

RSDPB5000/RSDPB4000

High Voltage Differential Probe Series



Please read this manual carefully before use

Safety precautions

1. Be cautious of an electric shock
2. Pay attention to the maximum input voltage

Please do not use in humid or in flammable and explosive environment

RSDPB5000 Series High Voltage Differential Probe

RSDPB5000 Series Summary

Model	Maximum Input Voltage	Bandwidth	Attenuation Rate
RSDPB5150	1500V	70MHz	50X/500X

Overview

RSDPB5000 series high voltage differential probes are designed for the measurement of high voltage differential signal, to meet the demand for floating measurement. The bandwidth can be as high as 100MHz, meeting the demand for majority of measurement systems.

There are a variety of ranges to choose from, and their differential voltage measurement range can meet with the demand for majority of tested circuits. Users may go into test mode to adjust the offset voltage, and also to adjust automatically to prevent probes being disordered after years' of use. The electronic touch buttons give them a longer working life.

The function of 5MHz bandwidth limit selection, whose frequency bandwidth fits the FETs switching frequency measurement in most switching power supplies, and they can filter out higher frequency noise and interference. With the sound & light alarming function, this can also be closed manually, with a USB power supply connector to make it easier and more flexible for use. The probes are equipped with standard BNC input connectors, they can be used with any manufacturer oscilloscope (oscilloscope input impedance should set to 1M Ω . when 50 Ω is selected, the attenuation multiply attenuates double.) to test waveform of the tested circuits, there is an automatic save function, to prevent users re-operating in case of power supply drops. The probes have good capability of common mode noise suppression and can be widely used in the research and development, debugging or overhauling work for switching power supply, frequency converter, electronic ballast, frequency conversion electronic appliances and other electric power equipments.

