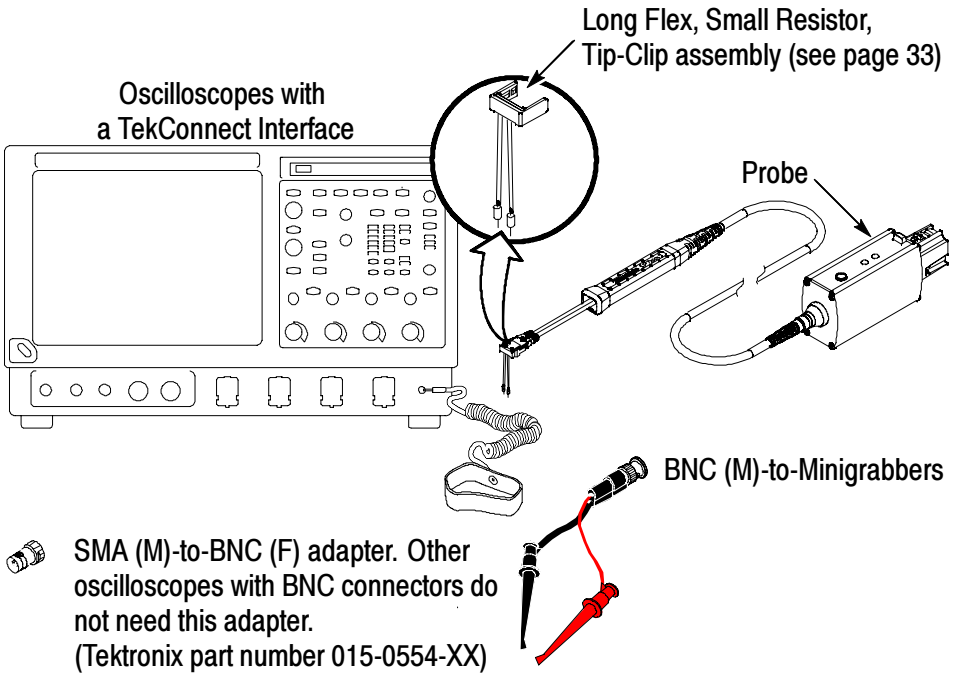


Figure 3: Equipment used for the functional check

CAUTION. *To avoid ESD damage to the probe, always use an antistatic wrist strap (provided with your probe), and work at a static-approved workstation when you handle the probe.*

Test Procedure

Following is a method for connecting the probe to a typical compensation connector.

1. Connect the probe to any channel of the oscilloscope.
2. Set the oscilloscope to display the probe channel.
3. Set the probe gain to 25X.
4. Connect the BNC (M)-to-Minigrabbers (with an SMA (M)-to-BNC (F) adapter) to the oscilloscope Probe Compensation connector. See Figure 4.

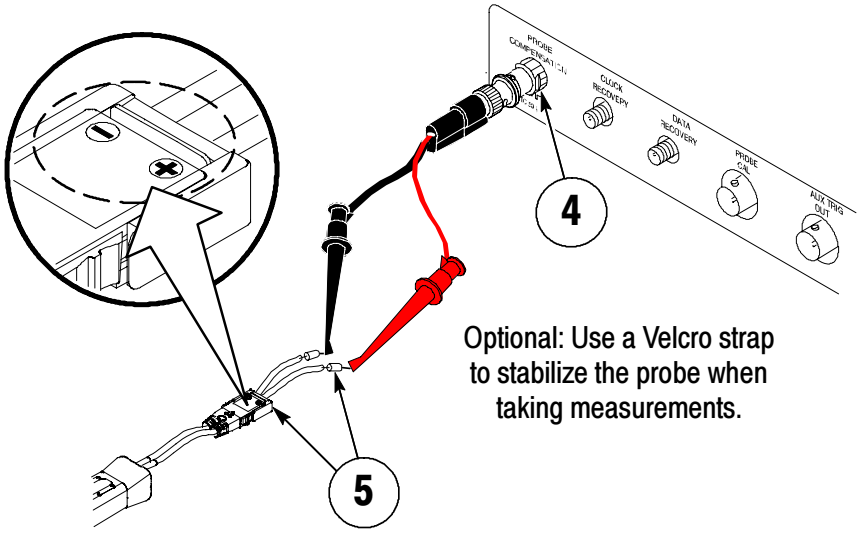


Figure 4: Connect to the probe for functional check

Installing a Tip-Clip Assembly

Retrieve a Long Flex, Small Resistor, Tip-Clip assembly from the Accessory Kit that came with your probe. For a list of Tip-Clip assemblies, refer to the *Accessory* section on page 33.

CAUTION. *To prevent damage to the Tip-Clip, use care when you handle any of the Tip-Clip assemblies.*

5. Attach the Long Flex, Small Resistor, Tip-Clip assembly to the probe tip.
   a. Grasp the sides of the Tip-Clip assembly and slide it toward the back of the probe tip. You will feel the Tip-Clip assembly click past a ridge on the probe tip when it is properly seated. See Figure 5.
   b. Check that the Tip-Clip housing seats flush against the probe-tip contacts.

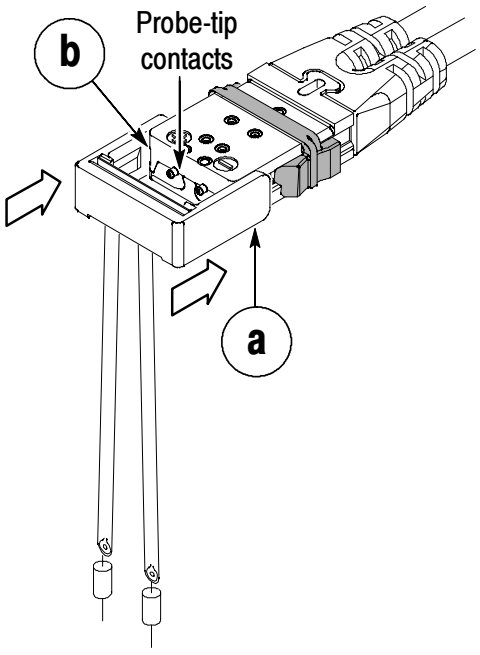


Figure 5: Installing a Tip-Clip assembly

6. Connect the BNC-to-Minigrabbers to the Long Flex, Small Resistor, Tip-Clip assembly on the probe.

- Connect the probe + input to the BNC red (+) terminal.
- Connect the probe – input to the adapter – or ground.

Quick Tip: The PPM203B Articulating Arm (used with the Probe Arm Adapter) and PPM100 Positioner Arm are not required, but may be used to support the probe. This relieves strain on the Tip-Clip assembly and provides a stable waveform measurement. See the *Accessories* section of this manual on page 38.

7. Adjust the oscilloscope to display a stable waveform (we recommend that you use the Autoset function). When you see a stable square wave, check the amplitude.

   The probe compensation signal amplitude and common mode voltage is dependent on oscilloscope model. Check that the signal amplitude on the oscilloscope and the common mode voltage approximate those in the table:

P7380 Probe set at 25X Attenuation	TDS6604	TDS7704
Signal amplitude	400 mV p-p	1.0 V p-p
V_{CM}	1.8 V	-500 mV

8. Use the (-) Minigrabber to short the resistor leads together and connect to a ground potential. See Figure 6.

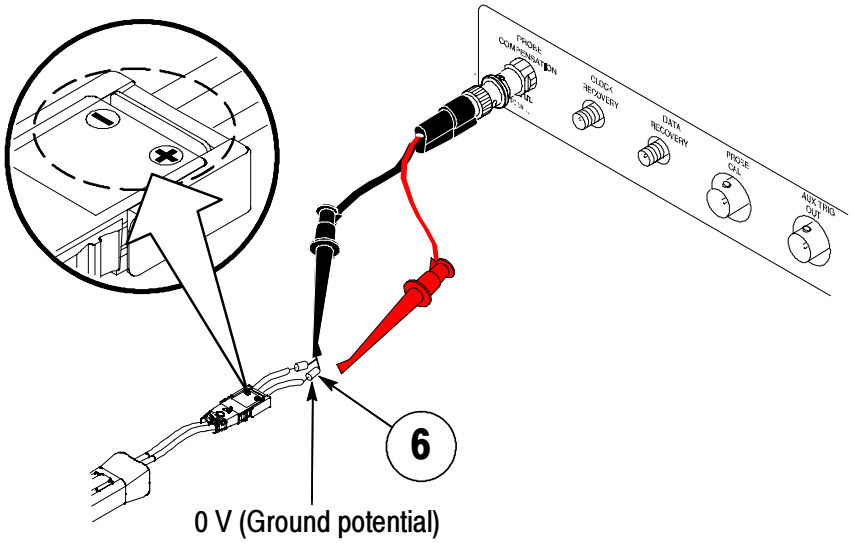


Figure 6: Short resistor leads

With the probe offset set to 0.0 V, the oscilloscope display will be at the ground reference.

9. Set the oscilloscope volts/division to 2 V.
10. Adjust the PROBE OFFSET between +4 V and -3 V. The displayed waveform will vary between approximately +3 V and -4 V.
11. Disconnect the shorting (-) Minigrabber.

Probe Calibration

After you perform a functional check of the probe, run a probe calibration routine. Probe calibration minimizes measurement errors by optimizing the gain and offset of the probe and oscilloscope combination. We recommend that you repeat the probe calibration on each channel that you use. Individual calibration constants are stored for each probe on each channel.

