

# High Voltage Differential Probes

## DP6000B Serie

DP6070B 700V<sub>pk</sub>/300MHz

DP6150B 1500V<sub>pk</sub>/300MHz

DP6350B 3500V<sub>pk</sub>/300MHz

DP6700B 7000V<sub>pk</sub>/300MHz



## 产品说明书

Product User Manual

## 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 attention.**

**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.

### DP6000B Series Brief Description

| Modal   | Maximum Input<br>Differential Voltage<br>(Vp) | Bandwidth | Attenuation |
|---------|-----------------------------------------------|-----------|-------------|
| DP6070B | ± 700V                                        | 300MHz    | 20X/200X    |
| DP6150B | ± 1500V                                       | 300MHz    | 50X/500X    |
| DP6350B | ± 3500V                                       | 300MHz    | 100X/1000X  |
| DP6700B | ± 7000V                                       | 300MHz    | 200X/2000X  |

## 1. Summary

- DP6000B Series High Voltage Differential Probe is designed with floating measurement function, with a maximum bandwidth up to 300MHz that can fulfill the need of most measuring system.
- DP6000B 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.
- DP6000B 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.
- DP6000B Series has sound & light alarming function, and users can turn it off manually if needed.
- DP6000B 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  $1M\Omega$ . If set to  $50\Omega$ , 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.

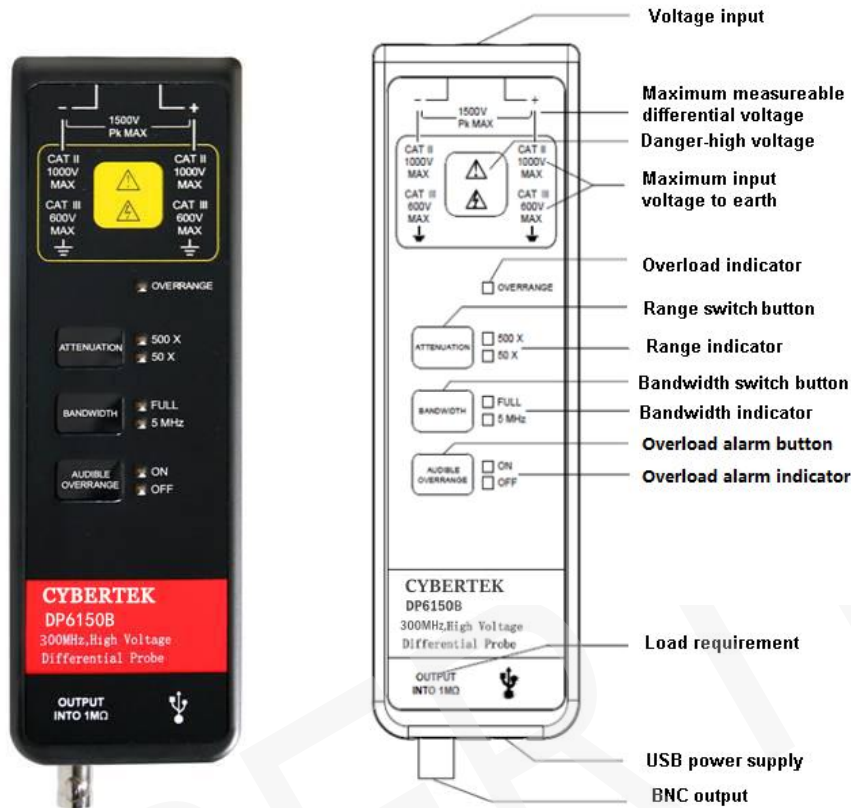
## 2. Application

- ◆ 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 DP6150B for example, different voltage, range, bandwidth would be in different product.



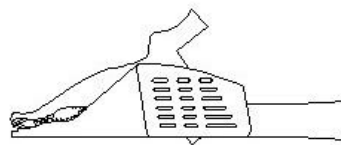
#### Detailed instructions

- ✧ 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 DP6150B: 500X, indicate the maximum test voltage is 1500V. 50X presents maximum test voltage is 150V. DP6700B: 2000X shows maximum test voltage is 7000V. 200X 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.

