RIGOL

PVA8000S Series

Single-ended Active Probe

User Guide

Sep. 2024

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1 Safety Requirement

1.1 General Safety Summary

High voltage measurement is involved in using the product. Read the following safety precautions before using the product to avoid personal injury and to prevent damage to this product or any equipment connected to this product.

To prevent possible hazards, be sure to use this product in accordance with the regulations.

- **Ground the Product Properly.**

  The product is indirectly grounded through the ground lead of the host power cord. To avoid electric shock, the ground lead must be connected to the ground. Make sure that the product is properly grounded before connecting the product's input or output terminals.

- **Connect or Disconnect the Equipment Properly.**

  Connect the probe output terminal to the instrument and connect the ground lead to earth ground before connecting the probe to the circuit under test. Disconnect the probe input terminal and the probe ground lead from the circuit under test before disconnecting the probe from the instrument.

- **Observe All Terminal Ratings.**

  To avoid fire or electric shock, please observe all ratings and markings on the product. Before making any connections to the product, consult the User Guide of the product for more details about ratings.

- **Avoid Direct Contact with High Voltages.**

  Make sure the system is powered off before connecting or disconnecting the probe. Handle the probe with caution even if the system is powered off, as dangerous voltages can remain inside the capacitor.

- **Use the Product only in Specified Measurement Category.**

  The probe only applies to circuits not directly connected to the mains (CAT I). It is not applicable to CAT II, CAT III, or CAT IV measurement.

- **Check the Equipment Status Periodically.**

  Check the physical status of the probe and its accessories, including the cables, interfaces, or any visible damage or wear. Do not use the probe with damaged, cracked, or defective cable. Stop using it with suspected failures.

- **Do Not Operate with Suspected Failures.**

  If you suspect that there is damage to the product, have it inspected by RIGOL authorized personnel before further operations. Any maintenance, adjustment or

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replacement especially to circuits or accessories must be performed by RIGOL authorized personnel.

- **Avoid Exposed Circuitry.**

  Do not touch exposed circuits and components after the power is connected.

- **Do Not Operate in Wet Conditions.**

  For indoor use only. To avoid short circuit inside the instrument or electric shock, never use the product in a humid environment.

- **Do Not Operate in an Explosive Atmosphere.**

  To avoid personal injuries or damage to the instrument, never operate the instrument in an explosive atmosphere.

- **Keep Product Surfaces Dry and Clean.**

1.2 Safety Notices and Symbols

Safety Notices in this Manual:



WARNING

Indicates a potentially hazardous situation or practice which, if not avoided, will result in serious injury or death.



CAUTION

Indicates a potentially hazardous situation or practice which, if not avoided, could result in damage to the product or loss of important data.

Safety Notices on the Product:

- **DANGER**

  It calls attention to an operation, if not correctly performed, could result in injury or hazard immediately.

- **WARNING**

  It calls attention to an operation, if not correctly performed, could result in potential injury or hazard.

- **CAUTION**

  It calls attention to an operation, if not correctly performed, could result in damage to the product or other devices connected to the product.

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Safety Symbols on the Product:



Hazardous Voltage



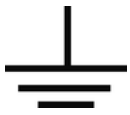
Safety Warning



Protective Earth Terminal



Chassis Ground



Test Ground

1.3 Environmental Considerations

The following symbol indicates that this product complies with the WEEE Directive 2012/19/EU.



The equipment may contain substances that could be harmful to the environment or human health. To avoid the release of such substances into the environment and avoid harm to human health, we recommend you to recycle this product appropriately to ensure that most materials are reused or recycled properly. Please contact your local authorities for disposal or recycling information.

You can click on the following link *https://int.rigol.com/services/services/declaration* to download the latest version of the RoHS&WEEE certification file.

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2 Document Overview

This manual gives you a quick overview of the technical specifications and basic operation methods of the PVA8000S Series Single-ended Active Probe.

