# High Voltage Differential Probe HVP6000E Series

HVP6150E 1500Vpk/100MHz

HVP6350E 3500Vpk/100MHz

HVP6700E 7000Vpk/100MHz


# 产品说明书

Product User Manual

# Preface

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.**

**Warn** **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 watch out the shock danger, do not use the probe to measure voltage out of range.
- Do not use the probe in damp environment or under explosive risk.
- Make sure the circuit under test is not under high voltage before using the probe.
- After the measurement is done, make sure the circuit under test is not under high voltage before removing the probe.
- Make sure the oscilloscope and other devices used are nicely grounded.
- Please check the probe and accessories before usage, stop immediately if you find any broken parts or exposed conductor.

## HVP6150E Series Briefing

| Model | Maximum input differential voltage Vp | Maximum input differential voltage peak to peak value Vp-p | Bandwidth | Attenuation ratio |
|---|---|---|---|---|
| HVP6150E | ±1500V | 3000V | 100MHz | 50X/500X |
| HVP6350E | ±3500V | 7000V | 100MHz | 100X/1000X |
| HVP6700E | ±7000V | 14000V | 100MHz | 100X/1000X |

# 1. Summary

**HVP6000E series** is the high voltage high frequency differential probe with floating ground measurement function. It can reach up to differential voltage of 7000Vpk and bandwidth of 100MHz, and the typical accuracy of 1% can fulfill the need for most measurement system. HVP6000E has standard BNC output connector, allowing it to operate with oscilloscope of any brand.

**HVP6000E series** has USB communication function, and it can interact with the Smart Probe Adaptor of our company, adjusting the parameter including model, voltage type, attenuation ratio and delay corresponding to the smart probe connected. This device solved the trouble of manually setting up parameter when using a third party probe on oscilloscope and provide the same experience as those probes of certain brands.

**Product Characteristics**

- The first online zero set function. Disconnection is no longer needed when you need to zero set.
- The first all range bias voltage elimination technology, making the probe able to measure ripple wave voltage accurately.
- The leading low distortion waveform measurement technology.
- The leading high stability and high common mode rejection ratio technology.
- The internationally authoritative German SGS safety certification.
- Standard Type-C power supply connector.
- 5MHz bandwidth limit function.
- Over voltage alarm function.

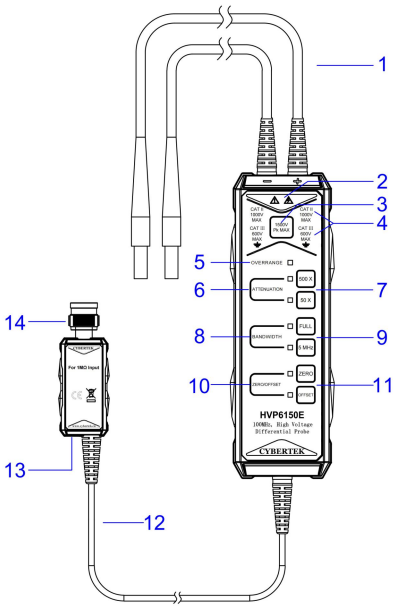
# 2. Application

- Floating ground voltage measurement
- Frequency converter
- Switch power supply design
- Welding and electroplating power supply
- Induction heating, induction cooker
- Motor drive design
- Electronic ballast design
- CRT monitor design
- Inverter and UPS power supply
- Variable frequency household appliances
- Design related to power conversion
- Electrical Experiment
- Low voltage electrical testing
- Power electronics and power transmission experiments, etc

# 3.Product and accessories

## Probe main part

Take HVP6150E as example:

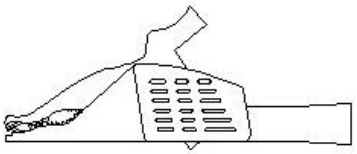



### Detailed instruction:

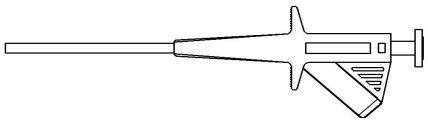
1. **Differential input cable(280mm)**: The end of differential input cable is standard 4mm banana plug. You can connect it to various standard probe clamp or connect it on an extension cable (around 1m) to increase the length of input cable. Please be aware that the high frequency performance will degrade with extension cable, and there will be waveform oscillation due to the decreasing of bandwidth.
2. **Safety Alarm Symbol.**
3. **Maximum differential input voltage symbol.**
4. **The maximum input to ground voltage under CAT level environment.**
5. **Overload indicator light:** will lighted red with buzzer alarm when measuring over range.
6. **ATTENUATION:** Different attenuation ratio correspond to different range, for instance, HVP6150E 500X corresponds to maximum differential voltage of 1500V, and the maximum differential voltage of 50X is 150V. HVP6700E 1000X corresponds to maximum differential voltage of 7000V, and the maximum differential voltage of 100X is 700V. For you oscilloscope to display voltage value correctly, please set up the attenuation ratio accordingly.
7. **Attenuation ratio indicator light:** lighted green for corresponding attenuation ratio.
8. **BANDWIDTH:** Choose 5MHz bandwidth limit function can neutralize the interference of high frequency signal.
9. **Bandwidth indicator:** lighted green for corresponding bandwidth (FULL or 5MHz)
10. **ZERO/OFFSET button:** pressing shortly for offset mode, pressing 1.5s for zero set mode.
11. **ZERO/OFFSET indicator light:** blink when corresponding mode in progress and lighted for long time after the process is finished.
12. **Signal and power supply transmission cable:** 1.5m.
13. **Standard Type-C power supply connector:** can be used for power supply through USB adaptor/oscilloscope/USB portable power supply.
14. **Standard BNC signal output connector**: can be connected with oscilloscope of any brand.

## Accessories

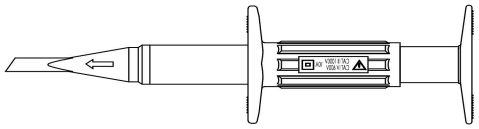
Alligator clip(CK-261 R&B one pair)



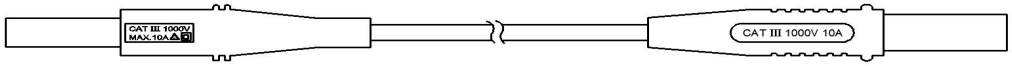
Alligator clip(CK-262 R&B one pair)



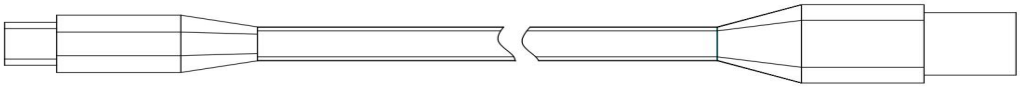
Piston probe clamp (CK-281 R&B one pair)



Test hook (CK-284A R&B one pair)

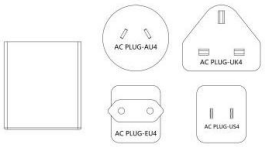



Input extension cable (CK-301 R&B one pair)



USB cable (CK-314 1.5m)

Banana head female socket (CK-293)




Adapter (CK-605A) USB 5V/2.4A

### Data sheet of standard accessories

| Model | HVP6150E | HVP6350E | HVP6700E |
|---|---|---|---|
| Alligator clip (CK-261) | CATIII 1000V<br>CATIV 600V | | -- |
| Alligator clip (CK-262) | -- | | CATIII 1000V<br>CATIV 600V |
| Piston probe clamp (CK-281) | CATIII 1000V | | |
| Test hook (CK-284A) | CATIII 1000V | | |
| Input extension cable (CK-301) | CATIII 1000V | | |
| Banana head female socket (CK-293) | Φ4mm | | |
| USB Cable (CK-314) | 1.5m | | |
| Adapter (CK-605A) | USB 5V/2.4A | | |