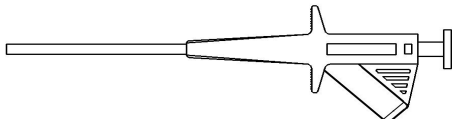
## ■ Accessories Description



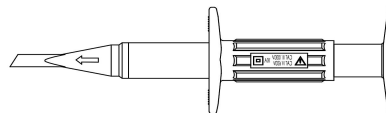
Alligator Clips (CK-261 red one pair)



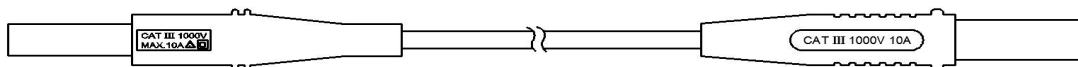
Alligator Clips (CK-262 one pair)



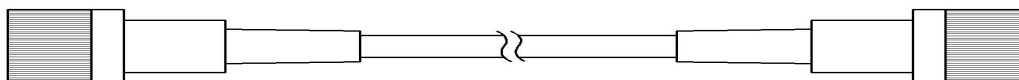
Pincer Clips (CK-281 one pair)



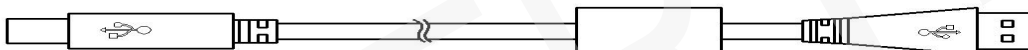
Hook Clips (CK-284A one pair)



Extender Leads (CK-301 one pair)



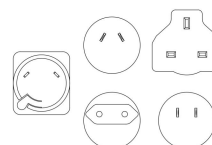
BNC Output Line(CK-310)



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



Banana jack (CK-293)



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

### Product standard accessories description:

| Modal                     | DP6070B                                    | DP6150B | DP6350B | DP6700B                    |
|---------------------------|--------------------------------------------|---------|---------|----------------------------|
| Alligator Clips(CK-261)   | CATIII 1000V<br>CATIV 600V                 |         |         | --                         |
| Alligator Clips(CK-262)   | --                                         |         |         | CATIII 1000V<br>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                                           |                           | DP6070B                                                                |        | DP6150B                    |        | DP6350B                    |        | DP6700B                     |        |
|-------------------------------------------------|---------------------------|------------------------------------------------------------------------|--------|----------------------------|--------|----------------------------|--------|-----------------------------|--------|
| Bandwidth(-3dB)                                 |                           | 300MHz                                                                 |        |                            |        |                            |        |                             |        |
| Rise time                                       |                           | ≤1.16ns                                                                |        |                            |        |                            |        |                             |        |
| Accuracy                                        |                           | Typical accuracy±1% (≤Full scale 80%)      ±2%(>Full scale 80%)        |        |                            |        |                            |        |                             |        |
| Range selection<br>(Attenuation rate)           |                           | 20X/200X                                                               |        | 50X/500X                   |        | 100X/1000X                 |        | 200X/2000X                  |        |
| Maximum differential<br>voltage(DC + Peak AC)   |                           | 20X                                                                    | ±70V   | 50X                        | ±150V  | 100X                       | ±350V  | 200X                        | ±700V  |
|                                                 |                           | 200X                                                                   | ±700V  | 500X                       | ±1500V | 1000X                      | ±3500V | 2000X                       | ±7000V |
| Common mode voltage (Vp)<br>(DC + Peak AC)      |                           | ±700V                                                                  |        | ±1500V                     |        | ±3500V                     |        | ±7000V                      |        |
| Maximum differential mode<br>VS frequency curve |                           | Reference<br>Figure 1                                                  |        | Figure 2                   |        | Figure 3                   |        | Figure 4                    |        |
| Maximum input<br>voltage-to-earth (Vrms)        |                           | 450V CATII<br>600V CATI*                                               |        | 600V CATIII<br>1000V CATII |        | 600V CATIII<br>1000V CATII |        | 1000V CATIII<br>2300V CATI* |        |
| Input<br>impedance                              | Single-ended<br>to ground | 2.5MΩ                                                                  |        | 5MΩ                        |        | 20MΩ                       |        | 20MΩ                        |        |
|                                                 | Between<br>inputs         | 5MΩ                                                                    |        | 10MΩ                       |        | 40MΩ                       |        | 40MΩ                        |        |
| Input<br>capacitance                            | Single-ended<br>to ground | <4pF                                                                   |        | <4pF                       |        | <4pF                       |        | <5pF                        |        |
|                                                 | Between<br>inputs         | <2pF                                                                   |        | <2pF                       |        | <2pF                       |        | <2.5pF                      |        |
| CMRR                                            | DC                        | >80dB                                                                  |        | >80dB                      |        | >80dB                      |        | >80dB                       |        |
|                                                 | 100kHz                    | >60dB                                                                  |        | >60dB                      |        | >60dB                      |        | >60dB                       |        |
|                                                 | 1MHz                      | >50dB                                                                  |        | >50dB                      |        | >50dB                      |        | >50dB                       |        |
| Noise(Vrms)                                     |                           | 20X                                                                    | <90mV  | 50X                        | <170mV | 100X                       | <410mV | 200X                        | <550mV |
|                                                 |                           | 200X                                                                   | <120mV | 500X                       | <250mV | 1000X                      | <550mV | 2000X                       | <1V    |
| Differential overvoltage<br>detection level     |                           | 20X                                                                    | ≥70V   | 50X                        | ≥150V  | 100X                       | ≥350V  | 200X                        | ≥700V  |
|                                                 |                           | 200X                                                                   | ≥700V  | 500X                       | ≥1500V | 1000X                      | ≥3500V | 2000X                       | ≥7000V |
| Propagation<br>time                             | Probe                     | 20X                                                                    | 5.6ns  | 50X                        | 5.5ns  | 100X                       | 5.2ns  | 200X                        | 5.1ns  |
|                                                 |                           | 200X                                                                   | 4.5ns  | 500X                       | 4.5ns  | 1000X                      | 4.2ns  | 2000X                       | 4.2ns  |
|                                                 | BNC<br>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<br>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.