TIP

For the latest version of this manual, download it from RIGOL official website (*http://www.rigol.com*).

Publication Number

UGE38100-1110

Content Conventions in this Manual

The PVA8000S Series Single-ended Active Probe includes the following model.

Model	Bandwidth
PVA8150S	1.5 GHz

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3 Product Overview

3.1 Introduction

The PVA8000S is the single-ended active probe solution for high frequency applications. It allows you to replace the probe tip and ground lead to fit different test point spacing. The probes can be mounted magnetically in line for you to use them at the same time. The probe is equipped with a LED headlight to illuminate the area around the probe tip.

The PVA8000S series is compatible with the auto-recognized interface of RIGOL oscilloscopes (e.g. MSO8000, DS70000, DHO4000) and can be recognized and configured automatically. It simplifies the operation and improves the user experience with immediate test.

3.2 General Inspection

1. **Inspect the packaging**

   If the packaging has been damaged, do not dispose the damaged packaging or cushioning materials until the shipment has been checked for completeness and has passed both electrical and mechanical tests.

   The consigner or carrier shall be liable for the damage to the instrument resulting from shipment. RIGOL would not be responsible for free maintenance/rework or replacement of the instrument.

2. **Check the probe**

   In case of any mechanical damage, missing parts, or failure in passing the electrical and mechanical tests, contact your RIGOL sales representative.

3. **Check the accessories**

   Please check the accessories according to the packing lists. If the accessories are damaged or incomplete, please contact your RIGOL sales representative.

3.3 Probe Size

The figure below shows the main body of the PVA8000S Series Single-ended Active Probe.

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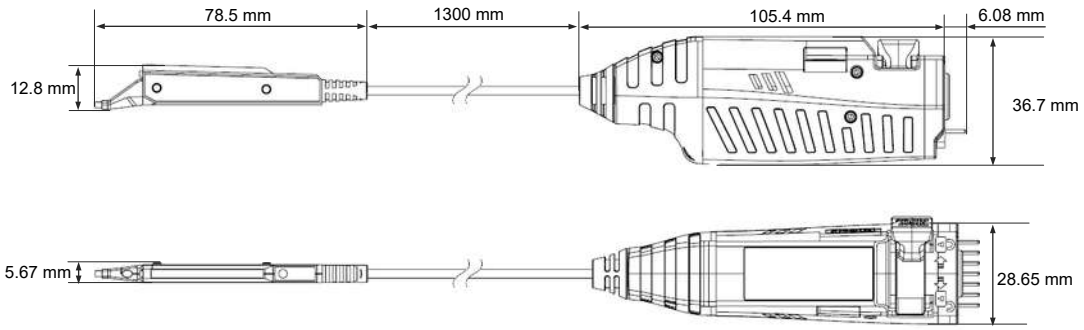


Figure 3.1 Probe Size

3.4 Probe Overview

The PVA8000S is as shown in the figure below.