P. S. The "--"means this model doesn't contain this accessories.

## 4.Electronics Specifications

| **Model** | | **HVP6150E** | | **HVP6350E** | | **HVP6700E** | |
|---|---|---|---|---|---|---|---|
| Bandwidth(-3dB) | | 100MHz | | | | | |
| Rise time | | ≤3.5ns | | | | | |
| Accuracy (% of the reading) | | ±1% | | | | | |
| Range option (attenuation ratio) | | 50X/500X | | 100X/1000X | | 100X/1000X | |
| Maximum differential measurement voltage (DC + Peak AC) | | 50X | ±150V | 100X | ±350V | 100X | ±700V |
| | | 500X | ±1500V | 1000X | ±3500V | 1000X | ±7000V |
| Common mode voltage (DC + Peak AC) | | ±1500V | | ±3500V | | ±7000V | |
| Maximum differential mode voltage vs frequency curve | | Refer to Fig. 1 | | Refer to Fig. 2 | | Refer to Fig. 3 | |
| Maximum input-to-ground voltage (Vrms) | | 600V CATIII<br>1000V CATII | | 600V CATIII<br>1000V CATII | | 1000V CATIII<br>1500V CATII | |
| Input impedance | Single end to ground | 5MΩ | | 20MΩ | | 20MΩ | |
| | Two input terminals | 10MΩ | | 40MΩ | | 40MΩ | |
| Input capacity | Single end to ground | ＜4pF | | ＜4pF | | ＜5pF | |
| | Two input terminals | ＜2pF | | ＜2pF | | ＜2.5pF | |
| CMRR | DC | ＞80dB | | ＞80dB | | ＞80dB | |
| | 100kHz | ＞60dB | | ＞60dB | | ＞60dB | |
| | 1MHz | ＞50dB | | ＞50dB | | ＞50dB | |
| Noise (Vrms) | | 50X | ＜60mV | 100X | ＜155mV | 100X | ＜250mV |
| | | 500X | ＜300mV | 1000X | ＜600mV | 1000X | ＜1V |
| Threshold value of voltage overload indication | | 50X | ≥150V | 100X | ≥350V | 100X | ≥700V |
| | | 500X | ≥1500V | 1000X | ≥3500V | 1000X | ≥7000V |
| Delay time | Probe | 50X | 15.5ns | 100X | 15.5ns | 100X | 15.5ns |
| | | 500X | 14.5ns | 1000X | 14.5ns | 1000X | 14.5ns |
| Bandwidth limit(5MHz) | | ≥-3dB@5MHz | | | | | |
| Overvoltage indicator light (red light) | | YES | | | | | |
| Overvoltage alarm sound | | YES | | | | | |
| Auto-save function | | YES | | | | | |
| Auto-zero function | | YES | | | | | |
| Bias voltage elimination function | | YES | | | | | |
| Terminal load requirements | | ≥100kΩ | | | | | |
| power supply | | USB 5V/2.4A Adaptor | | | | | |
| Safety standards | | IEC 61010-031: 2022, EN IEC 61010-031: 2023 | | | | | |
| EMC standard | | EN IEC 61326-1:2021 EN IEC 61000-3-2:2019+A1:2021+A2:2024<br>EN 61000-3-3:2013+A1:2019+A2:2021 | | | | | |