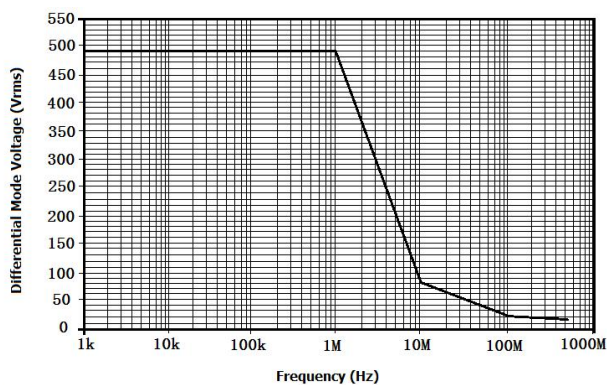


Figure 1:DP6070B Differential Mode Voltage VS Frequency

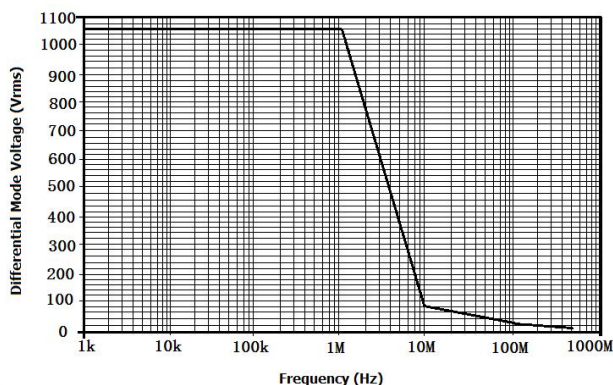


Figure 2:DP6150B Differential Mode Voltage VS Frequency

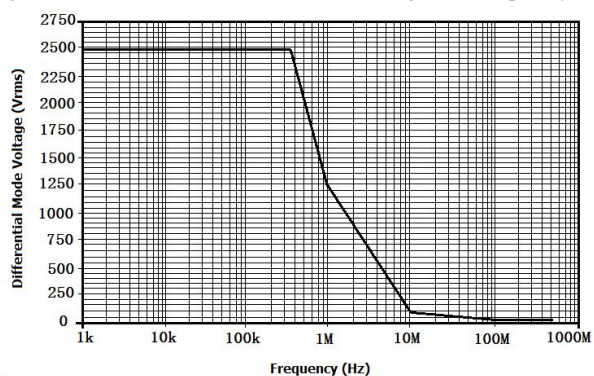


Figure 3:DP6350B Differential Mode Voltage VS Frequency

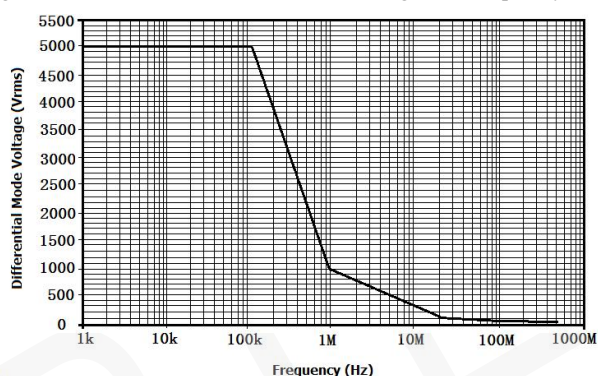


Figure 4:DP6700B Differential Mode Voltage VS Frequency

## 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)

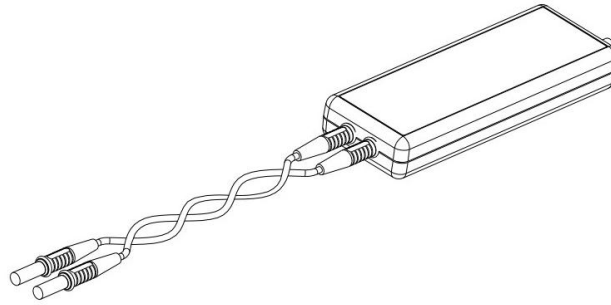
User may enter the test mode to adjust offset if the output zero drift. The adjustment method is as follows:

- ✧ Make the input terminals short circuits, and then press these both keys  .
- ✧ 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  for offset increasing; press  for offset decreasing.
- ✧ After the adjustment, press key  to switch to low attenuation ratio offset adjustment (corresponding indicator light), press key  for offset increasing, press  for offset decreasing.
- ✧ After the above step, press key  to exit the test mode, offset adjustment is completed and the overload indicator light off, entering into normal operation mode.

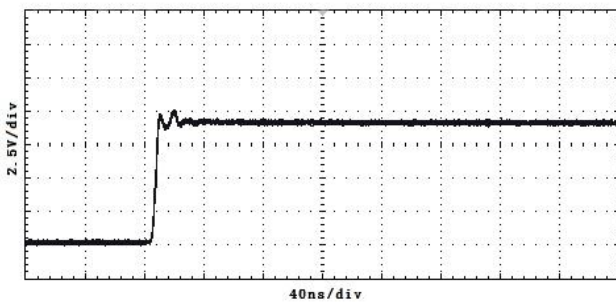
## 9. Safety Notices:

### Note

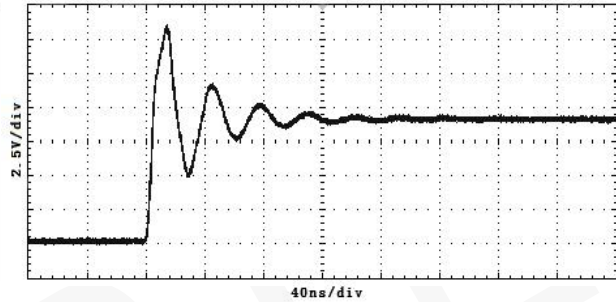
- ✧ Please try to wind the input leads when testing, which is better for eliminating noise, to improve the ability of high frequency response.  
Please view below for the winding method:



- ✧ 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 $\geq$ 500MHz; Accuracy $\leq$ 1.5%, e.g. Tektronix MSO/DSO4000        | Displays probe output                                     |