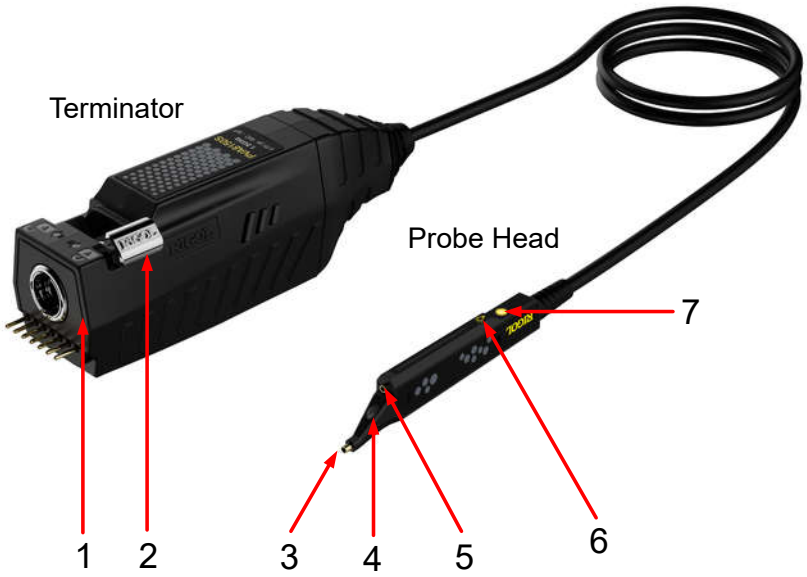


Figure 3.2 PVA8000S

NOTE

The terminator in the figure above is connected to the oscilloscope via the output connector. It will power the PVA8000S automatically when the oscilloscope is powered on.

1. Probe output connector, used to connect the input interface of the oscilloscope.
2. Lever switch. Push the lever to lock ( ) or unlock ( ) the connection between the the probe and the oscilloscope interface.
3. Probe tip socket, used to connect the probe or adapter to input measurement signals.

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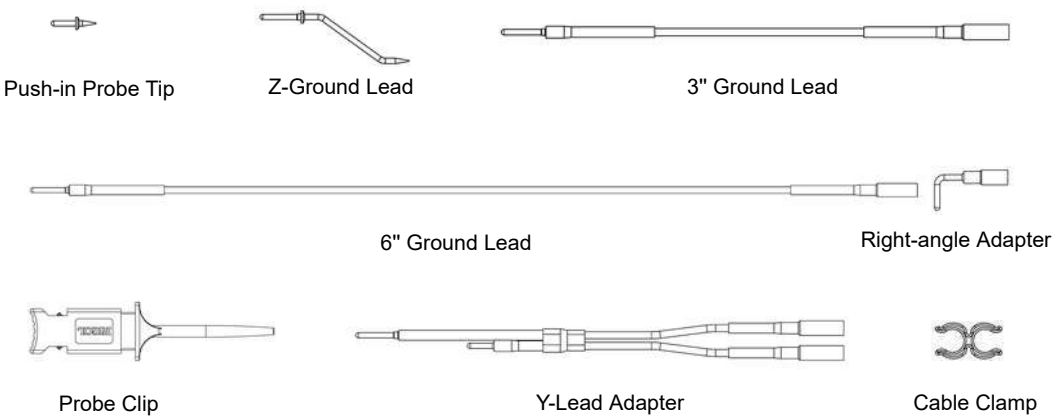
4. LED headlight, used to illuminate the area around the probe tip. This headlight has a fixed intensity. You can use the touch switch on the probe's body to turn on or off the light.
5. Ground socket, used to connect the ground lead or adapter for ground connections.
6. Probe headlight touch switch, used to control the on/off of the headlight.
7. Channel indicator light. When the probe is connected to a channel of the oscilloscope, the indicator is lit with the color consistent with that channel. It enables you to quickly identify the channel connected to each probe.

3.5 Standard Accessories

The table below lists the standard accessories of the PVA8000S series active probe. For how to use them, please refer to *To Use Probe Accessories*.

Item	Quantity
Push-in Probe Tip	10
Z-Ground Lead	2
3'' Ground Lead	2
6'' Ground Lead	2
Right-angle Adapter	2
Probe Clip	2
Y-Lead Adapter	2
Cable Clamp	2
Probe Bag	1
Storage Box	1

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4 To Use the Probe

When using the PVA8000S Series Single-ended Active Probe, correct operation methods can guarantee the probe performance, prolong the service life of the probe, and ensure valid signal measurement results. This chapter elaborates on how to use the PVA8000S series properly.

CAUTION

Do not bend or pull the probe cable to avoid any mechanical shocks to the probe in order to guarantee the product performance.

