High Voltage Differential Probes

DP6000 Series

DP6150 1500Vpk/70MHz

DP6350 3500Vpk/70MHz

DP6700 7000Vpk/70MHz

ShenZhen ZhiYong Electronics Co., Ltd

Introduction

First of all, thank you for purchasing our products, this instruction manual is the description about the function, usage, operation attention points, etc. Before use, please read the instructions carefully and use correctly.

Manual annotation will use the following symbols to distinguish.

This symbol means it is harmful to the machine and human body; you must strictly follow the instruction manual to operate.

Warning **In the case of wrong operation, the user risk injury. The content under this mark records the relevant matters needing attention to avoid such dangers.**

Notice **The user may suffer minor injuries and material damage with the wrong operation. To avoid such situation, the matters under this mark need**

Note **This symbolizes important note about how to use the machine.**

To the safely use the machine, you must abide by the following safety precautions strictly. The violation against the manual is likely to damage the protective function of the machine. In addition, the company is not responsible for any safety problem caused by the violation of matters needing attention in operation.

- Please be careful to the danger of electric shock and pay attention to highest input voltage.
- Do not operate in wet or combustible conditions.
- Make sure the circuit under test is turned off before access it to the probe.
- Turn off the circuit after the measurement, and then remove the probe.
- When BNC lines are connected to the oscilloscope or other devices, ensure the BNC terminal is well grounded.
- Please check the probe skin. If there is any breakage, stop using it immediately.
- Select the product standard adapter power supply.

DP6000 Series Brief Description

Modal	Maximum Input Differential Voltage（Vp）	Bandwidth	Attenuation
DP6150	±1500V	70MHz	50X/500X
DP6350	±3500V	70MHz	100X/1000X
DP6700	±7000V	70MHz	100X/1000X

1. Summary

- DP6000 Series High Voltage Differential Probe is designed with floating measurement function, with a maximum bandwidth up to 70MHz that can fulfill the need of most measuring system.
- DP6000 Series provides a wide measuring range for selection, and its differential measurement voltage range can meet the requirement of most measurement circuit.
- The users can enter the test mode to adjust the offset voltage of the probe and realize zero set.
- DP6000 Series provides a 5MHz bandwidth limit function. 5MHz frequency bandwidth can meet the measurement of the switching frequency of most FETs in switching power supplies, and can filter out higher frequency noise and interference.
- DP6000 Series has sound & light alarming function, and users can turn it off manually if needed.
- DP6000 Series is powered by USB connector, and it contains standard BNC output connector that can adapt oscilloscope of any brand. In which, require the oscilloscope input impedance set to 1MΩ. If set to 50Ω, the output attenuation is a half of the practical value.
- The probe has good CMRR, with high input impedance and low capacitance at the input end, which can accurately and quickly measure differential voltage signals. It can be widely used in the research and development, debugging, or maintenance of switching power supplies, frequency converters, electronic ballasts, variable frequency household appliances, and other electrical power devices.

