RIGOL

PHA1150B/2150B/5150B

High Voltage Differential Probe

User Guide

Aug. 2025

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Contact Us

If you have any problem or requirement when using our products or this manual, please contact RIGOL.

E-mail: service@rigol.com

Website: *http://www.rigol.com*

Section	Description	Page

1 Safety Requirement

1.1 General Safety Summary

CAUTION

This product involves high-voltage measurements. For your own safety and the safety of the product, please read this manual carefully before use.

- **Ground the Product Properly.**

  Make sure that the probe output terminal is connected to the oscilloscope and the oscilloscope is grounded properly before connecting the probe to the circuit under test.
- **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. Do not connect the probe to any lead whose voltage exceeds its rating.
- **Connect or Disconnect the Equipment Properly.**

  Connect the probe output terminal to the oscilloscope 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 oscilloscope.
- **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 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 without Covers.**

  Do not operate the product with the case open.
- **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**

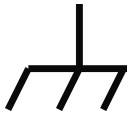
  It calls attention to an operation, if not correctly performed, could result in damage to the product or other devices connected to the product.

Safety Symbols on the Product:

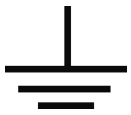
Hazardous Voltage

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.

2 Document Overview

This manual gives you a quick overview of the technical specifications and basic operation methods of the PHA1150B/2150B/5150B High Voltage Differential Probe.

TIP

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

Publication Number

UGE40100-1110

Content Conventions in this Manual

The PHA1150B/2150B/5150B High Voltage Differential Probe includes the following models. Unless otherwise specified, this manual takes PHA1150B as an example to illustrate the functions and basic operations of the series.

Model	Bandwidth
PHA1150B	100 MHz
PHA2150B	200 MHz
PHA5150B	500 MHz

3 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.

4 Product Overview

4.1 Introduction

PHA1150B/2150B/5150B High Voltage Differential Probe connects the voltage under test through the high voltage differential input cables and converts the high differential voltage to low voltage. Its output interface can be connected to a waveform measurement instrument which will display the voltage waveform.

Key Features

- High bandwidth, meeting the requirements of most high-frequency test systems.
  - PHA1150B: 100 MHz
  - PHA2150B: 200 MHz
  - PHA5150B: 500 MHz
- Two attenuation ranges, meeting the requirements of most common mode test circuits.
  - PHA1150B/PHA2150B:

    20×: 150 V (DC + Peak AC)

    200×: 1500 V (DC + Peak AC)
  - PHA5150B:

    50×: 150 V (DC + Peak AC)

    500×: 1500 V (DC + Peak AC)

- PHA1150B and PHA2150B support the 5 MHz bandwidth limit function[1].

  When measuring low frequency signals, it can reduce high frequency noise and interference to measure FETs switching frequency in most switching power supplies.
- Dual-range switching, improving the signal to noise ratio (SNR) effectively to meet more test circuit requirements.
- Quick Zero setting. Short-circuit the differential probe and press the Zero button. The differential probe can be zeroed quickly.
- Standard BNC output interface, working with waveform measuring instruments of most manufacturers.
- Overvoltage alarm. LED flashes and buzzer beeps as an overrange alert for your safety and assurance.

Note[1]: When the 5 MHz bandwidth limit function is enabled, it reduces the high frequency components, noise, and harmonics, making it easier to test and analyze the low frequency signals.

Applications

PHA1150B/2150B/5150B can used in the following situations where high-voltage floating measurements are required.

- Floating voltage measurements
- Switching power supply design
- Inverter, UPS power supply measurements
- Frequency converter measurements
- Electronic ballast design
- Third generation semiconductor test
- High voltage isolation measurements
- Power conversion and related design
- Low-voltage electrical appliance test
- Electrical engineering experiment
- Motor drive design
- Power electronics and power transmission experiments

4.2 Probe Overview

PHAX150B series includes PHA1150B, PHA2150B, and PHA5150B models. This manual takes PHA1150B as an example for illustration.