| Standard signal generator; calibrator | Amplitude accuracy $\leq$ 0.75%; rise time $\leq$ 700ps 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 50 $\Omega$ load show as Figure 4                                    | Signal source load                                        |

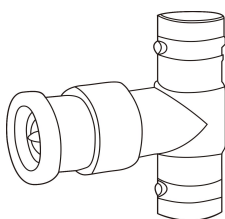


Figure 1 BNC-male-to-female-dual

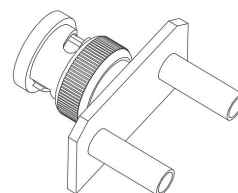


Figure 2 BNC-male-to-banana female-dual

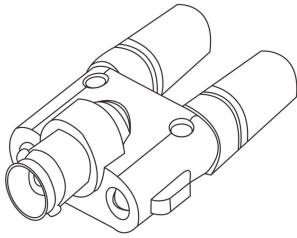


Figure 3 BNC-female-to-dual binding post

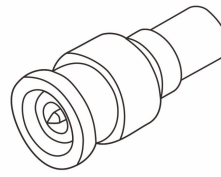


Figure 4 BNC-male-to 50 Ω load

## 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 |
|---------|------------------|------------------------------|-------------------------------|--------------------------------|
| DP6070B | 20X              | 2V                           | 100mV±2mV                     |                                |
|         | 200X             | 20V                          | 100mV±2mV                     |                                |
| DP6150B | 50X              | 5V                           | 100mV±2mV                     |                                |
|         | 500X             | 50V                          | 100mV±2mV                     |                                |
| DP6350B | 100X             | 10V                          | 100mV±2mV                     |                                |
|         | 1000X            | 100V                         | 100mV±2mV                     |                                |
| DP6700B | 200X             | 20V                          | 100mV±2mV                     |                                |
|         | 2000X            | 200V                         | 100mV±2mV                     |                                |