After you calibrate and then disconnect the probe, there may be a slight offset displayed on the screen. This slight offset occurs if you leave the probe inputs open. The normal measurement configuration is to calibrate the probe offset with a low source impedance. To check offset calibration, short the probe tips together. When the offset returns to zero, you have completed a successful probe calibration.



CAUTION. *To avoid ESD damage to the probe, always use an antistatic wrist strap (provided with your probe), and work at a static-approved workstation when you handle the probe.*

You can use the equipment shown in the *Functional Check* in Figure 3 on page 5 to perform the probe calibration.

Test Procedure

The Calibration Status of the instrument Signal Path Compensation test must be pass for the probe calibration routine to run:

1. From the Utilities menu, select Instrument Calibration.
2. In the Calibration box, check that the Status field is pass. If it is not, disconnect all probes and signal sources from the oscilloscope, and run the Signal Path Compensation routine.

When the Signal Path compensation test status is pass, run the following probe calibration routine:

3. Connect the probe to one of the oscilloscope channels, and set the oscilloscope to display the channel. Allow the probe to warm up for 20 minutes.

***NOTE**. Connect the + probe input to the positive Minigrabber, connect the - probe input to the ground Minigrabber.*

4. Connect the BNC-to-Minigrabbers to the oscilloscope PROBE CAL connector as shown in Figure 7.

   If a PROBE CAL connector is not available on your oscilloscope, you may be able to use the PROBE COMPENSATION connector for the probe calibration procedure. Check your oscilloscope manual or online Help for specific direction on probe calibration.

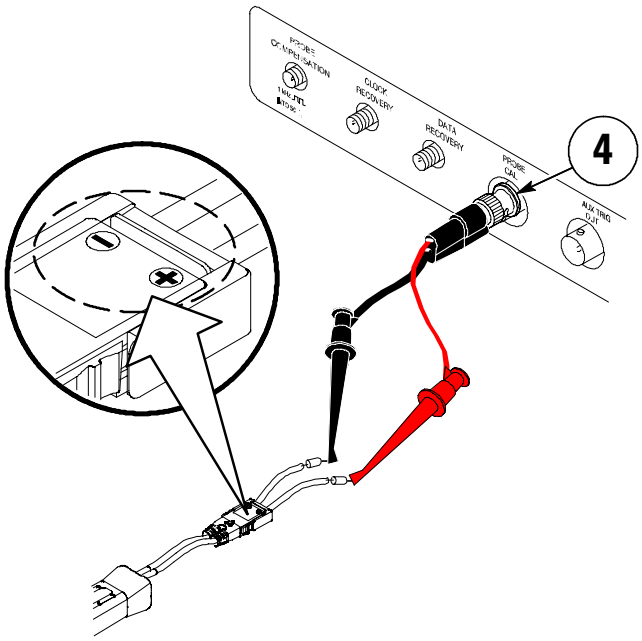


Figure 7: Connect the probe for probe calibration (TDS6000B/C shown)

5. In the menu bar, select Vertical and then select Probe Cal.
6. When the Probe Cal dialog box appears, select Clear Probe Cal, and then select Calibrate Probe.

   The probe calibration routine runs, optimizing the probe to the oscilloscope for both probe attenuation settings.
7. After a successful Probe Cal, the screen displays pass.

Tip-Clip Ejector

A Tip-Clip Ejector is shipped installed on the probe tip and is used to remove the Tip-Clip assembly.

CAUTION. *To prevent wear to the Tip-Clip housing, it is recommended that you use the Tip-Clip Ejector to remove the Tip-Clip assembly from the probe tip.*

Removing a Tip-Clip Assembly

Follow these steps to remove the Tip-Clip assembly by using the Tip-Clip Ejector:

1. Grasp the sides of the Tip-Clip Ejector and slide the Tip-Clip Ejector towards the front of the probe tip. You will feel the Tip-Clip Ejector click past a ridge on the probe tip and the Tip-Clip assembly will loosen. See Figure 8.
2. Remove the Tip-Clip assembly.

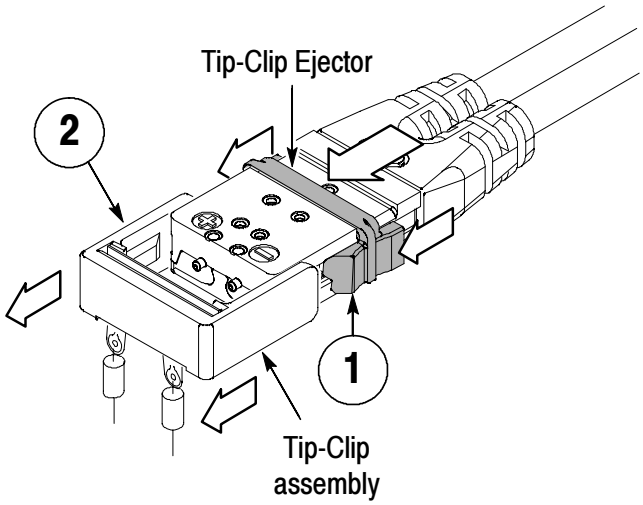


Figure 8: Removing a Tip-Clip assembly

Tip-Clip Ejector Installation

If you find that a Tip-Clip Ejector is missing from the probe tip, follow these steps to reattach the Tip-Clip Ejector:

We recommend that you use the Magni-Spec magnifiers when you attach the Tip-Clip Ejector to the probe tip.

1. Remove any Tip-Clip assemblies from the probe tip, if necessary.
2. Turn the probe tip over with the back of the probe tip facing you. See Figure 9.
3. Position the Tip-Clip Ejector with the angled faces pointing towards the probe tip.
4. Place the Tip-Clip Ejector into the slot on the back of the probe tip. The Tip-Clip Ejector slides easily in this slot when placed correctly.

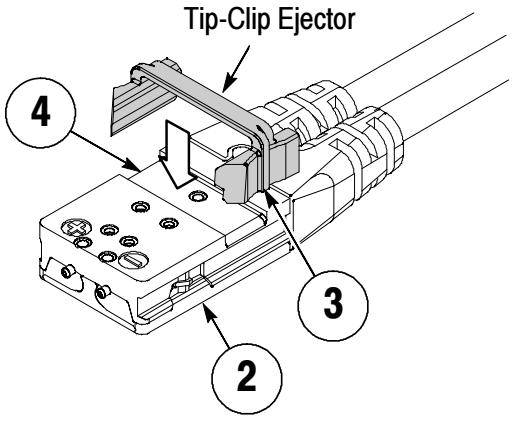


Figure 9: Attaching a Tip-Clip Ejector

Connecting to a Circuit Board

When connecting to a circuit, you can use the probe in three modes:

- Use one or several Tip-Clip assemblies soldered to a circuit board for measurements in tight spaces. See Figure 10.
- Use the Handheld Adapter with the Variable Spacing Adapter where probe clearance is less of an issue.
- Use a fixtured adapter for hands-free probing.
- Use the Square Pin Tip-Clip assembly to probe a pair of square pins.

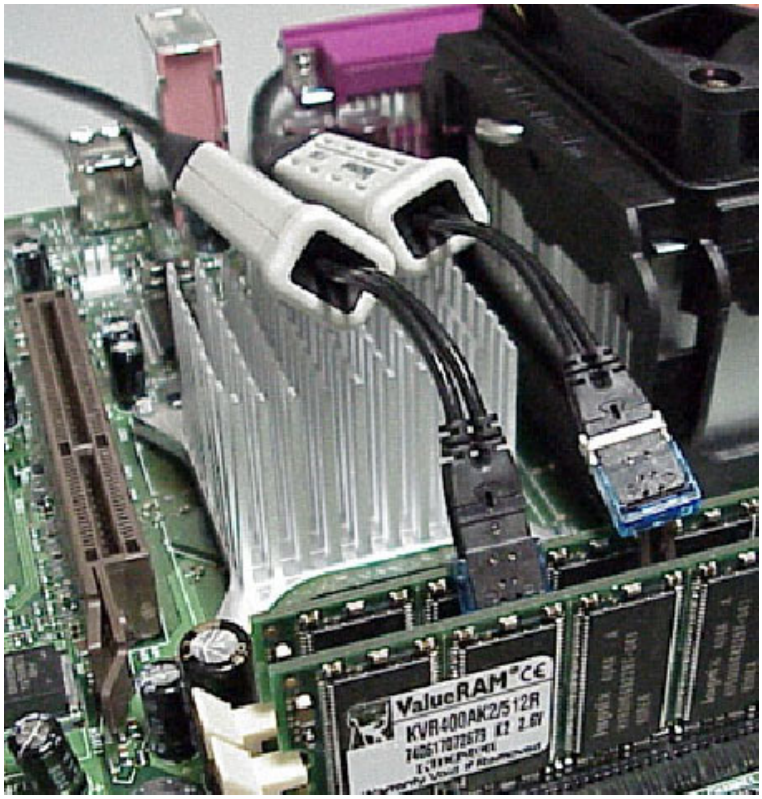


Figure 10: Soldered Tip-Clip assemblies

Soldered Tip-Clip Assembly

Follow these steps to solder a Tip-Clip assembly to a circuit board, except for the HBW Tip-Clip assemblies; then see page 18.

***NOTE**. For the choice of Tip-Clip assemblies and Tip-Clip performance information, see page 33 in the* Accessories *section.*

Identify a location near the circuit under test where the Tip-Clip can be placed and soldered to a circuit with the recommended Tip-Clip damping resistor lead length (see step 4).

1. Attach the Tip-Clip Tape to the circuit board, then press the Tip-Clip assembly to the tape. See Figure 11. Wait a moment for the adhesive to set.