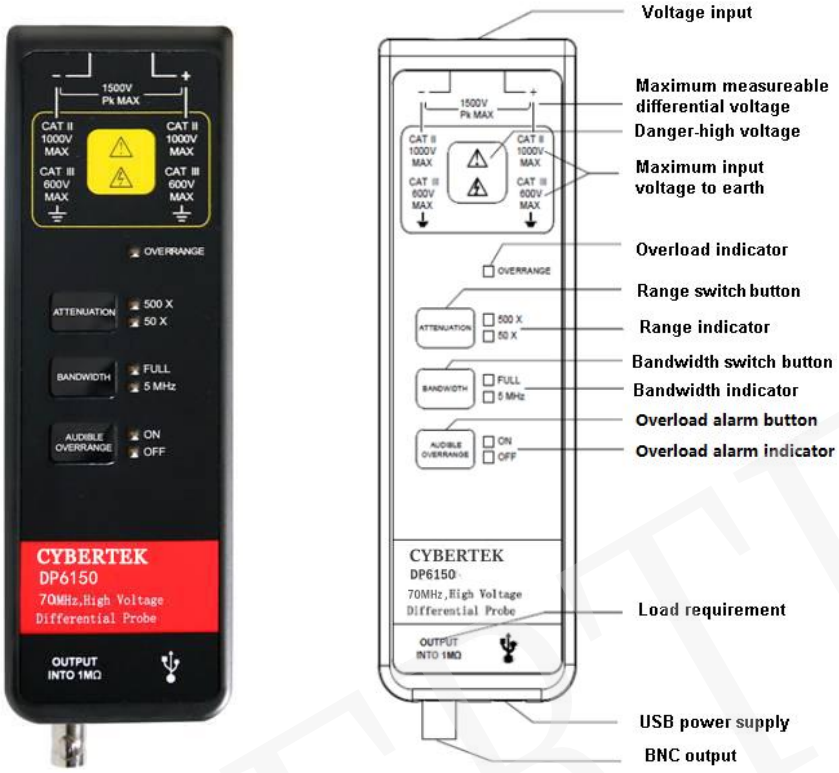
2. Application

- Floating voltage measurement
- Inverter
- Switch Power Supply
- Welding, plating power supply
- Induction heating, electromagnetic oven
- Motor driver design
- Electronic ballast design
- CRT display design
- Inverting, UPS power supply
- Inverter appliance
- Power conversion and related design
- Experiment of electrical engineering
- Low voltage test
- Power electronics and power transmission experiment, etc

3. Products and Accessories

■ Main part of probe

As DP6150 for example, different voltage, range, bandwidth would be in different product.

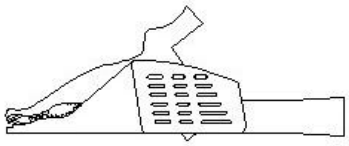


Detailed instructions

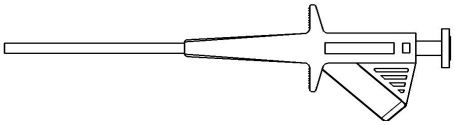
- Integral input leads: The integral input leads extend 28cm from the probe body. Connect the leads directly to your circuit, or use the extender leads and other accessories.
- ATTENUATION: Different attenuation indicates different ranges, such as DP6150：500X, indicate the maximum test voltage is 1500V. 50X presents maximum test voltage is 150V. DP6700： 1000X shows maximum test voltage is 7000V. 100X indicate maximum test voltage is 700V; oscilloscope attenuation factor should be set accordingly based on the probe attenuation selection.
- 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.
- AUDIBLE OVERRANGE: When 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.
- Output connector: Standard BNC output connectors, can be connected to any oscilloscope of any brand. In which, require oscilloscope input impedance should set to 1MΩ; if set to 50Ω, the output attenuation is a half of the practical value.
- Power interface: Standard USB type B interface, supply power with standard USB adapter, can be supplied by oscilloscope, easy to use, also can be supplied by portable power source, convenient for outdoor test.
- Factory Setting: The default factory setting is high attenuation ratio, FULL bandwidth, audible alarm is on. The product has automatic memory, automatically save the state before power off.

■ Accessories Description

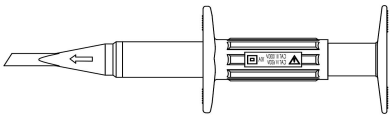
Alligator Clips (CK-261 red one pair)



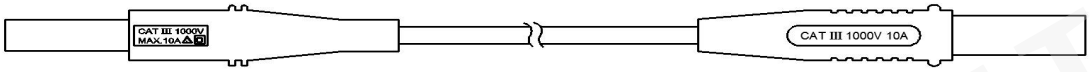
Alligator Clips (CK-262 one pair)



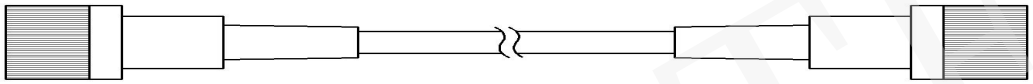
Pincer Clips (CK-281 one pair)



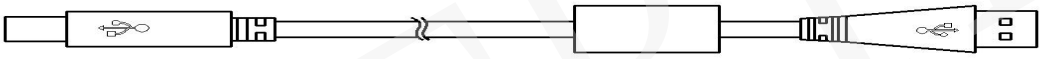
Hook Clips (CK-284A one pair)