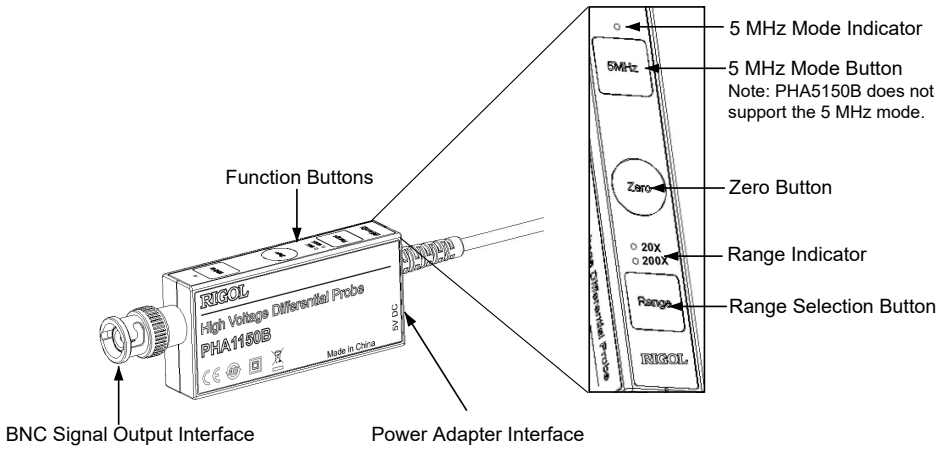


Figure 4.1 Probe Controller

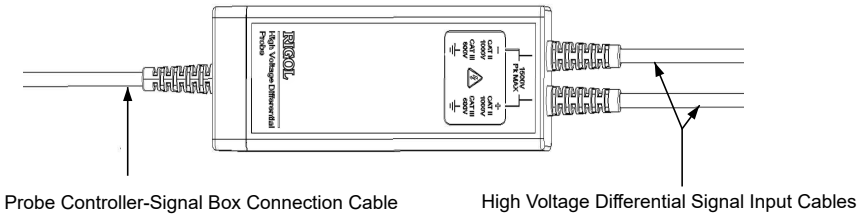


Figure 4.2 Signal Box

BNC Signal Output Interface

Standard BNC output interface, working with waveform measuring instruments of most manufacturers.

Power Adapter Interface

The power requirement of the probe is DC 5 V. Please use the power adapter and USB cable provided in the accessories to connect the probe to the AC power source.

Function Buttons

- 5 MHz Mode Indicator, used to indicate the on/off status of the 5 MHz mode. The indicator lights up when the 5 MHz mode is enabled. Note that PHA5150B does not support the 5 MHz mode and therefore does not provide the indicator.
- 5 MHz Mode Button, used to enable or disable the 5 MHz bandwidth limit function. When measuring low frequency signals, enabling the 5 MHz mode can reduce the interference of high frequency signals. Note that PHA5150B does not support the 5 MHz mode and therefore does not have the button.
- Zero Button. Short-circuit the differential probe and press the Zero button. The differential probe can be zeroed quickly.

- Range Selection Button, used to select between the voltage ranges of the probe. The voltage range settings of different models are as follows:
  - PHA1150B/PHA2150B:

    20×: 150 V maximum measurable voltage.

    200×: 1500 V maximum measurable voltage.
  - PHA5150B:

    50×: 150 V maximum measurable voltage.

    500×: 1500 V maximum measurable voltage.
- Range Indicator, used to indicate the current range of the probe.

High Voltage Differential Signal Input Cable

Used to connect the insulated plunger hook clip for measuring the voltage input signal. You can also use extension cables to extend the length of the input cables. When using the extension cables, the frequency of the signal under test should be less than 5 MHz.

Probe Controller-Signal Box Connection Cable

Used to connect the probe controller and the signal box.