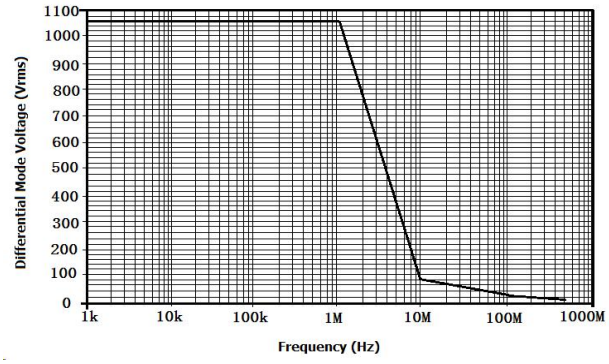



Figure 1: Maximum differential mode voltage of HVP6150E vs. Frequency

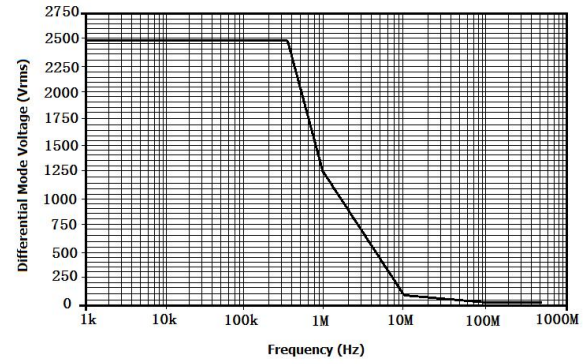



Figure 2(Left): Maximum differential mode voltage of HVP6350E vs. Frequency

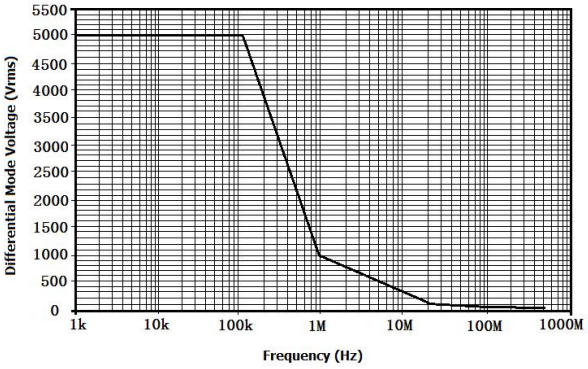



Figure 3(Right): Maximum differential mode voltage of HVP6700E vs. Frequency

## 5.Mechanical Specifications

| Model | **Parameter** |
|---|---|
| Differential input line | 28cm |
| Input extension cable (CK-301) | 1m |
| Crocodile clip (CK-261) | 85*40*17mm |
| Piston probe clamp (CK-281) | 152*50*13mm |
| Test hook (CK-284A) | 121*37*20mm |
| USB cable (CK-314) | 1.5m |
| Banana Head Mother Seat (CK-293) | Φ4mm,31*5.5mm |
| Probe control box size | 185*63*26mm |
| Probe output size | 83*31*22mm |
| Probe weight | 335g |

## 6.Environmental Specifications

| **Model** | **Parameter** |
|---|---|
| Operating temperature | 0℃～45℃ |
| Storage temperature | -30℃～70℃ |
| Operating humidity | ≤85%RH |
| Storage humidity | ≤90%RH |
| Operating altitude | 3000m |
| Storage altitude | 12000m |

# 7.Operating Steps

- Before testing, always estimate the amplitude of the common mode voltage and differential voltage being measured. Exceeding the limits may cause personal injury or damage to the probe.
- Choose the proper probe clamp and connect it to the circuit under test, connect the output cable to the oscilloscope or other measurement devices.
- Connect the power supply of the probe.
- Choose the proper attenuation ratio according to the voltage need to measure. The over-voltage indicator will be lighted and buzzer will be activated when the voltage exceed the range.
- Set up the attenuation ratio of the oscilloscope or other measurement devices according to the attenuation ratio of the probe. Adjust the vertical gear of the oscilloscope according to the voltage measured.
- Move the probe main body as far as possible from the high voltage pulse circuit to decrease the interference during testing.
- Switch off the power supply of the circuit under test before removing the probe after testing.

# 8.Steps for auto zero set and offset elimination.

**8.1 Auto zero set function: supports online zero set, no need to disconnect from the circuit under test during zero set.**

- Press 

button for around 1.5s until the ZERO indicator light start blinking, then release the button.
- When the buzzer beeps twice, it means that the zero set is complete, and the ZERO indicator light will be lighted continuously.

**8.2 Bias voltage elimination function: able to eliminate the bias voltage in all range, making the probe able to accurately measure the ripple wave voltage. The measurement accuracy will be improved if you choose the 20MHz bandwidth option on oscilloscope.The steps are shown below:**

- Press 

button shortly, and the OFFSET indicator light will start blinking when the offset zero set mode is activated.
- When the buzzer beeps twice, it indicates that the bias elimination is complete, and the OFFSET indicator light will be lighted continuously.

**8.3 The following figures are examples of measuring the ripple on the PFC (bias voltage of approximately 380V) when the switching power supply is unloaded and loaded respectively:**