Extender Leads (CK-301 one pair)

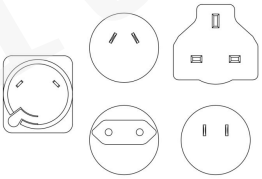


BNC Output Line(CK-310)



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

Banana jack（CK-293）



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

Product standard accessories description:

Modal	DP6150	DP6350	DP6700
Alligator Clips(CK-261)	CATIII 1000V CATIV 600V		--
Alligator Clips(CK-262)	--		CATIII 1000V CATIV 600V
Pincer Clips(CK-281)	CATIII 1000V		
Hook Clips(CK-284A)	CATIII 1000V		
Extender Leads (CK-301)	CATIII 1000V		
Banana jack（CK-293）	Φ4mm		
BNC Output Line((CK-310)	Double-ended BNC connector coaxial line 1m		
USB Line（CK-315B）	1.5m		
Power Adapter (CK-605A)	USB 5V/1A		

NOTE: The above “--” refers to non-standard accessory of this model.

4. Electric Specification

Model		DP6150		DP6350		DP6700	
Bandwidth(-3dB)		70MHz					
Rise time		≤5ns					
Accuracy		±2%					
Range selection (Attenuation rate)		50X/500X		100X/1000X		100X/1000X	
Maximum differential voltage(DC + Peak AC)		50X	±150V	100X	±350V	100X	±700V
		500X	±1500V	1000X	±3500V	1000X	±7000V
Common mode voltage (Vp) (DC + Peak AC)		±1500V		±3500V		±7000V	
Maximum differential mode VS frequency curve		Figure 1		Figure 2		Figure 3	
Maximum input voltage-to-earth (Vrms)		600V CATIII 1000V CATII		600V CATIII 1000V CATII		1000V CATIII 2300V CATI*	
Input impedance	Single-ended to ground	5MΩ		5MΩ		20MΩ	
	Between inputs	10MΩ		10MΩ		40MΩ	
Input capacitance	Single-ended to ground	<4pF		<4pF		<5pF	
	Between inputs	<2pF		<2pF		<2.5pF	
CMRR	DC	>80dB		>80dB		>80dB	
	100kHz	>60dB		>60dB		>60dB	
	1MHz	>50dB		>50dB		>50dB	
Noise(Vrms)		50X	<50mV	100X	<100mV	100X	<220mV
		500X	<300mV	1000X	<600mV	1000X	<1.2V
Differential overvoltage detection level		50X	≥150V	100X	≥350V	100X	≥700V
		500X	≥1500V	1000X	≥3500V	1000X	≥7000V
Propagation time	Probe	50X	9ns	100X	9.3ns	100X	9.3ns
		500X	7.5ns	1000X	7.4ns	1000X	7.2ns
	BNC Line(1m)	About 5ns					
Bandwidth limit filters (5MHz)		≥-3dB@5MHz					
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		≥100kΩ					
Power supply		USB 5V/1A adapter					
Safety standard		IEC/EN 61010-031:2015 + AMD1:2018					
EMC standard		EN61326-1:2013 EN61000-3-2:2006+A1:2009+A2:2009 EN61000-3-3:2013					