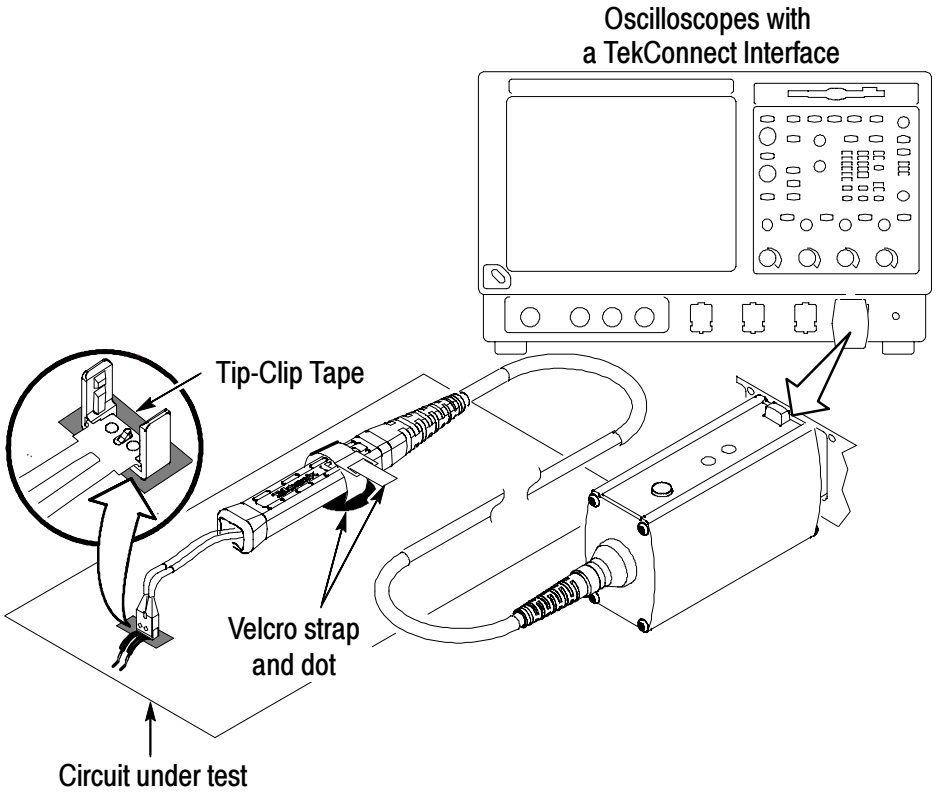


Figure 11: Connect to a circuit board

Connect the probe to any oscilloscope that features the TekConnect interface.

2. Attach the probe to the Tip-Clip assembly.



CAUTION. *To prevent damage to the circuit board or circuit board connections due to accidental movement of the probe and soldered leads, it is recommended that the Tip-Clip assembly and probe be secured to the circuit board using the provided Velcro fastening strap and dots, and the Tip-Clip Tape.*

3. Attach the Velcro fastening strap and dots to the probe and circuit board.



CAUTION. *To avoid damage to the Tip-Clip or the circuit under test, avoid applying excessive heat from the soldering iron. Use a low wattage, temperature-controlled soldering iron and appropriately sized soldering iron tip.*

4. Solder the Tip-Clip leads to test points on your circuit board. See *Quick Tips*.

Quick Tips

- For optimum performance and signal integrity, keep the lead length between the DUT (Device Under Test) and the Tip-Clip resistor short, less than 0.050-in if possible, and the lead lengths the same length.
- Since the Tip-Clip loading is relatively light at about 0.1 pF, you may be able to leave several Tip-Clip assemblies attached to your circuit while you take measurements, depending on the sensitivity of your circuit to loading. Tip-Clip loading of the circuit under test is minimum when the probe is attached to the Tip-Clip.

You can connect TekConnect probes to some nonTekConnect instruments using special probe adapters. The 80A03 TekConnect Probe Interface adapts any TekConnect probe to the TDS8X00 and CSA8X00 Series oscilloscopes. The RTPA2A TekConnect Probe Interface adapts any TekConnect probe to the RTSA Real-Time Spectrum Analyzers. See page 44 for alternate setups.

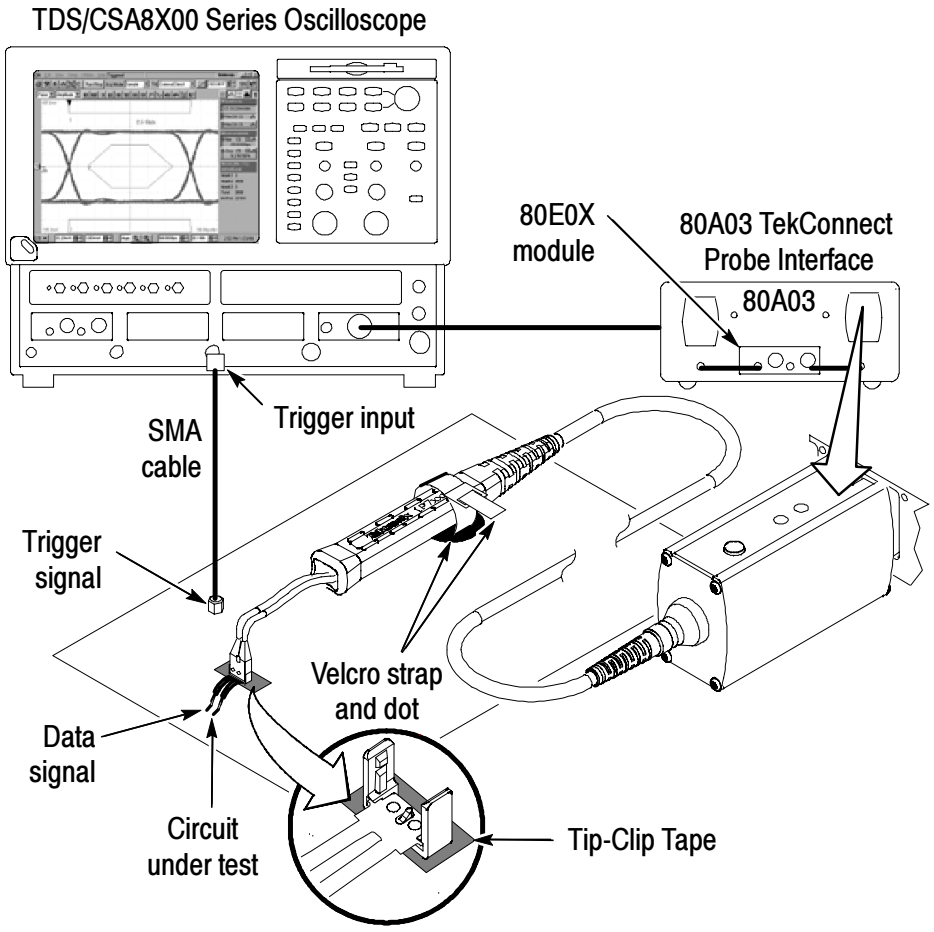


Figure 12: TDS/CSA8X00 Series Sampling oscilloscope

***NOTE**. For proper operation, the 80A03 firmware must be version 2.0 or above. The firmware version label is on the rear panel of the 80A03 instrument.*

Soldered HBW Tip-Clip Assemblies (P7313 Only).

The HBW solder-in Tip-Clips are required for full bandwidth measurements using the P7313 probe. The HBW Tip-Clips are designed with damping resistors mounted on a flex circuit and circuit attachment wires soldered to the ends of the damping resistors (see Figure 13).

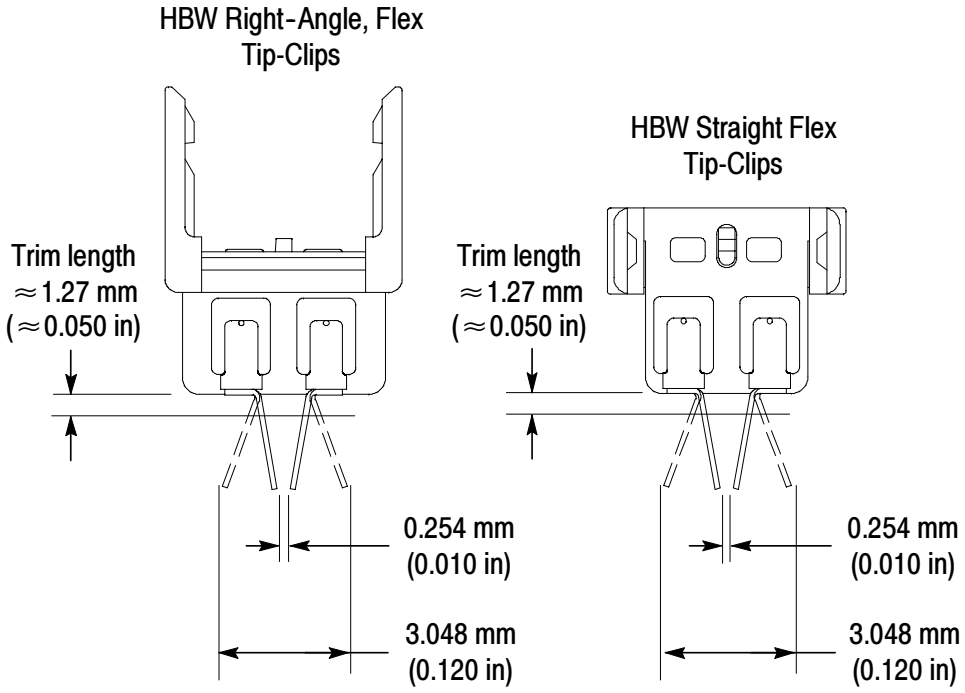


Figure 13: Wire-lead length for HBW Tip-Clip assemblies

The attachment wires can be bent symmetrically to vary the interconnect spacing. Care must be used when soldering a HBW Tip-Clip to a circuit under test to avoid inadvertently desoldering either the attachment wires or the damping resistor.