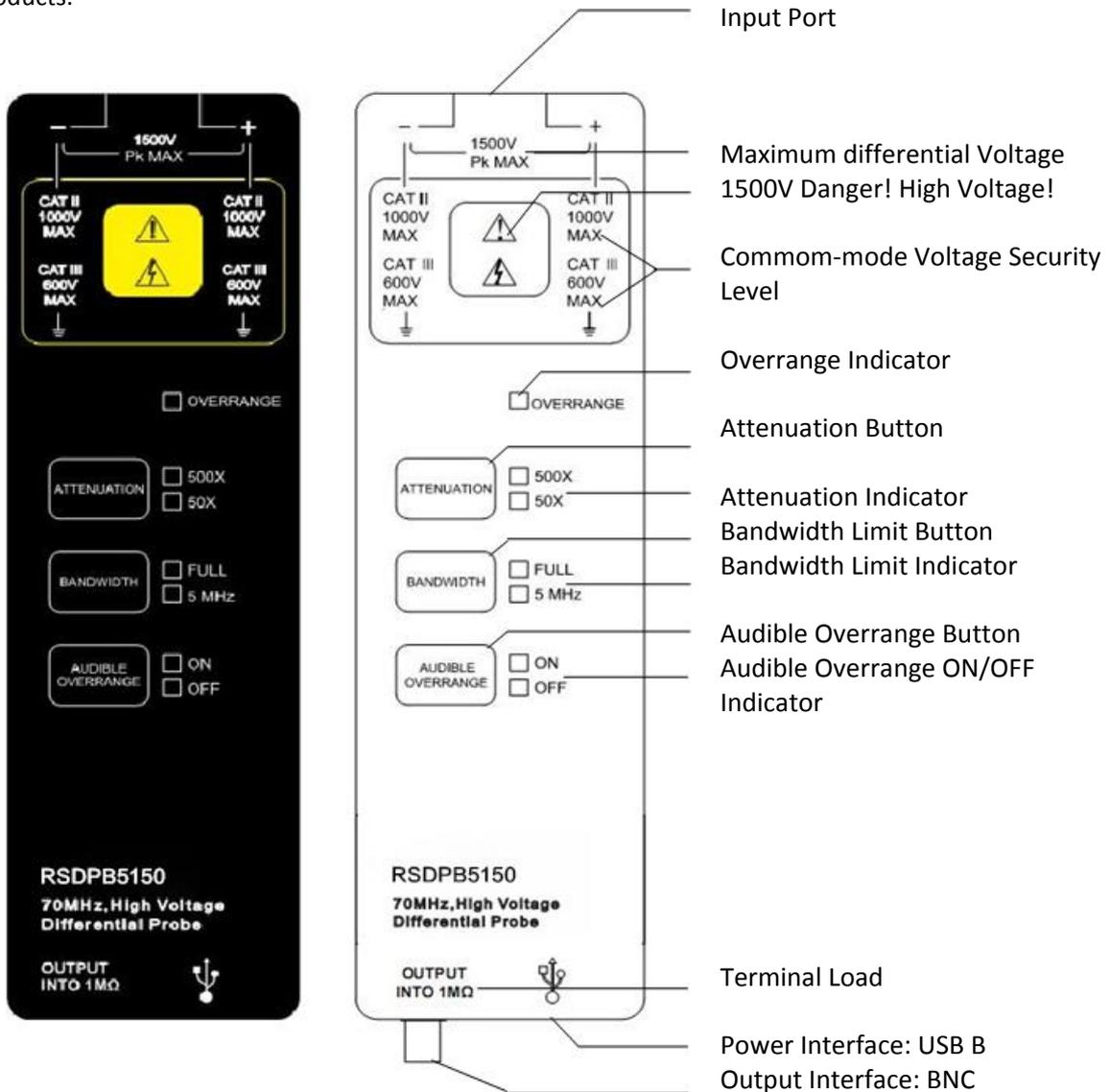
Application

- Floating voltage measurement
- Frequency converter
- Switching power supplies designs
- Welding, plating power supplies
- Induction heating, electromagnetic oven
- Motor driven design
- Electronic ballast design
- CRT displayer design
- Inverter, UPS power supplies
- Frequency conversion electrical appliances
- Power conversion and related design
- Electrical engineering experiment
- Low voltage appliances experiment
- Power electronics and electric drive experiment

Product and Accessories Description

Probe body description

Take RSDPB5150 as an example, voltage, range and bandwidth are varied with different products.



Detailed Description:

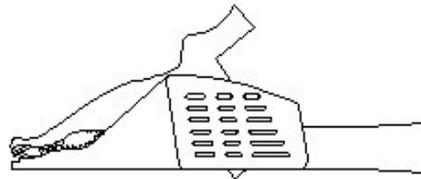
1. Input connector: Standard red and black socket. Red is positive, black negative, output will reverse when is reversely connected. Use together with standard red black input cables.
2. ATTENUATION: Different attenuation indicates different ranges, such as RSDPB5150: 500X indicate the maximum test voltage is 1500V. 50X indicates the maximum test voltage is 150V. Oscilloscope attenuation factor should be set accordingly based on the probe attenuation selection.

3. **BANDWIDTH:** The series products have bandwidth selection function. The default is full bandwidth(FULL) of the product. When testing low frequency signal, you can choose 5MHz bandwidth limit to prevent being interfered by high frequency signal.
4. **AUDIBLE OVERRANGE:** When the test range exceeds probe range, audible and visual alarm will start. The function is to control buzzer alarm on or off, ON is to open audible alarm and OFF closes the alarm.
5. **Output connector:** Standard BNC input connectors, can be connected to any Manufacturer oscilloscope, oscilloscope input impedance should set to 1MΩ.Ifset to 50Ω, the output attenuation is a half of the practical value.
6. **Power interface:** Standard USB type B interface, supply power with standard USB adapter, can be supplied by the oscilloscope, it can also be supplied by portable power source, convenient for outdoor test.
7. **Factory Setting:** The default factory setting is high attenuation ratio, FULL bandwidth, audible alarm is on. The product has an automatic memory; this will automatically save the state before power off.

Accessories Description



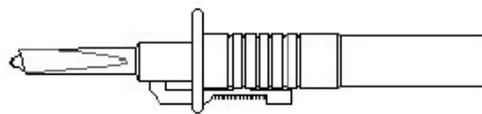
Alligator Clips (CK-261 red black 1 pair)



Alligator Clips (CK-262 red black 1 pair)



Pincer Clips (CK-281 red black 1 pair)



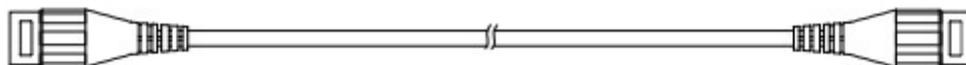
Hook Clips (CK-284 red black 1 pair)



Input differential lead (CK-28 one pair)



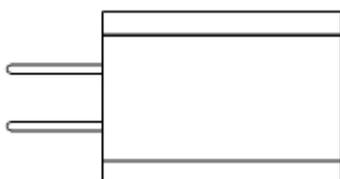
Coaxial Output Line (CK-310)



Coaxial Output Line (CK-320)



USB line (CK-315 AM-BM, 1.5m)