4.1 To Connect the Oscilloscope

After the PVA8000S Series Single-ended Active Probe is properly connected to RIGOL MSO8000/DS70000/DHO4000 series oscilloscope, the oscilloscope recognizes the probe automatically and provides power and offset voltage for the probe via the front panel. At this point, you can adjust the offset voltage (see *To Adjust Offset Voltage*) and calibrate the probe (see *To Calibrate the Probe*) via the oscilloscope front panel.

Follow the steps below to connect the probe and the oscilloscope:

1. Connect the probe output interface to an input connector of the oscilloscope. Before the connection, make sure that the lever switch of the probe controller is in the unlock position ( ).
2. Pull the lever switch to the lock position ( ). Make sure that the input impedance of the oscilloscope matches the output impedance of the probe.

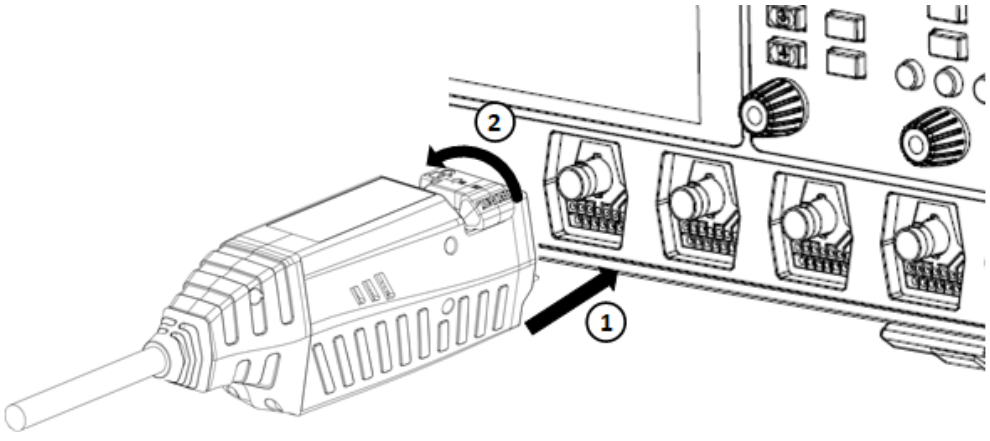


Figure 4.1 Connect the Oscilloscope

3. Use any probe auxiliary device to connect the probe to the circuit under test.

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4. If you want to disconnect the probe from the oscilloscope, first use the lever switch to unlock ( ) their connection and then pull the connector straight out of the oscilloscope.

CAUTION

Never attempt to pull the probe from the BNC connector of the oscilloscope when the probe is locked, or it may cause damage to the probe.

4.2 To Use Probe Accessories

The PVA8000S Series Single-ended Active Probe offers various accessories to meet different measurement requirements. This section introduces the purpose and using method of each accessory.

TIP

The parts of the PVA8000S series can be ordered from RIGOL (see *Standard Accessories*).

Push-in Probe Tip

The push-in probe tip applies to the hand-held spot test for near-distance test points or the soldering test. It can also be used with the other socketed leads or adapters to meet different measurements.

To attach the probe tip, seat the tip into the probe tip socket and push the tip in until it is seated. To remove the probe tip, gently grab the tip with pliers and pull it out along the axis of the probe.

CAUTION

Attach and remove the sharp probe tip with care to avoid injury.

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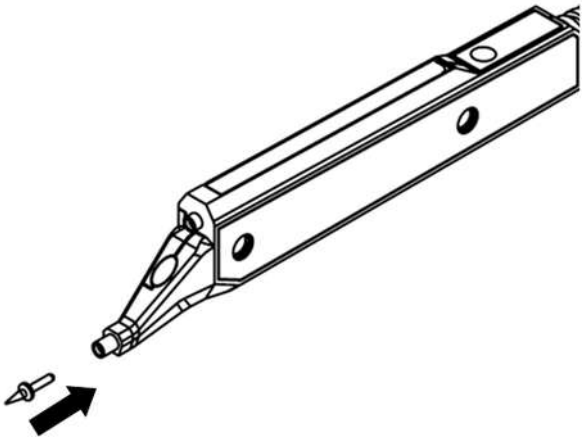


Figure 4.2 Push-in Probe Tip

Z-Ground Lead

Using a Z-ground lead can significantly shorten the ground path and lower the inductance of the lead.