Use the following precautions when soldering HBW Tip-Clips:

- Avoid strain on the attachment wires. To avoid strain on the attachment wires, the HBW Tip-Clip should be attached to the circuit board with the Tip-Clip tape as shown in Figure 11 on page 15. The use of Velcro fastening straps and dots to anchor the probe body is also recommended.
- Use the high-temperature solder supplied with the wire replacement kit when replacing wires on the HBW Tip-Clip damping resistor. The relatively large thermal mass of the damping resistor and the use of a high-temperature solder to attach the wire to the damping resistor helps to reduce the risk of accidentally desoldering the attachment wire from the damping resistor. However, avoid applying too much heat from a soldering iron when attaching the HBW Tip-Clip wires to the circuit under test.
- Use a low-temperature solder to attach the HBW Tip-Clip wires to the circuit under test.
- Use a low-wattage, temperature-controlled soldering iron and a small mass soldering iron tip. The soldering iron temperature should be set as low as possible, while still providing a reliable solder joint.
- The circuit interconnect on the circuit board should be pre-trimmed, if possible, to minimize the wire attachment dwell time. Carefully pre-trimming the Tip-Clip wire may also help reduce the required soldering iron dwell time for the wire attachment to the circuit.

Handheld Adapter

Before probing with the Handheld Adapter, you must follow these steps to attach the handheld adapter housings and Variable Spacing Tip-Clip assembly to the probe:

1. Attach the Variable Spacing Tip-Clip assembly to the probe tip (see Figure 14 on page 20). Although the Tip-Clip is insensitive to mechanical attachment polarity, the probe measurement polarity will be affected by the polarity of the probe input contacts connected to the Variable Spacing Tip-Clip.

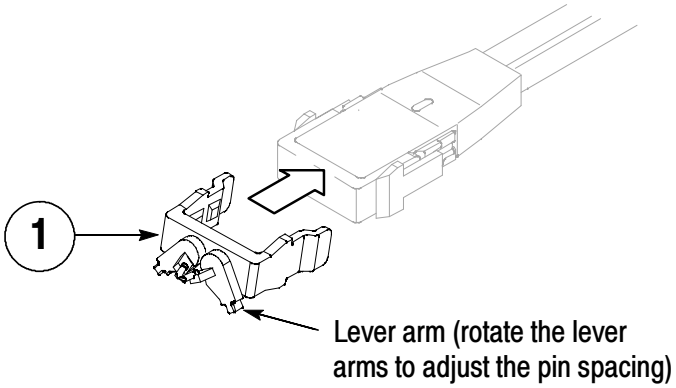


Figure 14: Variable Spacing Tip-Clip assembly

NOTE. *The Variable Spacing Tip-Clip assembly is a small precision part and careful handling will extend the life of this part. Use care when applying pressure to the probe Tip-Clip assembly during probing and handling.*

To loosen the action of the lever arms on the Variable Spacing Tip-Clip assembly, rotate the lever arms three or four times.

For Variable Spacing Tip-Clip assembly specifications, refer to the technical reference on your documentation CD or Tektronix Web site.

You can store the Variable Spacing Tip-Clip assembly in the plastic accessory box.

2. Separate the Handheld Adapter housings, if necessary (see Figure 16 on page 22 for latch location), and place the probe in the lower housing. See Figure 15.

   a. Check that the plastic pins on the lower housing are keyed in the slots on the probe (either side). When seated correctly, the probe will not move in the lower housing.

   b. Dress the wires around the post in the lower housing. For consistent polarity, do not cross the wires.

   c. Seat the probe tip on the metal pin in the nose of the lower housing.

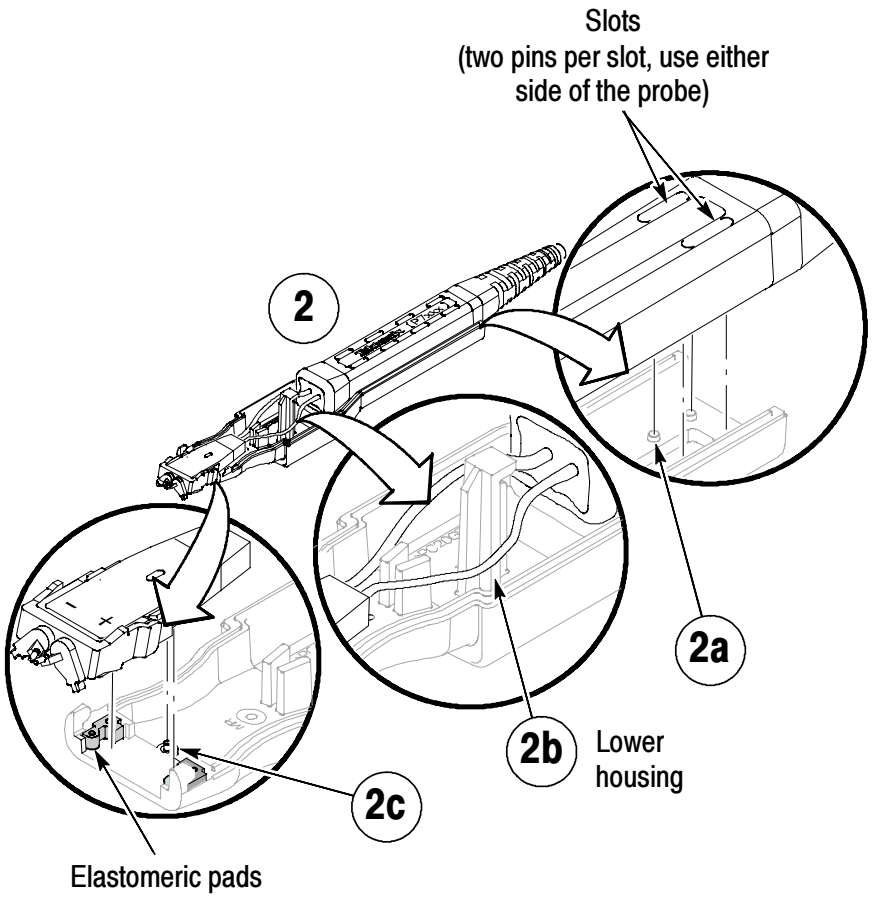


Figure 15: Assembling the handheld adapter

3. While holding the lower housing and probe still, hook the nose of the upper housing into the nose of the lower housing.
4. Bring the two housings together.
5. Slide the latch forward on the upper housing to lock the housings in place. See Figure 16.

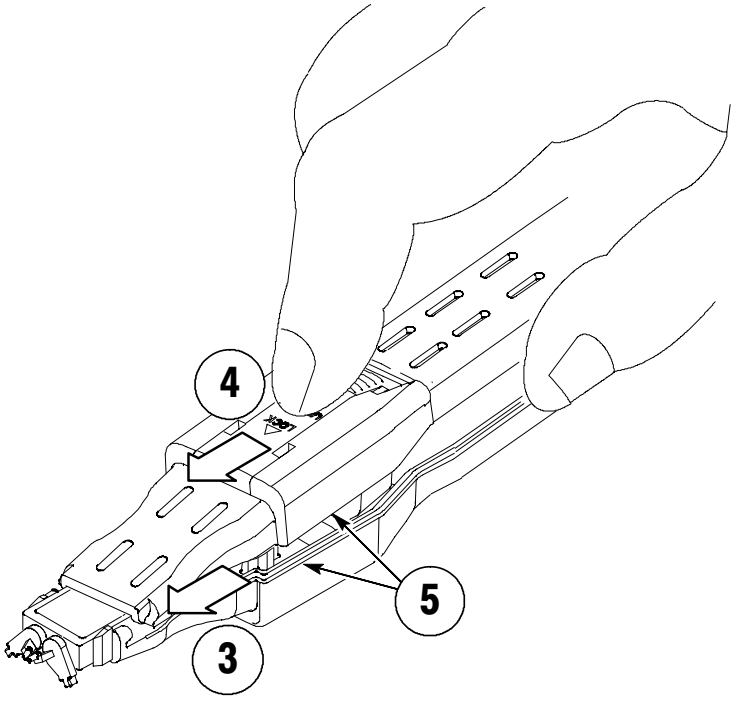


Figure 16: Lock the handheld adapter

NOTE*. When the Handheld Adapter is properly assembled, the elastomeric pads seated in the nose of the Handheld Adapter* (see Figure 15) *provide a balanced cushioning for the probe tip, unless too much pressure is applied to the probe tip. This balanced cushioning of the probe tip helps make the connections to the two interconnect points of a differential measurement easier.*

How to Remove the Handheld Adapter Housing.



CAUTION. *To prevent damage to the Handheld Adapter when removing it from the probe, slide the latch on the upper housing first before attempting to separate the housings.*

To remove the Handheld Adapter housings from the probe:

1. Slide the latch to the unlock position.
2. Slide the top housing back from the probe tip, and then separate and remove the probe housing halves.

You can store the Handheld Adapter in the probe case that shipped with the probe.

Square-Pin Tip-Clip Assembly

Use the Square Pin Tip-Clip assembly for probing 0.025-in diameter square pins spaced 0.1-in on center. Square pins are not an ideal transmission path for high speed electrical signals. Square pins are not recommended for signals faster than 100 ps or 3 GHz.