***CAT I per IEC/EN 61010-031/A1:2008. No Rated Measurements Category per IEC/EN 61010-031:2015 + AMD1:2018.**

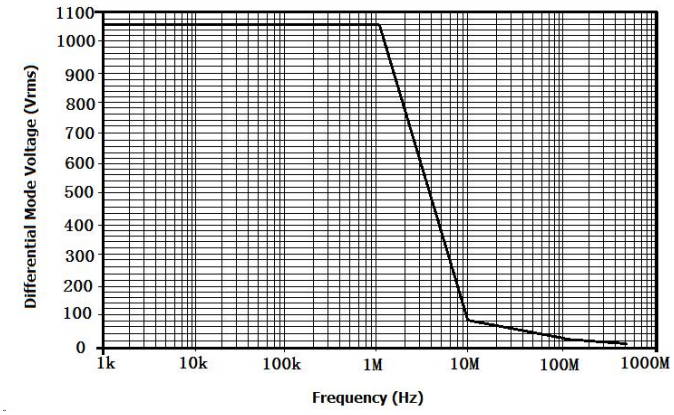


Figure 1:DP6150 Differential Mode Voltage VS Frequency

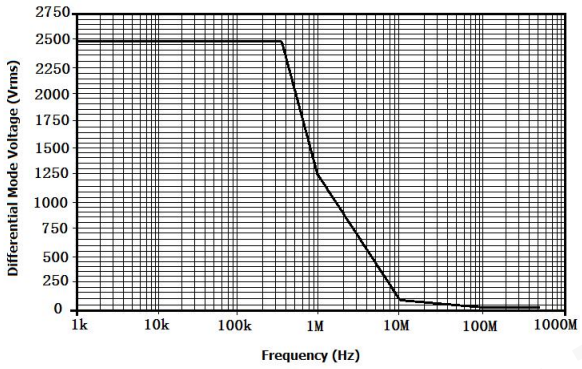


Figure 2:DP6350 Differential Mode Voltage VS Frequency

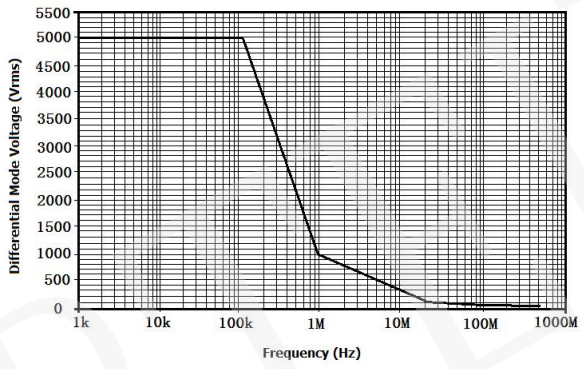


Figure 3:DP6700 Differential Mode Voltage VS Frequency

5. Mechanical Specification

Model	Parameters
Input leads	Approx 28cm
Extender leads(CK-301)	Approx 1m
BNC Output Line(CK-310)	Approx 1m
Alligator clips CK-261	Approx 85*40*17mm
Alligator clips CK-262	Approx 106*43*16mm
Pincer clips CK-281	Approx 152*50*13mm
Hook clips CK-284A	Approx 121*37*20mm
Banana jack CK-293	Approx 31*5.5mm(Φ4mm)
Probe dimensions	Approx 195*58*25mm
Probe weight	Approx 250g

6. Environmental Characteristics

Model	Parameters
Operating temperature	0℃～50℃
Storage temperature	-30℃～70℃
Operating humidity	≤85%RH
Storage humidity	≤90%RH
Operating altitude	3000m
Storage altitude	12000m

7. Operating steps

- You should estimate the tested voltage amplitude before testing. Please do not use if exceeds the voltage range, or the probe could be damaged.
- Connect the input lead and output lead to the probe, and then connect the probe to oscilloscope or other instruments.
- 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.
- 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.
- Connect the probe clips based on needs, start after connecting to the circuits to be tested. When testing, the probe body should keep away from high voltage pulse circuits to reduce interference to the probe.
- Turn off the probe power after the testing is completed, first disconnect the two inputs from the tested points, and then unplug the BNC plug from the oscilloscope.

8. Test Mode (Offset Setting)

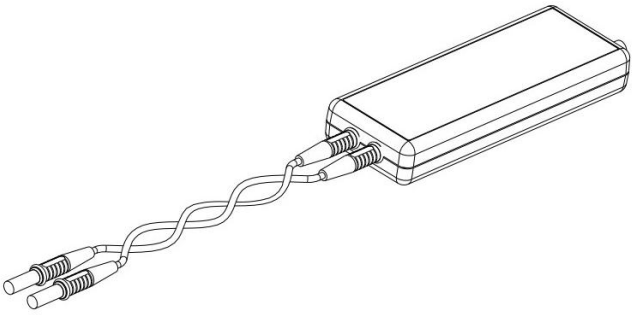
User may enter the test mode to adjust offset if the output zero drift. The adjustment method is as follows:

- Make the input terminals short circuits, and then press these both keys ATTENUATION BANDWIDTH,.
- Turn power on to start, you will be in test mode while the overload indicator light is on, then release the two keys.
- The high attenuation factor offset adjustments (corresponding indicator light): press the key ATTENUATION for offset increasing; press BANDWIDTH for offset decreasing.
- After the adjustment, press key AUDIBLE OVERRANGE to switch to low attenuation ratio offset adjustment (corresponding indicator light), press key ATTENUATION for offset increasing, press BANDWIDTH for offset decreasing.
- After the above step, press key AUDIBLE OVERRANGE to exit the test mode, offset adjustment is completed and the overload indicator light off, entering into normal operation mode.

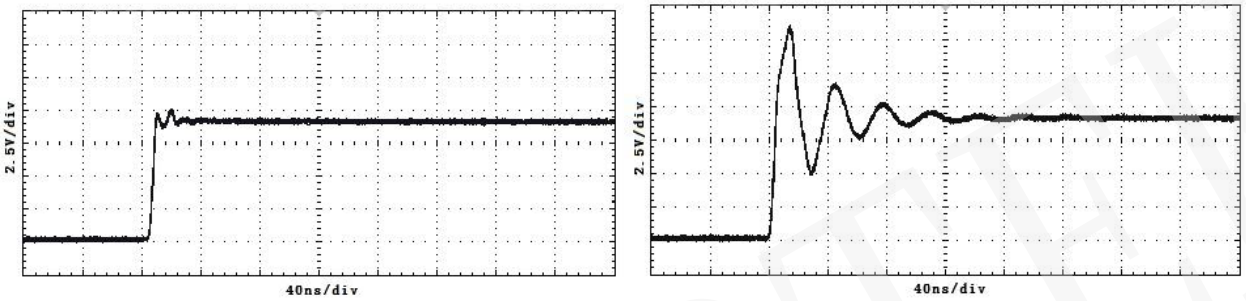
9. Safety Notices:

Note

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



- 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 at same length, and the input frequency is under 5MHz, errors may exist if exceeds 5MHz output.



Without extender leads　　With extender leads

10. Performance Verification

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

Equipment	Minimum Requirements	Usages
Oscilloscope	Bandwidth≥100MHz; Accuracy≦1.5%, e.g. Tektronix MSO/DSO4000	Displays probe output
Standard signal generator; calibrator	Amplitude accuracy≤0.75%; rise time≤3.5ns e.g.: FLUKE/WAVETEK 9100	Test bandwidth; AC accuracy; common mode rejection ration
Digital multimeter	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 Figure 1	Test adapter
BNC adapter 2	BNC-male-to-banana female-dual 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 50Ωload show as Figure 4	Signal source load

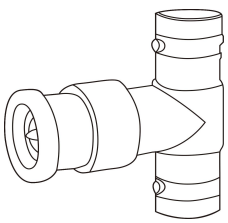


Figure 1　BNC-male-to-female-dual

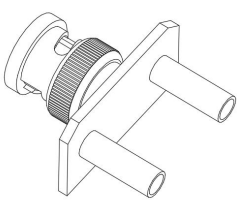


Figure 2　BNC-male-to-banana female-dual

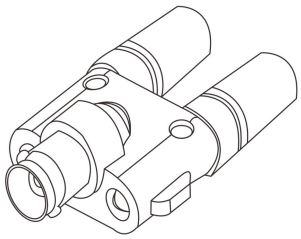


Figure 3 BNC-female-to-dual binding post

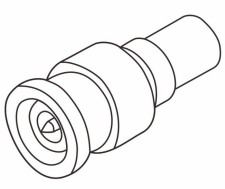


Figure 4 BNC-male-to 50 Ω load

10.1 Setup

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

10.2 DC Accuracy

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

Model	Attenuation Rate	Signal source output voltage	Probe expected output voltage	Probe practical output voltage
DP6150	50X	5V	100mV±2mV	
	500X	50V	100mV±2mV	
DP6350	100X	10V	100mV±2mV	
	1000X	100V	100mV±2mV	
DP6700	100X	10V	100mV±2mV	
	1000X	100V	100mV±2mV	