Power adapter (CK-605) USB 5V/1A

Product standard accessories description

Model	RSDPB5150
Alligator Clips (CK-261)	CATIII 1000V CATIV 600V
Alligator Clips (CK-262)	-----
Pincer Clips (CK-281)	CATIII 1000V
Hook Clips (CK-284)	CATIII 1000V
High Voltage Input differential lead (CK-28)	10A CATIII 1000V
Coaxial Output Line (CK-310)	Double-ended BNC connector coaxial line 1m (Standard accessories)
Coaxial Output Line (CK-320)	Double-ended BNC connector coaxial line 2m (non-standard, purchased individually)
USB line (CK-315)	AM-BM, 1.5 m
Power adapter (CK-605)	USB 5V/1A

Electric Specification

Model		RSDPB5150
BW (-3dB)		DC-70MHz
Rise time		≤5ns
Accuracy		±2%
Attenuation Rate		50X/500X 100X/1000X
Max Differential Test Voltage (DC + Peak AC)		50X: 150V 100X: 750V
		500X: 1500V
Max input common mode voltage(voltage-to-earth)		600V CATIII
Input Impedance	Single-ended to ground	5MΩ
	Two inputs	10MΩ
Input Capacitance	Single-ended to ground	<4pF
	Two inputs	<2pF
CMRR	DC	>80dB >80dB
	100kHz	>60dB
	1MHz	>50dB
Noise (Vrms)		50X: <50mV 500X: <50mV 100X: <200mV 1000X: <1.2V
Propagation delay (standard 1 m output lead)		18ns±1ns
Bandwidth limit(5MHz)		≥-3dB@5MHz
Differential overvoltage detection level		50X:≥150V
Overload indicator (red light)		YES
Overload Alarm		Yes(Can shut up manually)
Automatic Save		YES
Offset Setting function		Yes (Set in test mode)
Terminate Load		1MΩ
Power Supply		USB 5V/1A adapter

Mechanical Specification

Model		RSDPB5150
Differential Input lead	CK-28	Approx 28 cm
Output Lead	CK-310	Approx 1 m
	CK-320	Approx 2 m
Alligator Clips CK-261		Approx 85*40*17 mm
Alligator Clips CK-261		Approx 106*43*16 mm
Pincer Clips CK-281		Approx 152*50*13 mm
Hook Clips CK-284		Approx 121*23*23 mm
Probe body dimensions		195*65*28 mm
Probe body weight		Approx 188 g

Environment Characteristics

Model	RSDPB5150
Operating Temperature	0~50°C
Non-operating	-30~70°C
Operating Humidity	≤85%RH
Non-operating Humidity	≤90%RH
Operating Altitude	3000m
Non-operating Altitude	12000m

Operating the Probe Safely

- 1) You should estimate the tested voltage amplitude before testing, please do not use if exceeds the voltage range, because it is likely the probe is damaged.
- 2) Connect the input lead and output lead to the probe, and then connect the probe to the oscilloscope or other instruments.
- 3) Connect the power adapter to voltage probe, the power indicator light turns on green. Please select proper range based on the tested voltage. When the tested voltage exceeds range, the overload indicator light is on with alarming sound, which can be manually turned off.
- 4) Please set proper attenuation rate for the oscilloscope or other instruments according to the probe range. And adjust the oscilloscope sensitivity based on the tested voltage.
- 5) Connect the probe clips based on needs, start after connecting to the circuits to be tested. When testing, the probe body should be kept away from high voltage pulse circuits to reduce interference to the probe.

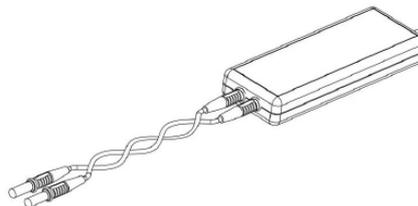
Test Mode (Offset Setting)

Users may enter the test mode to adjust offset based on needs. The probes may be disordered after years' of use. The adjustment method is as follows if not at zero:

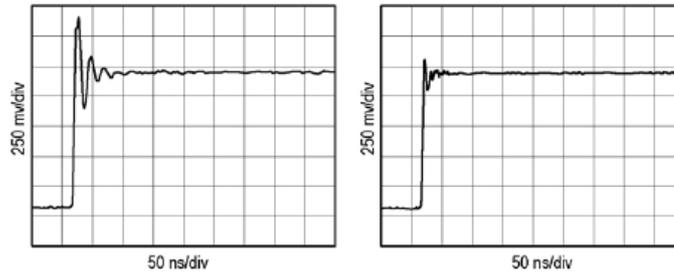
- ① Please press these two keys, **ATTENUATION** **BANDWIDTH** and make short circuits for input terminals.
- ② Turn power on to start, entering test mode, and the overload indicator light is on, release the two keys.
- ③ Go into the high attenuation fact or offset adjustments under the state, press the **ATTENUATION** offset increase. Press **BANDWIDTH** offset decrease.
- ④ After the adjustment, press key **AUDIBLE OVERRANGE** to switch to low attenuation ratio offset adjustment, press key **ATTENUATION** offset increases, press **BANDWIDTH** , offset decreases .
- ⑤ Then press key **AUDIBLE OVERRANGE** to exit the test mode, offset adjustment is completed and the overload indicator light is off, entering into normal operation mode.

Safety Notices

1. Please try to wind up the input leads when testing, this is better for eliminating noise and to improve the ability of high frequency response. Please view below for the winding method:



2. It is better not to extend input lead when testing; otherwise it may introduce more noise. If extra extension lead is necessary, please ensure the extension leads are the same length, and the input frequency is under 10MHz, errors may exist if exceeds 10MHz output.



HF transient response with (left) and without (right) extension leads

Performance Verification

The below operation is for performance verification of the electric specification, requirement for test equipment is shown below:

Equipments	Minimum Requirements	Usages
Oscilloscope	Bandwidth $\geq 100\text{MHz}$. Accuracy $\leq 1.5\%$, e.g.: SO/DSO4000	Displays probe output
Standard signal Generator or calibrator	Amplitude accuracy $\leq 0.75\%$. rise time $\leq 3\text{ns}$ e.g.: FLUKE/WAVETEK 9100	Test bandwidth. AC accuracy. Common mode rejection
Digital millimeter	Accuracy of not less than 6 and a half e.g.: KEITHLEY 2000	Test the DC accuracy
Insulation pincer clips	Supplied in the accessories	Testing clips
BNC adapter 1	BNC-male-to-female-dual show as	Test adapter
BNC adapter 2	BNC-male-to-dual binding post show as Figure 2	Test adapter
BNC adapter 3	BNC-female-to-dual binding post show as Figure 3	Test adapter
Load terminal	BNC-male-to 50Ω load show as Figure 4	Signal source load

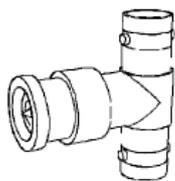


Figure 1 BNC-male-to-female-dual

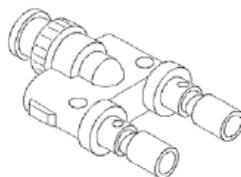


Figure 2 BNC-female-to-dual binding post

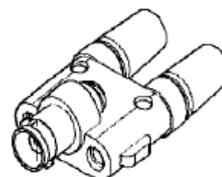


Figure 3 BNC-male-to-dual binding post

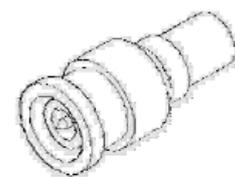


Figure 4 BNC-male-to 50Ω load

Setup

- 1) Connect power adapter to voltage probe, which turns on green light, to ensure accuracy, test the probe index after 20minutes.
- 2) Uncover the red black plastic cover of the BNC-male-to-dual binding post.

DC Accuracy

- 1) Connect the probe output to the BNC-female-to-dual binding post; plug the two input terminals of the digital multi-meter into the binding posthole.
- 2) Connect the probe input to insulation pincer clips, and then connect the calibrator output and the generator closed, connect the red clip to the positive pole, black clip to negative pole.
- 3) Set the probe attenuation factor in the first gear.
- 4) Follow the chart below to set output values for the signal source.
- 5) Enable the signal output, observe and record the output voltage for the attenuation.
- 6) Close the signal source output.
- 7) Switch the probe attenuation factor to the second gear.
- 8) Repeat step 4~6, and calculate whether is within the accuracy ranges.

Model	Attenuation Rate	Signal source output voltage	Probe expected output voltage
RSDPB5150	50X	5V	100mV±2mV
	500X	50V	100mV±2mV

Rise Time

- 1) Configure the fast rise output of the generator for a 50 Ω load. Attach a 50 Ω terminator to the generator fast-rise output and attach the modified BNC adapter to the terminator.

Attach the differential probe input leads (without attachment accessories) by sliding the banana plug of the leads onto the binding posts metal sleeves on the modified BNC adapter.