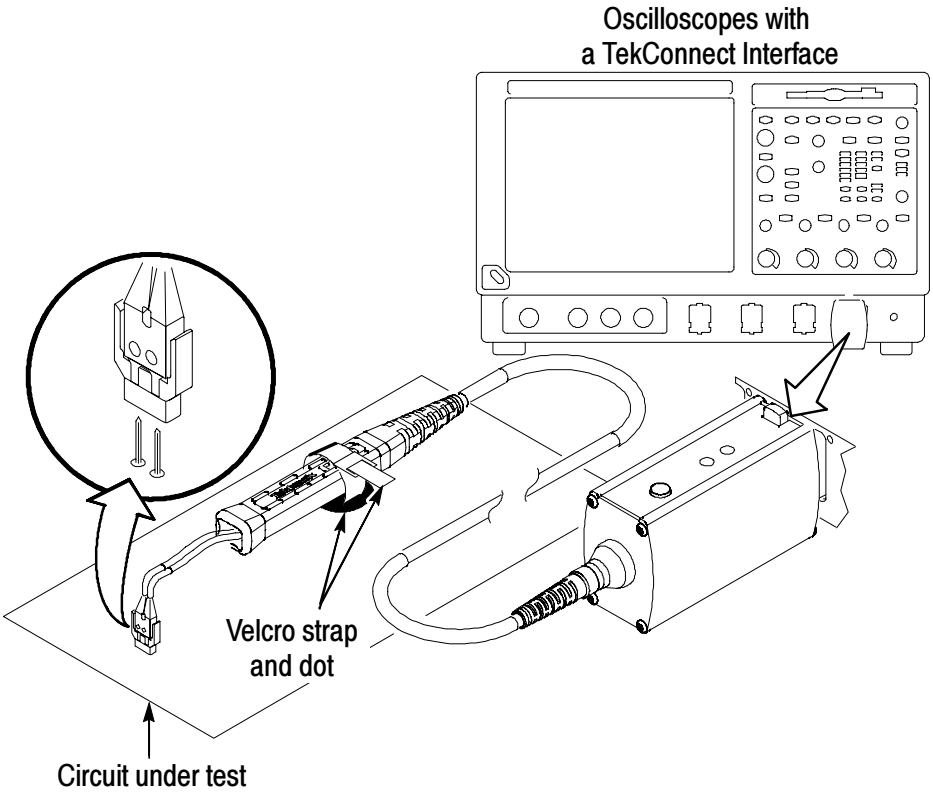


Figure 17: Square Pin Tip-Clip assembly

Fixtured Probing

Fixtured probing can be used to make hands-free connections to a circuit under test. The probe arm adapter is used to attach the probe body or Handheld Adapter to a PPM203B Articulating or PPM100 Probe Fastener. Figure 18 shows a fixtured probe (PPM203B with a Probe Arm Adapter).

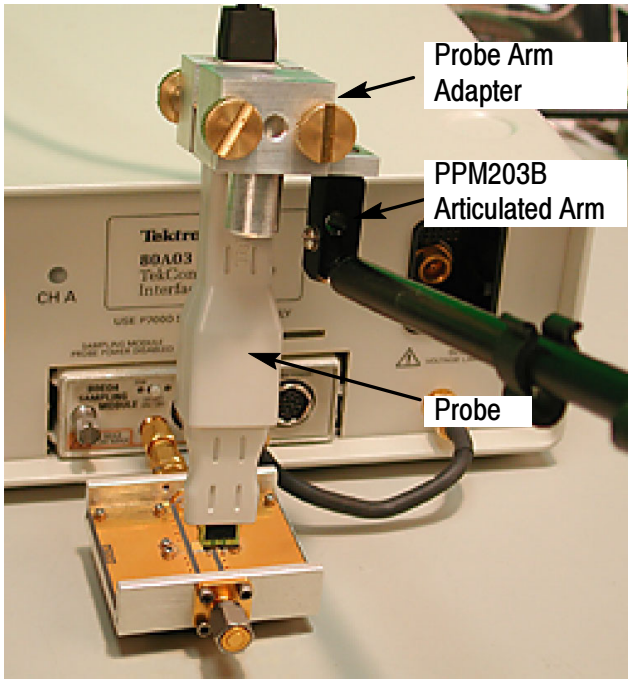


Figure 18: Fixtured probe

Fixtured probing can be used with the Handheld Adapter and Variable Spacing Tip-Clip assembly to make non-soldered, hands-free connections to a circuit under test. Fixtured probing can also be used to reduce the strain on the probe with solder-in probing connections.

Reinstalling the Flex Strip

If the flex strip separates from the Tip-Clip housing, follow these instructions to reinstall the flex strip.

1. Ensure that the two elastomeric backing buttons are in place in the Tip-Clip housing. Position the flex strip and Tip-Clip housing as shown in 1 of Figure 19.
2. Reinstall the flex strip as shown in 2 of Figure 19. Check that the flex strip is seated evenly against the Tip-Clip housing.

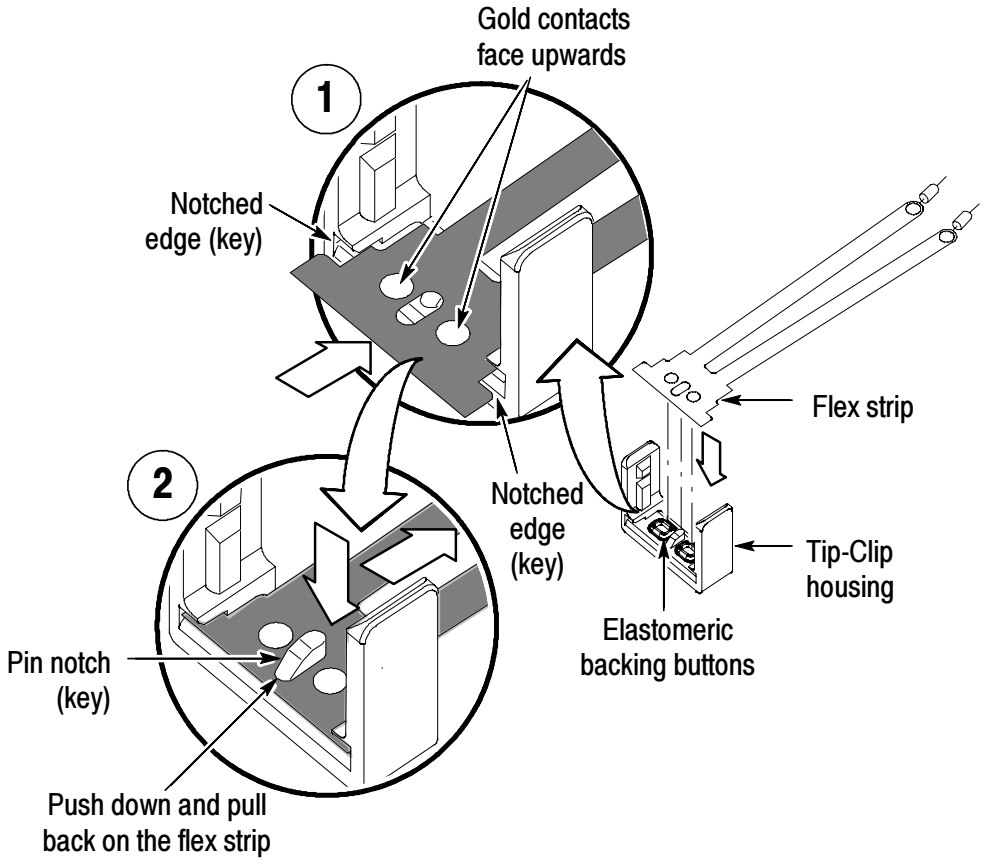


Figure 19: Reinstalling the flex strip

Wire Replacement (P7313 Only)

If you need to resolder a HBW Tip-Clip wire lead, refer to the instructions in the Wire Replacement Kit. This kit is located inside the Accessory Kit box that came with the probe. The Wire Replacement Kit includes the high temperature solder recommended for use in replacing wire leads on the HBW Tip-Clips. The kit also includes both replacement 8 mil wire and 4 mil wire, which is used with smaller circuit board traces and vias.

Accessories

You can reorder the following parts separately if a part number is listed, but in many cases the quantities differ from those originally shipped.

Tip-Clip performance and application information is in this section starting on page 33. For more detailed Tip-Clip information (dimensions and waveforms), see the *Specification* section in your technical reference manual on the probe documentation CD-ROM.

Standard Accessories

The following standard accessories are shipped with the probes, unless otherwise noted as P7313, P7380, or P7360. If a quantity is not listed, it is understood to be a quantity of one.

Table 1: Standard accessories

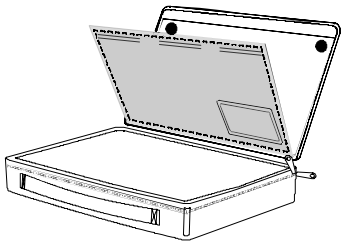
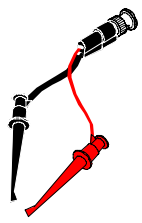
Accessory	Reorder part number and quantity	Description *(includes original shipment quantities)*
	016-1952-XX	**Pouch, nylon carrying case with inserts.** This carrying case has several compartments to hold the probe and accessories.
	013-0342-XX	**BNC (M)-to-Minigrabber adapter.** This adapter connects the probe to the oscilloscope during the functional test.

Table 1: Standard accessories (Cont.)