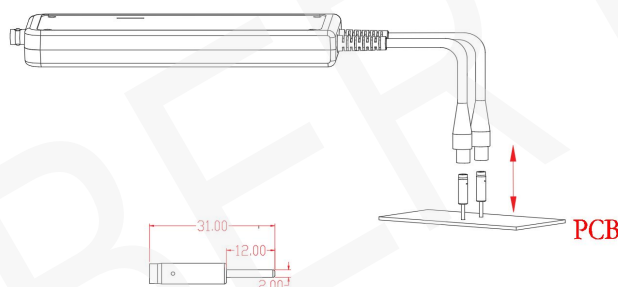
## 10.3 Rise Time

- ✧ 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 |
|---------|------------------|------------------------------------------|--------------------------|-------------|
| DP6070B | 20X              | 20Vp-p 100MHz                            | $\leq 1.16\text{ns}$     |             |
|         | 200X             | 20Vp-p 100MHz                            | $\leq 1.16\text{ns}$     |             |
| DP6150B | 50X              | 20Vp-p 100MHz                            | $\leq 1.16\text{ns}$     |             |
|         | 500X             | 20Vp-p 100MHz                            | $\leq 1.16\text{ns}$     |             |
| DP6350B | 100X             | 20Vp-p 100MHz                            | $\leq 1.16\text{ns}$     |             |
|         | 1000X            | 20Vp-p 100MHz                            | $\leq 1.16\text{ns}$     |             |
| DP6700B | 200X             | 20Vp-p 100MHz                            | $\leq 1.16\text{ns}$     |             |
|         | 2000X            | 20Vp-p 100MHz                            | $\leq 1.16\text{ns}$     |             |

**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 DP6000B series probes at low attenuation ration, respectively (20X, 50X, 100X,200X).
- ✧ 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 |
|---------|------------------|-------------------------------|--------------------------------|
| DP6070B | 20X              | $\leq 1\text{mV}$             |                                |
| DP6150B | 50X              | $\leq 1\text{mV}$             |                                |
| DP6350B | 100X             | $\leq 1\text{mV}$             |                                |
| DP6700B | 200X             | $\leq 1\text{mV}$             |                                |

**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

| Items                            | Package |         |         |         |
|----------------------------------|---------|---------|---------|---------|
|                                  | DP6070B | DP6150B | DP6350B | DP6700B |
| Voltage probe body               | 1 unit  | 1 unit  | 1 unit  | 1 unit  |
| USB 5V/1A Adapter(CK-605A)       | 1 unit  | 1 unit  | 1 unit  | 1 unit  |
| Alligator clips (CK-261)         | 1 pair  | 1 pair  | 1 pair  | --      |
| Alligator clips (CK-262)         | --      | --      | --      | 1 pair  |
| Insulation pincer clips (CK-281) | 1 pair  | 1 pair  | 1 pair  | 1 pair  |
| Hook clips (CK-284A)             | 1 pair  | 1 pair  | 1 pair  | 1 pair  |
| Extension cord (CK-301)          | 1 pair  | 1 pair  | 1 pair  | 1 pair  |
| Output lead(CK-310)              | 1 pcs   | 1 pcs   | 1 pcs   | 1 pcs   |
| Banana jack( CK-293)             | 2 unit  | 2 unit  | 2 unit  | 2 unit  |
| USB connecting line (CK-315B)    | 1 pcs   | 1 pcs   | 1 pcs   | 1 pcs   |
| User manual                      | 1 book  | 1 book  | 1 book  | 1 book  |
| Warranty card                    | 1 unit  | 1 unit  | 1 unit  | 1 unit  |
| Testing report                   | 1 pcs   | 1 pcs   | 1 pcs   | 1 pcs   |

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

**CYBERTEK**

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