4.3 Standard Accessories

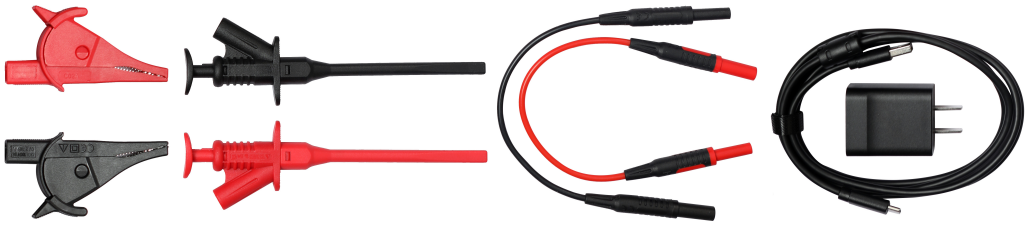
This section lists the standard accessories of the PHA1150B/2150B/5150B High Voltage Differential Probe.

Table 4.2 PHA1150B/2150B/5150B High Voltage Differential Probe Standard Accessories

Accessory	Quantity
Voltage probe body	1
Alligator clip	Red: 1; Black: 1
Retractable test clip	Red: 1; Black: 1
Input extension cable, 30 cm	Red: 1; Black: 1
Power adapter conforming to the standard of the destination country	1
USB Type-C cable, 1.2 m	1

Accessory	Quantity
Packing list	1
Warranty Card	1

Accessories



Alligator Clip | Retractable Test Clip | Input Extension Cables (30 cm) | USB Cable & Power Adapter

5 To Use the Probe

When using the PHAX150B Series High Voltage Differential Probe, correct operation methods can guarantee the probe performance, prolong the service life of the probe, and ensure valid signal measurement results. Before using the probe, read this chapter and *Safety Requirement* carefully to learn how to use the probe and understand the safety requirements including potential dangers.

5.1 Measurement Steps

Before measurements, please estimate the measured voltage to verify that it is within the probe range. If it exceeds the voltage range, select an appropriate probe, otherwise it may cause inaccurate measurements or damage to the probe, and may even cause safety accidents.

1. **Power the probe**. Use the power adapter provided in the accessories to power the differential probe.
2. **Connect the oscilloscope**. Connect the BNC output interface of the probe to an input connector of the oscilloscope (make sure that the oscilloscope is grounded properly).
3. **Select the range**. Select the proper voltage range for the probe according to the measured voltage.
4. **Set the oscilloscope**. Set the input impedance of the oscilloscope according to the output impedance setting of the probe (PHA1150B/PHA2150B: 1 MΩ; PHA5150B: 50 Ω). Adjust the attenuation value of the oscilloscope to be consistent with the probe range, and adjust the vertical scale of the oscilloscope according to the measured voltage.
5. **Connect the DUT**. Make sure that the DUT has no power applied. Select a proper probe clip according to the DUT. Install one end of the probe clip on the probe input cable, and connect the other end to the DUT.
6. **Turn on the DUT and start the test**. When testing, the probe body should stay as far away from the high-voltage pulse circuit as possible to reduce the interference to the probe.

CAUTION

If the measured voltage exceeds the probe range, the probe range indicator flashes and the alarm occurs. In this case, shut down the DUT immediately.

After the test is completed, disconnect the power supply of the DUT and then power off the probe. Disconnect the two input ends of the probe from the test points and disconnect the BNC end from the measuring instrument.

TIP

Try not to use extension cables when measuring, or it could bring more noise. If the input cables must be extended, make sure the extension cables are of identical length and twist them together. The input frequency should not exceed 5 MHz, or it will cause a certain error to the output.

5.2 Measurement Precautions

1. When connecting the differential probe to the oscilloscope, the bandwidth of the oscilloscope should not be less than that of the probe.
2. The channel input impedance of the oscilloscope should be consistent with the output impedance of the probe (PHA1150B/PHA2150B: 1 MΩ; PHA5150B: 50 Ω).
3. Before measurements, calibrate the zero point of the probe. Short-circuit the two input ends, power on, and press the Zero button. The range indicator lights flash alternately. After the 5 MHz indicator flashes, a "Di" sound indicates that the calibration is successful. Three short "Di" sounds indicate that the calibration has failed and that the probe needs to be recalibrated.
4. It is recommended to use the probe after 10 minutes of warm-up to get more accurate results.
5. If the range indicator flashes and beeps rapidly, it is an over-voltage warning and you should switch to higher range.