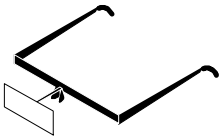
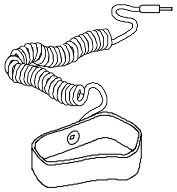
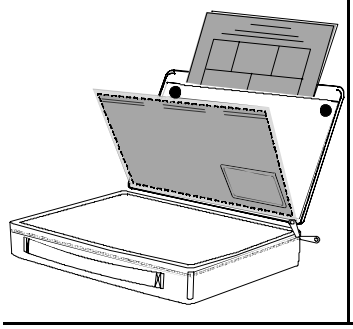
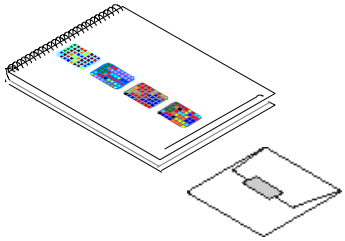
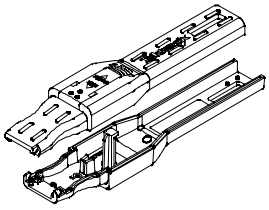
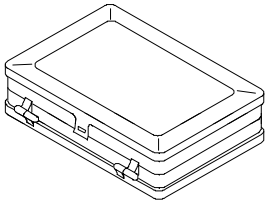
Accessory	Reorder part number and quantity	Description *(includes original shipment quantities)*
	378-0486-XX	**Magni-Spec Magnifier.** A hands-free magnifier that can be worn alone or over eyeglasses to assist you when attaching the Tip-Clip leads to your circuit board or attaching the Tip-Clip Ejector. When not needed, you can flip the magnifier lenses up.
	006-3415-XX	**Antistatic Wrist Strap.** When using the probe, always work at an antistatic work station and wear the antistatic wrist strap.
	---	**Calibration Certificate.** A certificate of traceable calibration is provided with every probe.
	Option D1	**Data Calibration Report.** The Data Calibration Report lists the manufacturing test results of your probe at the time of shipment and is included with every probe.
	001-1389-XX	**Accessory Reorder and Tip-Clip Data Sheet.** Use the accessory reorder sheet as a quick guide for ordering probe accessories. An illustration of each Tip-Clip assembly is on the reorder sheet. This sheet is located in the probe case.

Table 1: Standard accessories (Cont.)

Accessory	Reorder part number and quantity	Description *(includes original shipment quantities)*
	020-2640-XX (English) 020-2648-XX (Japanese) 020-2649-XX (Simplified Chinese)	**User Manual and CD-ROM.** The user manual provides instructions for operating and maintaining the P7313, P7380, and P7360 differential probes. The documentation CD-ROM contains PDFs of primers, basic probe and measurement literature, and the probe manuals (the user manual and a probe specific technical reference).
	015-0717-XX	**HHA Housing.** One pair of Handheld Adapter housings.
	020-2636-XX (P7313) 020-2557-XX (P7380) 020-2690-XX (P7360)	**Accessory Kits.** The kits include an Attachment kit, a Color Band kit, Adhesive Tip-Clip Tape, Keying labels, a Tip-Clip Ejector kit, and an assortment of Tip-Clip assemblies. Keying labels come attached to the inside of the accessory kit lid. Turn the box over for access to the second lid. The Wire Replacement kit comes with the P7313 Accessory Kit only.

Note. *The following standard accessories are included in the Accessory Kits, unless noted otherwise.*

Table 1: Standard accessories (Cont.)

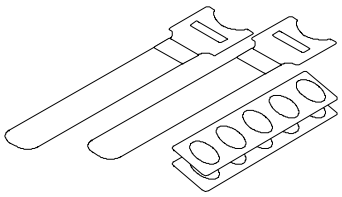
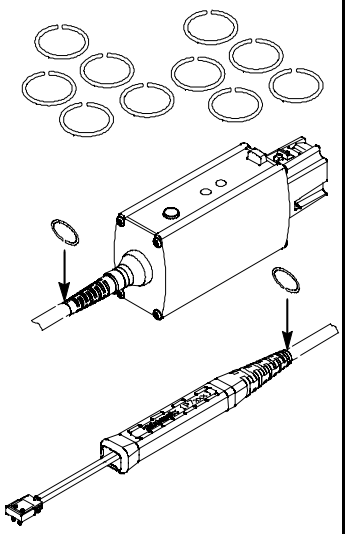
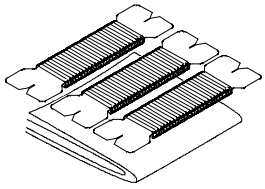
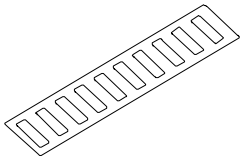
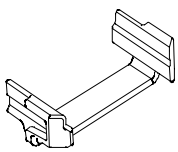
Accessory	Reorder part number and quantity	Description *(includes original shipment quantities)*
	016-1953-XX (two Velcro straps and ten dots)	**Attachment kit.** This kit includes two Velcro fastening straps and ten Velcro dots that are used to stabilize the probe body when taking measurements.
	016-1948-XX (kit of two sets of five colored pairs)	**Color Band Kit**. This kit includes two sets of five colored pairs. When you are using more than one probe, the bands enable you to quickly match the probes to the channels that they are connected to. To use the marker bands, attach a band to the indent on the end of the molded strain relief of the probe cable and on the end of the probe compensation box. Use the color band that matches the color of the channel that the probe is connected to.
	020-2644-XX (kit of three bobbins and an instruction sheet)	**Wire Replacement Kit.** (P7313 Accessory kit only). Includes three bobbins; solder, 4 mil wire, and 8 mil wire. This kit is used to replace wire leads on HBW Tip-Clip assemblies.
 	*(both parts are included when reordering a Tip-Clip assembly)*	**Adhesive Tip-Clip Tape.** (three strips of 10) Use the Tip-Clip Tape to secure the Tip-Clip assembly to your circuit board. **Tip-Clip Ejector.** (3 ea.) The Tip-Clip Ejector assists in the removal of the Tip-Clip assemblies from the probe tip.

Table 1: Standard accessories (Cont.)

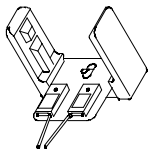
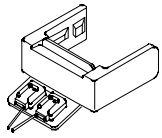
Accessory	Reorder part number and quantity	Description *(includes original shipment quantities)*
 Blue	020-2639-XX (kit of 10) 020-2657-XX (kit of 5)	**HBW Straight Flex, 8 mill wire, Tip-Clip Assembly.** (3 ea.) Bandwidth: >12.5 GHz (P7313) TR: 10/90 <40 ps, 20/80 <25 ps Loading: Z_{MIN} >200 Ω to 10 GHz Highest bandwidth and best probe loading for HBW Tip-Clip assemblies. Using the Wire Replacement Kit allows you the flexibility to solder 8 mil or 4 mil wires to small vias.
 Blue	020-2638-XX (kit of 10) 020-2656-XX (kit of 5)	**HBW Right-Angle Flex, 8 mil wire, Tip-Clip Assembly.** (3 ea.) Bandwidth: >12 GHz (P7313) TR: 10/90 <42 ps, 20/80 <27 ps Loading: Z_{MIN} >150 Ω to 10 GHz Provides an alternative connection orientation. Using the Wire Replacement Kit allows you the flexibility to solder 8 mil or 4 mil wires to small vias.

Table 1: Standard accessories (Cont.)

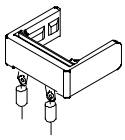
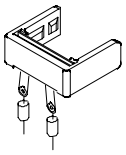
Accessory	Reorder part number and quantity	Description *(includes original shipment quantities)*
 Blue	020-2600-XX (kit of 10)	**Short Flex, Small Resistor, Tip-Clip Assembly.** Bandwidth: >8.0 GHz (P7313 & P7380) 3 ea. TR: 10/90 <55 ps (Guaranteed), 20/80<35 ps Loading: Z_{MIN} 290 Ω to 8 GHz Bandwidth: >6.0 GHz (P7360) 2 ea. T_R: 10/90 <70 ps, 20/80 <50 ps Loading: Z_{MIN} 290 Ω to 6 GHz Best overall signal fidelity. The small resistors are ideal for connecting to small vias and fine pitch circuitry.
 Blue	020-2602-XX (kit of 10)	**Medium Flex, Small Resistor**, **Tip-Clip Assembly**. Bandwidth: >7.0 GHz (P7313 & P7380) 3 ea. T_R: 10/90 <55 ps, 20/80 <35 ps Loading: Z_{MIN} 290 Ω to 8 GHz Bandwidth: >5.0 GHz (P7360) 2 ea. T_R: 10/90 <70 ps, 20/80 <50 ps Loading: Z_{MIN} 290 Ω to 6 GHz Good compromise between ease-of-use and maximum performance when attaching to smaller devices or circuit board vias.

Table 1: Standard accessories (Cont.)

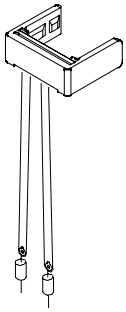
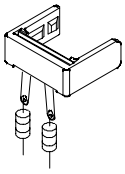
Accessory	Reorder part number and quantity	Description *(includes original shipment quantities)*
 Blue	020-2604-XX (kit of 10)	**Long Flex, Small Resistor**, **Tip-Clip Assembly.** (3 ea.) Bandwidth: >6.0 GHz (P7313 & P7380) T_R: 10/90 <130 ps, 20/80 <40 ps Loading: Z_{MIN} 360 Ω to 8 GHz Bandwidth: >4.0 GHz (P7360) T_R: 10/90 <130 ps, 20/80 <60 ps Loading: Z_{MIN} 360 Ω to 6 GHz Extended reach with good step response. Useful for connecting to hard-to-reach small vias and fine pitch circuitry. Conveniently sized to fit between DIMM modules. Not recommended for signals faster than 4 GHz.
 Red	020-2601-XX (kit of 10)	**Short Flex, Large Resistor, 1/8 W, Tip-Clip Assembly.** (3 ea.) Bandwidth: >8.0 GHz (P7380) T_R: 10/90 <55 ps, 20/80 <35 ps Loading: Z_{MIN} 290 Ω to 8 GHz High bandwidth and good signal fidelity, ideal for connecting to large features.