- 2) Connect the probe output to the oscilloscope, set attenuation factor in the first gear.
- 3) Refer to the below stable to set standard signal generator.
- 4) Enable signal source output and record the rise time.
- 5) Close signal source output.
- 6) Switch the probe attenuation factor to the second gear.
- 7) Repeat step 3-5, and calculate whether is in the range.

Model	Attenuation Rate	Signal source voltage, frequency setting	Expected probe Rise time
RSDPB5150	50X	20Vpp, 70MHz	≤5ns
	500X	20Vpp, 70MHz	≤5ns

DC Common Mode Rejection Ratio (CMRR)

- 1) Set RDPB5000 series probes at low attenuation ration, respectively (10X, 50X,100X).
- 2) Set 500V DC voltage for signal source, now the voltage output shutoff.
- 3) Connect the two probe inputs to 500Vvoltage.
- 4) Connect the probe output to BNC-female- to- dual binding post, and plug into the two inputs of the digital millimeter.
- 5) Enable signal source output, respectively record voltage output values; check with the following chart to calculate whether is within the ranges.
- 6) Close the calibrator after completion of the test.

Model	Attenuation Rate	Probe expected output voltage
RSDPB5150	50X	$\leq 1\text{mV}$

Note: High voltage500 V is used during the testing, please pay attention to personal safety, to reduce voltage fluctuation, be sure to make the calibrator output 500 V high voltages after the completion of all connections.

RSDPB4080 High Voltage Differential Probe

RSDPB4080 Summary

Model	Maximum Input Voltage	Bandwidth	Attenuation Rate
RSDPB4080	800V	50MHz	10X/100X

Overview

The RSDPB4080 differential probe provides a safety means for measuring differential voltage to all models of oscilloscopes. It can convert the high differential voltage ($\leq 800V_{peak}$) into a low voltage ($\leq 8V$) and display this on the oscilloscope. Its bandwidth is up to 50MHz, which is ideal for large power testing, development and maintenance.

The RSDPB4080 is designed to operate with the $1M\Omega$ impedance oscilloscopes. When combined with the 50Ω load, the attenuation will be 2 times as much.

RSDPB4080 is recommend for use with our own manufactured PL-10 to expand the measuring with the electricity meter to observe more accurate measurement. The accuracy of oscilloscope is 1% and the electricity meter is about 10%.

Electric Specification

- (1) Bandwidth: DC-50MHz
- (2) Attenuation: X100, X10
- (3) Accuracy: $\pm 1\%$
- (4) Input voltage range (DC+AC PEAK TO PEAK)
 $\leq \pm 80V$ for X10, (about 30V RMS or DC)
 $\leq \pm 800V$ for X100, (about 290V RMS or DC)
- (5) Permitted max input voltage:
Max differential voltage: 800V (DC+AC PEAK TO PEAK)
Max voltage between each input terminal and ground: 800V RMS
- (6) Input Impedance: Differential: $54M\Omega/1.2pF$
Between terminal and ground: $27M\Omega/2.3pF$
- (7) Output voltage: $\leq \pm 8V$
- (8) Output impedance: 50Ω



Operating environmental conditions

	Reference	Use	Storage
Temperature	+20°C ~ +30°C	0°C ~ +50°C	-30°C ~ +70°C
Relative Humidity	≤70%RH	10% ~ 85%RH	10% ~ 90%RH

(1) Dimensions and weight: 69x26x165mm.500g

(2) Electrical safety to IEC

1010-1 Dual insulation

Installation category III

Degree of Pollution 2

Related voltage or max line-earth: 6500V RMS

CE: EN50081-1 and 50082-1

Operating procedure

Connect the probe to the oscilloscope with the BP-250 BNC TO BNC cable.

Adjust the vertical zero adjustment of the oscilloscope if necessary.

Select the attenuation rate and the vertical deviation of the oscilloscope in accordance with the conversion table below.

Note: The power must be on

Attenuation Rate	X100	X10
Input Voltage(DC+AC Peak)	±800V	±80V

Attention: The real vertical deviation is equal to the attenuation rate multiplied by the range of vertical deviation selected on the oscilloscope. It will be double in the case of a 50Ω load.

Care and Maintenance

- 1) Keep the probe clean and dry.
- 2) Please wipe with soft dry cloth to clean. Chemical must not be used to clean.
- 3) Please put the probe in the package provided, and put it in cool, clean and dry places.
- 4) Please put the probe in the package provided to prevent shock.
- 5) Do not forcefully pull the input and output lead to prevent bending, twisted and folding.