5.3 Troubleshooting

When using the probe, the following faults may exist. Please use the methods below to fix the problem. If the problem still persists, please contact RIGOL.

1. **The indicator light does not work.**
   a. Check the connection between the power adapter plug and the power socket.
   b. Check the connection between the power adapter output and the probe power interface.
   c. Check whether the power adapter works properly.
2. **The measured waveform can not be displayed stably or has obvious errors.**
   a. Check the connection between the probe input and the probe clip and between the probe clip and the test point.
   b. Check the connection between the probe output and the measuring instrument.
   c. Change the probe or measuring instrument to clear the fault.

6 Specifications

Technical Specifications

Item	PHA1150B	PHA2150B	PHA5150B
Bandwidth (-3 dB)	100 MHz	200 MHz	500 MHz
Rise Time	≤3.5 ns	≤1.75 ns	≤0.7 ns
Range Setting (Attenuation Ratio)	20×/200×		50×/500×
Accuracy	±2%		
Max. Differential Input Voltage (DC + AC peak)	20×: ±150 V 200×: ±1500 V		50×: ±150 V 500×: ±1500 V
Max. Voltage to Ground	CAT II 1000 V CAT III 600 V		
Noise	Full bandwidth: 20×: ≤25 mVrms 200×: ≤80 mVrms 5 MHz bandwidth limit: 20×: ≤10 mVrms 200×: ≤60 mVrms		Full bandwidth: 50×: ≤250 mVrms 500×: ≤350 mVrms
CMRR	DC: >-80 dB 100 kHz: >-60 dB 10 MHz: >-30 dB 100 MHz: >-26 dB		DC: >-80 dB 100 kHz: >-60 dB 10 MHz: >-40 dB
Input Impedance	Differential: 10 MΩ/ 2 pF Each input to ground: 5 MΩ/4 pF		Differential: 20 MΩ/ 1.175 pF Each input to ground: 10 MΩ/2.35 pF

Item	PHA1150B	PHA2150B	PHA5150B
Output Voltage	≤7.5 V		≤3 V
Output Impedance	1 MΩ		50 Ω
Delay Time	20×: 12.7 ns 200×: 12.2 ns		50×: 11 ns 500×: 9.8 ns
Power Supply	DC 5V adapter		
Overrange Indication	LED alarm, buzzer		
Regulation Standards	Q/MKX001-2023		
CE Standard	EN IEC 61010-2-030		
EMC Standard	EN IEC 61326-1:2021 EN IEC 61000-3-2:2019+A1:2021 EN 61000-3-3:2013+A1:2019+A2:2021 EN IEC 61326-1:2021		

Dimensions

Item	Specification
Control Module Size	91 mm x 33 mm x 15 mm
Control Module Size	100 mm x 36 mm x 20 mm
Probe Body Weight (Net Weight)	216 g
Insulated Piston Test Clip Size	152 mm x 50 mm x 13 mm
Alligator Clip Size	106 mm x 43 mm x 16 mm
High Voltage Differential Input Cable Length	Approx. 8 cm
Probe Output Cable Length	About 120 cm

Environmental Requirements

Environmental Characteristics	Specification
Operating Temperature	0℃ to 40℃
Storage Temperature	-30℃ to 70℃
Operating Humidity	≤85% RH (0℃ to 40℃)
Storage Humidity	5% to 85% RH (≤40℃) 5% to 45% RH (40℃ to 70℃)

7 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.

8 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.

There is no other warranty, expressed or implied, except such as is expressly set forth herein or other applicable warranty card. There is no implied warranty of merchantability or fitness for a particular purpose. Under no circumstances shall RIGOL be liable for any consequential, indirect, ensuing, or special damages for any breach of warranty in any case.

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