Table 1: Standard accessories (Cont.)

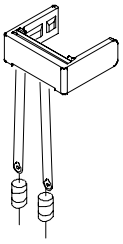
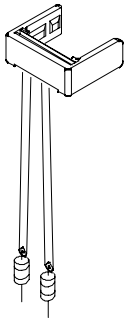
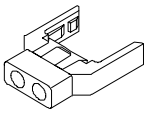
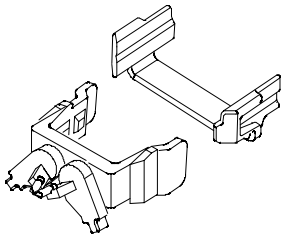
Accessory	Reorder part number and quantity	Description *(includes original shipment quantities)*
 Red	020-2603-XX (kit of 10)	**P7380 Medium Flex, Large Resistor, 1/8 W, Tip-Clip Assembly.** (3 ea.) Bandwidth: >8.0 GHz (P7380) T_R: 10/90 <55 ps, 20/80 <35 ps Loading: Z_{MIN} 260 Ω to 8 GHz Bandwidth: >5.0 GHz (P7360) T_R: 10/90 <70 ps, 20/80 <50 ps Loading: Z_{MIN} 260 Ω to 6 GHz Good compromise between ease-of-use and maximum performance when attaching to larger devices
 Red	020-2605-XX (kit of 10)	**P7380 Long Flex, Large Resistor, 1/8 W, Tip-Clip Assembly.** (3 ea.) Bandwidth: >7.0 GHz (P7380) T_R: 10/90 <75 ps, 20/80 <40 ps Loading: Z_{MIN} 300 Ω to 8 GHz Extended reach with good step response. Useful for connecting to hard-to-reach circuitry with large features. Conveniently sized to fit between DIMM modules. Not recommended for signals faster than 4 GHz.

Table 1: Standard accessories (Cont.)

Accessory	Reorder part number and quantity	Description *(includes original shipment quantities)*
	020-2701-XX	**Square Pin, Tip-Clip Assembly.** (3 ea.) Bandwidth: >6.0 GHz T_R: 10/90 <70 ps, 20/80 <50 ps Use the Square-Pin Tip-Clip assembly for probing 0.025-in diameter square pins spaced 0.1-in on center. Square pins are not an ideal transmission path for high speed electrical signals. Square pins are not recommended for signals faster than 100 ps or 3 GHz.
	020-2596-XX	**Variable Spacing Tip-Clip Kit**.. Bandwidth: >8 GHz (P7313 & P7380) TR: 10/90 <55 ps, 20/80 <35 ps Loading: Z_{MIN} 220 Ω to 8 GHz Bandwidth: >6 GHz (P7360) T_R: 10/90 <70 ps, 20/80 <50 ps Loading: Z_{MIN} 220 Ω to 6 GHz Use the Variable Spacing Tip-Clip assembly for probing test points spaced from 0.020-in to 0.180-in apart. Exercise care when handling the articulated pins. Optional Accessories are not included with the probe.

Optional Accessories

Table 2: Optional accessories

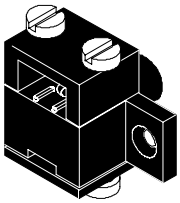
Optional accessory	Part number	Description
	PPM203B	**PPM203B Articulating Arm.** This High precision articulating arm has fine adjustment controls for all three axes. It is designed for probing PC boards, hybrids and MCMs that employ fine-pitch devices and interconnects. Use the Articulating Arm to provide stability and support for the probes when taking measurements. Use the Probe Arm Adapter to attach a probe to the PPM203B Articulating Arm.
	013-0339-XX	**Probe Arm Adapter.** This adapter is used to attach a probe to the end of the PPM203B Articulating Arm or the PPM100 Probe Positioner.
	PPM100	**PPM100 Probe Positioner.** A general purpose bench top probe holder with flexible arm, designed for hands-free probing and fine positioning adjustments. The heavy duty base can be replaced with the clamp for securing the probe arm in a variety of situations.

Table 2: Optional accessories (Cont.)

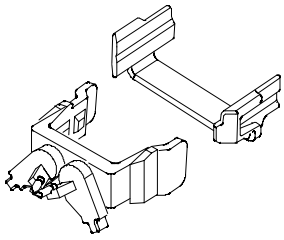
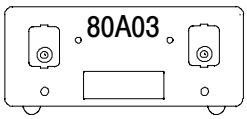
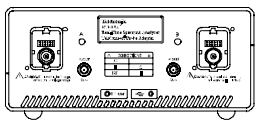
Optional accessory	Part number	Description
	020-2596-XX	**Variable Spacing Tip-Clip Kit**. This kit includes three Variable Spacing Tip-Clip assemblies and three Tip-Clip Ejectors. Bandwidth: >8 GHz (P7313 & P7380) TR: 10/90 <55 ps, 20/80 <35 ps Loading: Z_{MIN} 220 Ω to 8 GHz Bandwidth: >6 GHz (P7360) T_R:10/90 <70 ps, 20/80 <50 ps Loading: Z_{MIN} 220 Ω to 6 GHz Use the Variable Spacing Tip-Clip assembly for probing test points spaced from 0.020-in to 0.180-in apart. Exercise care when handling the articulated pins. Optional Accessories are not included with the probe.

Table 2: Optional accessories (Cont.)

Optional accessory	Part number	Description
	80A03	**80A03 TekConnect Probe Interface Module**. This module allows you to adapt the TekConnect probes with a CSA8200 and TDS8200 Series Sampling Oscilloscopes and a 80E0X Sampling Modules. The interface is comprised of an enclosure that houses a compartment for one 80E0X Electrical Sampling Module and two TekConnect probe inputs. The interface routes the probe signal outputs through SMA connectors on the front panel. Semi-rigid SMA cables link the probe outputs to the 80E0X module inputs. P7313 and P7360 Probes require firmware version 2.0 and above. The P7380 Probe requires firmware version 1.2 and above. The 80A03 Interface Module is required to complete a performance verification of the probe. For the performance verification procedure, refer to the technical reference on the documentation CD that came with your probe.
	RTPA2A	**RTPA2A TekConnect Probe Adapter.** This adapter allows you to connect a TekConnect probe to a Real-Time Spectrum Analyzer.

Options

Option C3. Calibration Service 3 years

Option C5. Calibration Service 5 years

Option D3. Calibration Data Report, 3 years (with Option C3)

Option D5. Calibration Data Report, 5 years (with Option C5)

Option R3. Repair Service 3 years

Option R5. Repair Service 5 years

Option L0. English

Option L5. Japanese

Option L7. Simplified Chinese

Probe Applications

The following are representative applications where the P7313, P7380, and P7360 probe characteristics enable measurements with good signal fidelity. Refer to *Z-Active: A New High Performance Probe Architecture* document (2FW-17826-X, at www.tektronix.com) for an in-depth discussion of these applications.

Dual In-line Memory Module (DIMM) Testing

- Solder a group of Tip-Clip assemblies to the circuit board and leave them in place on critical signal measurement locations. (The DIMMs are then inserted into the motherboard sockets).
- Attach one or more probes to the Tip-Clip assemblies and probe the critical measurement nodes. See Figure 20.

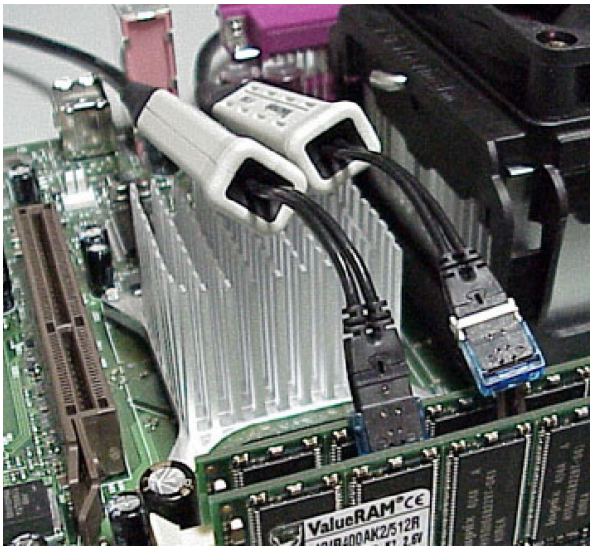


Figure 20: Circuit board with Tip-Clip assemblies

P7000 Probe with a TDS8000 Sampling Oscilloscope

- Connect one channel of the 80A03 to probe a clock that is source synchronous to the signal to be measured, to provide a trigger signal. See Figure 21.
- Connect a cable between the TekConnect socket output connector of the probed trigger signal and the sampling oscilloscope External Trigger input.
- Probe the synchronous data signal you want to measure on the other 80A03 channel.