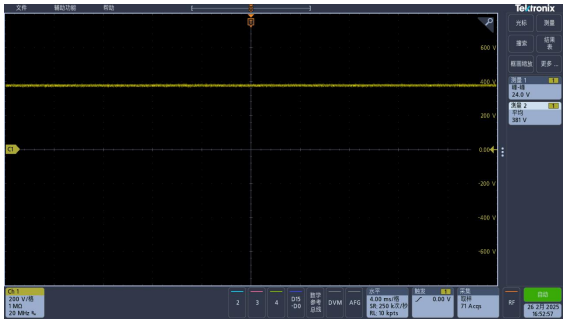


Fig. 1 PFC bias voltage of switching power supply

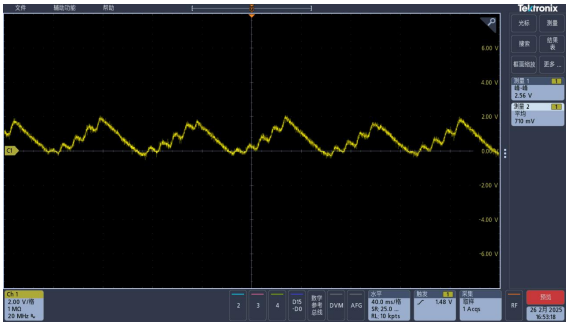


Fig. 2 Ripple wave after PFC bias voltage elimination when switching power supply is unloaded

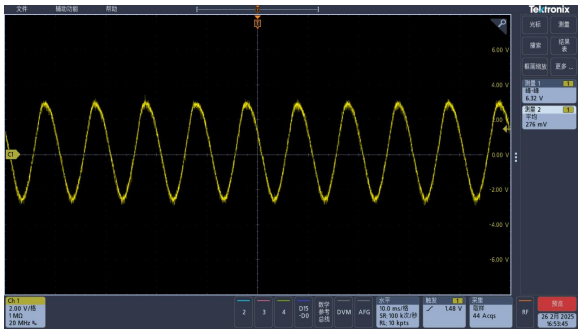


Fig. 3(Left) Ripple wave after PFC bias voltage elimination at 170W switching power supply

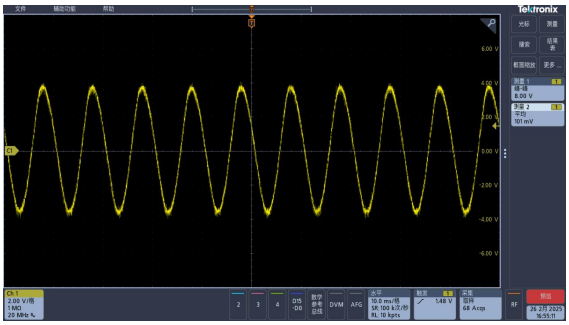


Fig. 4(Right) Ripple wave after PFC bias voltage elimination at 230W switching power supply

## 9.Matters need to pay attention during usage:

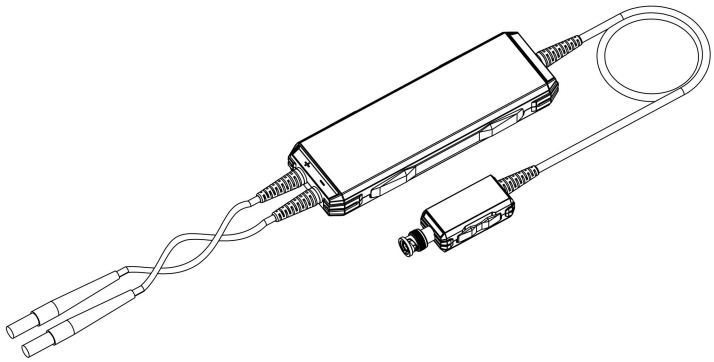
**Note**

**9.1** The input impedance of the probe and oscilloscope must be paired to receive the correct measurement result.

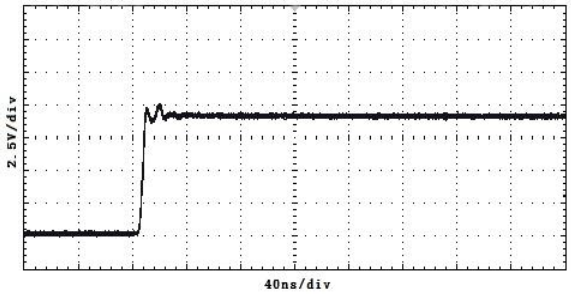
| | | **High end oscilloscope (over 350M)** | | **Low end oscilloscope (below 200M)** | |
|---|---|---|---|---|---|
| | | **50Ω** | **1MΩ** | **1MΩ** | **External through type 50 Ω load (CK-50)** |
| Probe | **50Ω** | Correct | **The signal amplitude is twice normal. The waveform oscillates.** | **The signal amplitude is twice normal. The waveform oscillates.** | Correct |
| | **1MΩ** | **The output signal amplitude is half of the normal.** | Correct | Correct | |

**9.2** During measurement, try to minimize the area encircled by two input cable, such as double line parallel or twisted pair. This will help decrease the inductance to ensure bandwidth, and decrease the environmental EM interference.