To attach the Z-ground lead, gently press the lead pin into ground socket on the probe head until it is seated.

CAUTION

Attach and remove the sharp ground lead pin with care to avoid injury.

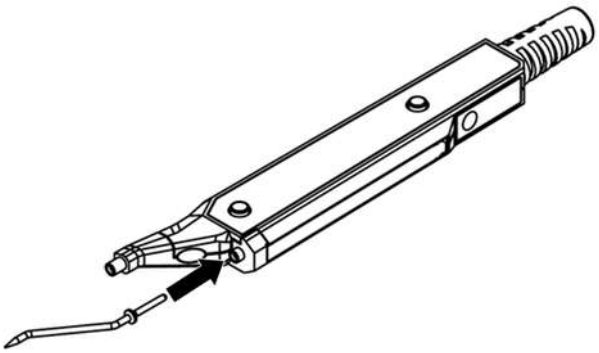


Figure 4.3 Z-Ground Lead

3-inch/6-inch Ground Lead

This product provides two 3-inch ground leads and two 6-inch ground leads. The socket end of the ground lead can be connected to any of the probe tips and adapters, or fitted onto 0.025 inch pins.

1. Seat the lead pin into the probe ground socket and then gently push it in until it is seated.

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2. Connect the socket end of the ground lead to adapters, probe tips, or fitted onto 0.025 inch pins.

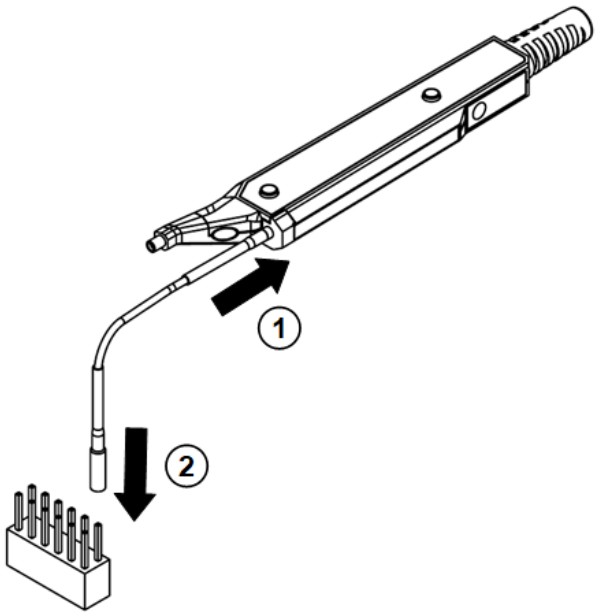


Figure 4.4 Ground Lead

TIP

The longer the ground lead, the higher the inductance. Therefore, maintain the ground path as short as possible.

Probe Clip

Use the probe clip to test dense circuitry. It can be used with the Y-lead adapter and ground lead.

1. Press the socket of the adapter or ground lead into the handle of the probe clip.
2. Then press the handle of the clip to extend the metal hook.
3. Rotate the clip for proper orientation and attach the hook to the test pin.