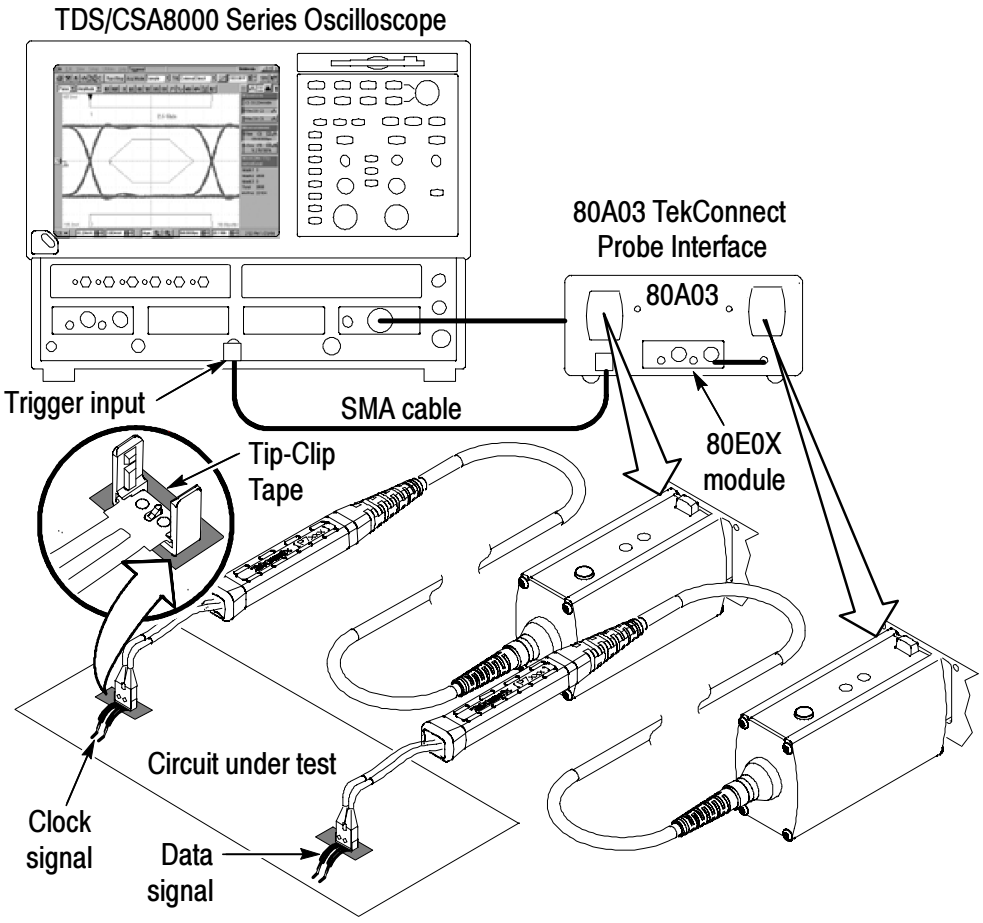


Figure 21: TDS8000 sampling oscilloscope

This TekConnect measurement signal should be connected between the TekConnect socket output and the embedded electrical sampling module in the 80A03 interface using the standard short semi-rigid cable.

If a synchronous clock signal source is not available, then use a 80A05 Module to recover a clean trigger signal that is synchronous to the input signal.

Measuring an RF Signal with a P7000 Series Probe

When the RTPA2A TekConnect probe adapter is used with a Real-Time Spectrum Analyzer and TekConnect probe, specific RF components can be measured with greater ease. See Figure 22.

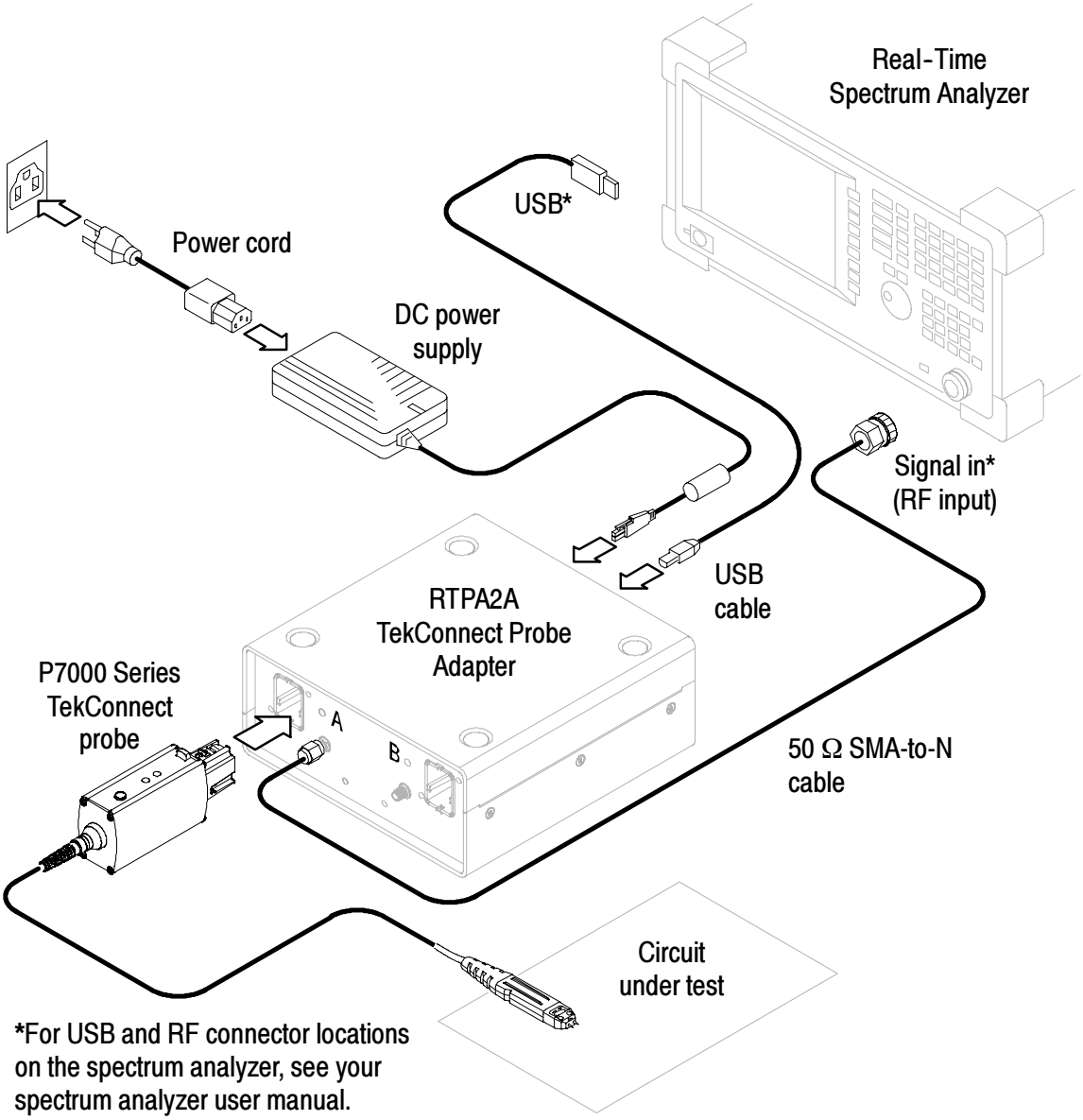


Figure 22: RTPA2A Probe adapter setup

Measuring a PCI Express signal with a P7000 probe

RT-Eye Application Software. When the P7000 probe is used with a TDS6000 or TDS7000 real-time oscilloscope configured with RT-Eye application software, physical layer testing on PCI Express signals is performed with greater ease and accuracy. See Figure 23.

As shown in Figure 23, the RT-Eye software separates the acquired transition and nontransition bits. The RT-Eye software also provides an extensive collection of measurements and statistics on the analyzed waveform record.

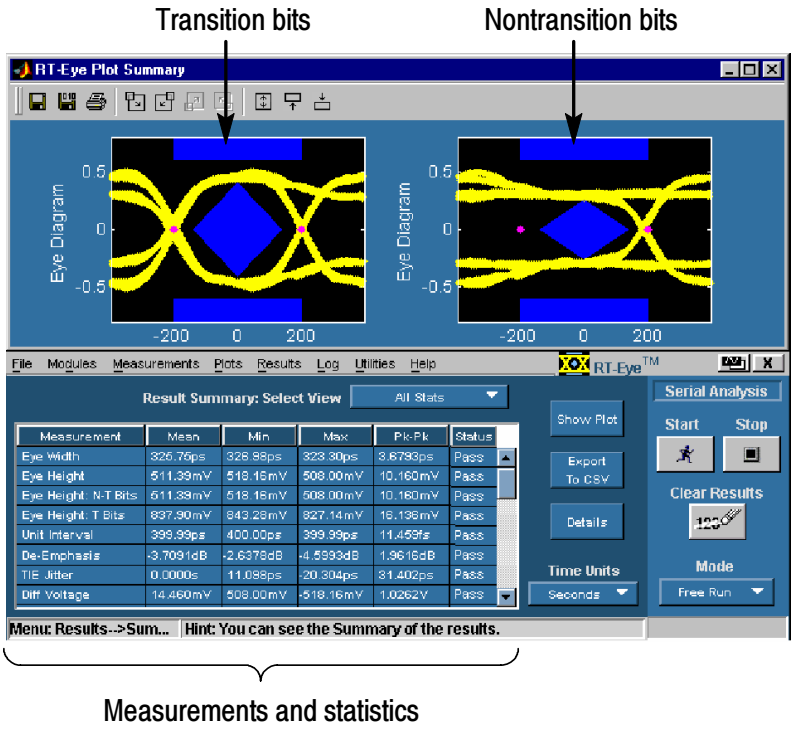


Figure 23: RT-Eye application

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