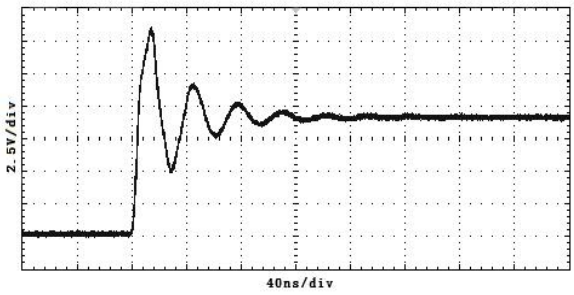
What a twisted pair looks like:



Please be aware that the high frequency characteristics will worsen if the extension cable is applied. The bandwidth will decrease and cause oscillation as shown below:



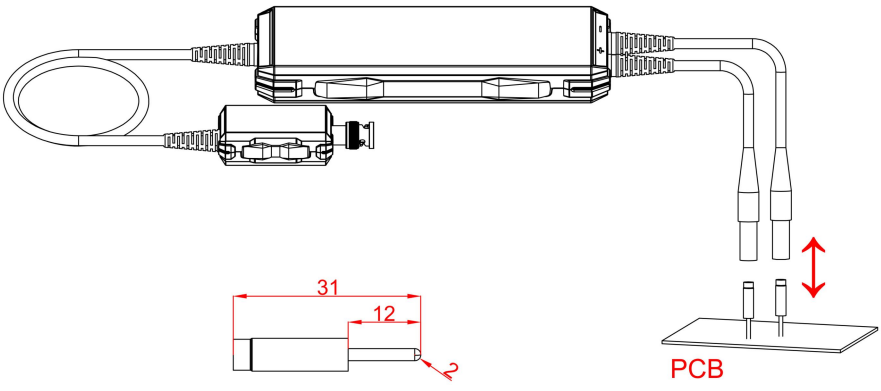

Waveform without extension cable




Waveform with extension cable(CK-301)

**9.3** To fully utilize the high-frequency performance (100MHz) of this probe and achieve maximum bandwidth while reducing waveform oscillation. You can use the banana head socket that comes with the factory to connect to the tested circuit.

As shown in the picture below:



### ■ Optional: Smart Probe Adaptor


The Smart Probe Adaptor can automatically identify the smart probe connected and set up parameters including voltage/current type, attenuation ratio and delay time on oscilloscope. Please refer to the instruction manual of the OT7001 for more detail.

## 10.Packing List

| Name | HVP6150E | HVP6350E | HVP6700E |
|---|---|---|---|
| Voltage probe body | 1 | 1 | 1 |
| USB 5V/2.4A adapter (CK-605A) | 1 | 1 | 1 |
| Crocodile Clip (CK-261) | 1 | 1 | -- |
| Crocodile Clip (CK-262) | -- | -- | 1 |
| Insulated piston probe clamp (CK-281) | 1 | 1 | 1 |
| Test hook (CK-284A) | 1 | 1 | 1 |
| Input extension cable (CK-301) | 1 | 1 | 1 |
| Banana head socket (CK-293) | 2 | 2 | 2 |
| USB cable (CK-314, 1.5 meters) | 1 | 1 | 1 |
| Instruction manual | 1 | 1 | 1 |
| Warranty card | 1 | 1 | 1 |
| CALIBRATION CERTIFICATE | 1 | 1 | 1 |

P. S. The “--”means this model doesn’t contain this accessories.

CYBERTEK
**SHENZHEN ZHIYONG ELECTRONICS CO., LTD.**
**Addr**：Room A1702, Building 4, TianAn Cyber Park, HuangGe Road, LongGang District, ShenZhen City, China
**Tel:** （86）400 852 0005 / （86 755）86628000
**Q Q:** 400 852 0005
**Email:** cybertek@cybertek.cn
**Url:** http://www.cybertek.cn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