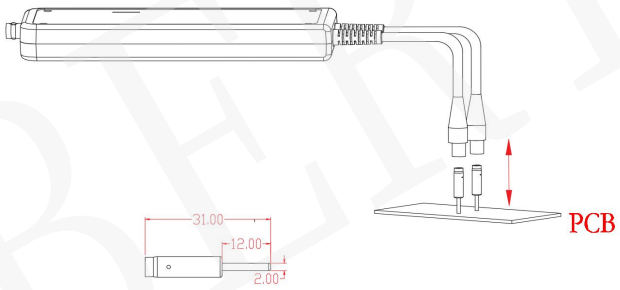
10.3 Rise Time

- ✧ 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.
- ✧ Connect the probe output to the oscilloscope, set attenuation factor in the first gear.

- ✧ Refer to the below stable to set standard signal generator.
- ✧ Enable signal source output and record the rise time.
- ✧ Close signal source output.
- ✧ Switch the probe attenuation factor to the second gear.
- ✧ Repeat step 3~5, and calculate whether is in the range.

Model	Attenuation Rate	Signal source voltage, frequency setting	Expected probe rise time	Rising time
DP6150	50X	20Vp-p 70MHz	≤5ns	
	500X	20Vp-p 70MHz	≤5ns	
DP6350	100X	20Vp-p 70MHz	≤5ns	
	1000X	20Vp-p 70MHz	≤5ns	
DP6700	100X	20Vp-p 70MHz	≤5ns	
	1000X	20Vp-p 70MHz	≤5ns	

Note: in order to reduce waveform oscillation while reaching the maximum bandwidth, please apply banana jack. Users can solder the banana jack onto the PCB board or the pins of the MOSFET under test as shown below:



10.4 DC Common Mode Rejection Ration(CMRR)

- ✧ Set DP6000 series probes at low attenuation ration, respectively (50X, 100X).
- ✧ Set 500V DC voltage for signal source, now the voltage output shut up.
- ✧ Connect the two probe inputs to 500V voltage.
- ✧ Connects the probe output to BNC-female- to- dual binding post (as shown in Figure 3), and plug into the two inputs of the digital multimeter.
- ✧ Enable signal source output, respectively record voltage output values; check with the following chart to calculate whether is within the ranges.
- ✧ Close the calibrator after completion of the test.

Model	Attenuation Rate	Probe expected output voltage	Probe practical output voltage
DP6150	50X	≤1mV	
DP6350	100X	≤1mV	
DP6700	100X	≤1mV	

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

11. Care and Maintenance

- ✧ Keep the probe clean and dry.
- ✧ Please wipe with soft dry cloth when clean needed, must not use chemicals to clean.
- ✧ Please put the probe in the package provided, and put it in cool, clean and dry places.
- ✧ Please put the probe in the package provided to prevent shock.
- ✧ Do not forcefully pull the input and output lead to prevent bending, twisted and folding.

12. Warranty

Please refer to the warranty instruction.

13. Packaging

Package			
Items	DP6150	DP6350	DP6700
Voltage probe body	1 unit	1 unit	1 unit
USB 5V/1A Adapter(CK-605A)	1 unit	1 unit	1 unit
Alligator clips (CK-261)	1 pair	1 pair	--
Alligator clips (CK-262)	--	--	1 pair
Insulation pincer clips (CK-281)	1 pair	1 pair	1 pair
Hook clips (CK-284A)	1 pair	1 pair	1 pair
Extension cord (CK-301)	1 pair	1 pair	1 pair
Output lead(CK-310)	1 pcs	1 pcs	1 pcs
Banana jack(CK-293)	2 unit	2 unit	2 unit
USB connecting line (CK-315B)	1 pcs	1 pcs	1 pcs
User manual	1 book	1 book	1 book
Warranty card	1 unit	1 unit	1 unit
Testing report	1 pcs	1 pcs	1 pcs

NOTE: The above "--" refers to non-standard accessory of this model

CYBERTEK

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