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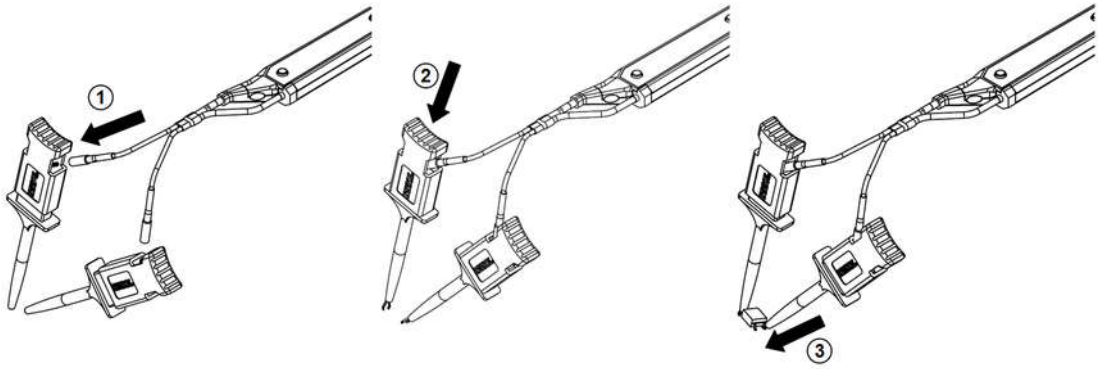


Figure 4.5 Probe Clip

Y-lead Adapter

The Y-lead adapter can extend the physical reach of the probe. The socket end of the Y-lead adapter can be connected to any of the probe tips and adapters, or fitted onto 0.025 inch pins.

1. Connect the lead pin to the probe head socket.
2. Connect the socketed end of the adapter to the circuit or adapter (e.g. probe clip).

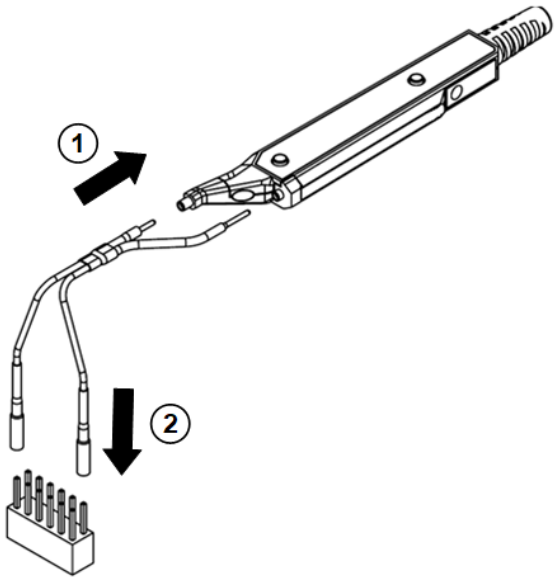


Figure 4.6 Y-lead Adapter

Right-angle Adapter

The right-angle adapter allows the probe to lie flat against the circuit board. It enables probing in limited vertical space such as between circuit boards. The right-angle adapter can be used directly with the probe, or attached to the Y-lead adapter or ground leads.

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1. Connect the lead pin of the adapter to the probe socket, Y-lead adapter, or ground lead.
2. Connect the other end of the adapter to the circuit.

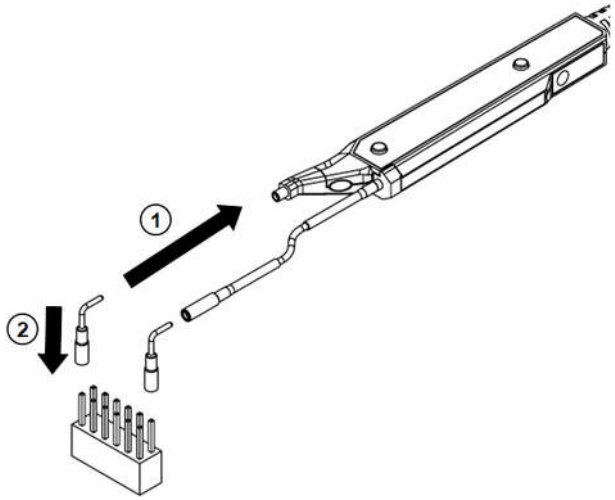


Figure 4.7 Right-angle Adapter

Cable Clamp

Multiple PVA8000S probe heads can be mounted magnetically in line for combined tests. When such a test is necessary, use the cable clamp to secure the cable close to the probe head for a stable probing system.

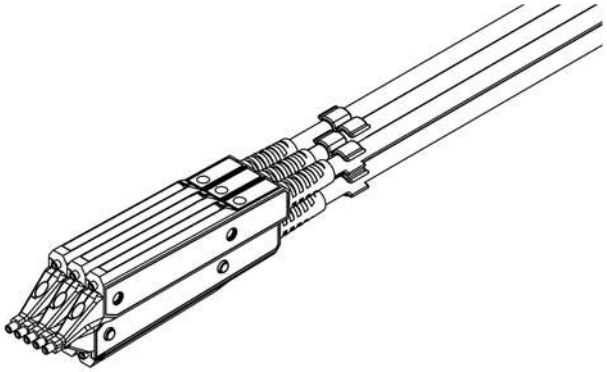


Figure 4.8 Cable Clamp

4.3 Function Inspection

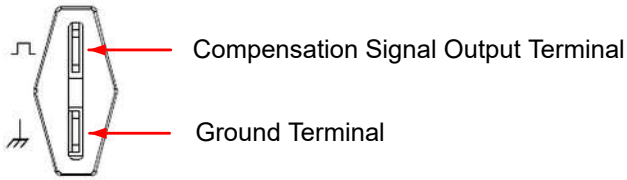
Use the following measurement procedure to perform the function inspection to ensure that your probe is functioning properly.

1. Restore the oscilloscope to its factory default settings.

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2. Connect the probe to any channel (e.g. CH1) of the oscilloscope and ensure that the input impedance of the oscilloscope matches the output input impedance of the probe.
3. Use the Y-lead adapter and two probe clips to connect the probe tip to the probe compensation terminal of the oscilloscope.

   The oscilloscope's probe compensation terminal is as shown in the figure below. Please connect the probe ground terminal to the "Ground Terminal" and connect the probe signal terminal to the "Compensation Signal Output Terminal".



4. Set the probe ratio based on the attenuation ratio of the probe. Then click or tap **Auto** and observe the waveform on the display. If the probe is functioning properly, a square wave should be displayed on the oscilloscope.

4.4 To Adjust Offset Voltage

RIGOL MSO8000/DS70000/DHO4000 series oscilloscope provides offset voltage for the PVA8000S Series Single-ended Active Probe. The offset voltage is used to adjust the signal under test that is out of the input dynamic range of the active probe amplifier to ensure the signal integrity.

You can adjust the offset voltage via the oscilloscope. The method is as follows:

1. Refer to *To Connect the Oscilloscope* to connect the PVA8000S series probe to the channel (e.g. CH1) input terminal of the oscilloscope.
2. Open the probe setting menu of the oscilloscope to adjust the offset voltage.

TIP

For how to open the menu and set the parameter, please refer to the manual of your oscilloscope.

4.5 To Calibrate the Probe

Before using the PVA8000S Series Single-ended Active Probe, you need to calibrate the probe. The method is as follows:

1. Connect the probe to the analog channel of the oscilloscope (taking the CH1 of DHO4000 as an example).
2. Click or tap the channel status label at the bottom of the screen to open the Vertical menu. Then click or tap **Probe** > **CH1** > **Calibration** and the oscilloscope

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will calibrate the probe automatically. The calibration takes about 2 minutes. After the calibration is completed, the prompt message "Probe calibrated successfully" or "Probe calibration failure" will be displayed on the oscilloscope based on the calibration result.

TIP

The calibration operation may differ for different oscilloscope models. For details, refer to the User Guide of your oscilloscope.

NOTE

The specification of the PVA8000S series depends on the calibration of the probe. After the calibration is completed, the DC gain, offset voltage zero point, and offset gain are calibrated. After the probe is connected, you can check the probe information including the vendor, model, serial number, and the last calibration time on the probe setting menu. After power-on, the PVA8000S only requires one manual calibration at most. No more calibration is required to ensure measurement accuracy.

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5 Care and Cleaning

Care

Do not leave the probe and its accessories where it may be exposed to sunlight for long periods of time.



CAUTION

Do not expose the probe and its accessories to caustic liquids.

Cleaning

Clean the probe and its accessories according to the operating conditions.

1. Disconnect the probe from the oscilloscope or the power source.
2. Wipe the exterior surfaces of the probe and its accessories with a soft cloth dampened with a mild detergent or water solution.



WARNING

To avoid short circuits or personal injury caused by moisture, make sure that the probe is completely dry before use.

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6 Specifications

Technical specifications are valid when:

- The probe is calibrated at 23°C ± 5°C ambient temperature
- The probe is powered by normal power supply
- The temperature, altitude, and humidity of the environment in which the probe is located cannot exceed the limits of the stated environmental requirements.

Table 6.1 Technical Specifications

Technical Specifications	PVA8150S
Bandwidth (-3 dB)	1.5 GHz
DC Attenuation Accuracy	10:1 ± 1%
System Bandwidth	1.5 GHz@2 GHz DSO
Rise Time (calculated, 10%-90%)	<250 ps
Input Capacitance	<1 pF
Input Resistance	1 MΩ ± 1%
Input Dynamic Range	-10 V to +10 V
Offset Range	-12 V to +12 V
Offset Error (Output Zero)[1]	<±2 mV
Flatness	≤0.4dB (100 kHz to 100 MHz) ≤0.6dB (100 MHz to 500 MHz) ≤1.0dB (500 MHz to 1 GHz) ≤1.5dB (1 GHz to 1.5 GHz)
Non-destructive Input Voltage (Max.)	±20 V (DC + Peak AC)
Probe Noise	<2 mVrms (referred to input)
Output Impedance	50 Ω

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Technical Specifications	PVA8150S
Propagation Delay	7.2 ns ± 200 ps
ESD	8 kV HBM

Table 6.2 Environmental Characteristics

Environmental Characteristics	Specification
Operating Temperature	0℃ to 50℃
Storage Temperature	-40℃ to +70℃
Operating Humidity	95% RH @40℃
Storage Humidity	90% RH @65℃
Operating Altitude	4000 m

Table 6.3 Mechanical Characteristics

Mechanical Characteristics	PVA8150S
Size	Refer to *Figure 3.1*
Cable Length	1.3 m
Weight	Probe Net Weight: 163 g ± 10 g Probe Kit (package included): 763 g ± 50 g

NOTE

[1]: Typical value. The specifications would change when different scales are selected.

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7 Warranty

RIGOL TECHNOLOGIES CO., LTD. (hereinafter referred to as RIGOL) warrants that the product mainframe and product accessories will be free from defects in materials and workmanship within the warranty period. If a product proves defective within the warranty period, RIGOL guarantees free replacement or repair for the defective product.

To get repair service, please contact your nearest RIGOL sales or service office.

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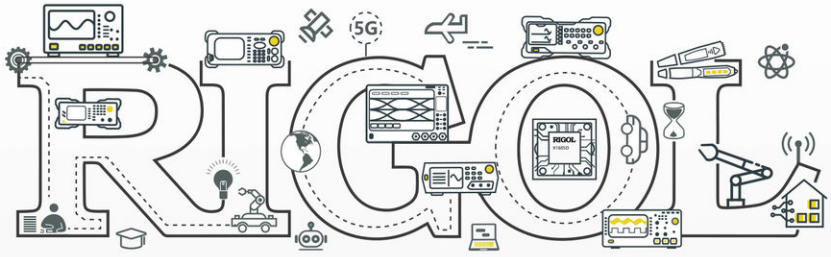




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