❖ Current Probe

CP3120 (DC-70MHz/ 30A)

CP3050 (DC-50MHz/ 50A)

CP3030 (DC-15MHz/150A)

CP4040 (DC- 5MHz/500A)

❖ Current Probe Amplifier

CPA3000 (DC-100MHz)

CPA4000 (DC- 50MHz)

Catalogue

- Please read the Instruction Manual carefully before use.
- Please do not use in humid, flammable and explosive environment.
- In case of electrical shocks, please do not open the device without authorization.

Summary

CPA3000 and CPA4000 is high performance Current Probe Amplifiers for the CP3000/CP4000 AC/DC current probes .The current probes covered in this manual are listed below:

- CP3120 (30A/70MHz, compatible with CPA3000)
- CP3050 (50A/50MHz, compatible with CPA3000)
- CP3030 (150A/15MHz, compatible with CPA3000)
- CP4040 (500A/5MHz, compatible with CPA4000)

Products and Accessories

■ Amplifier Panel

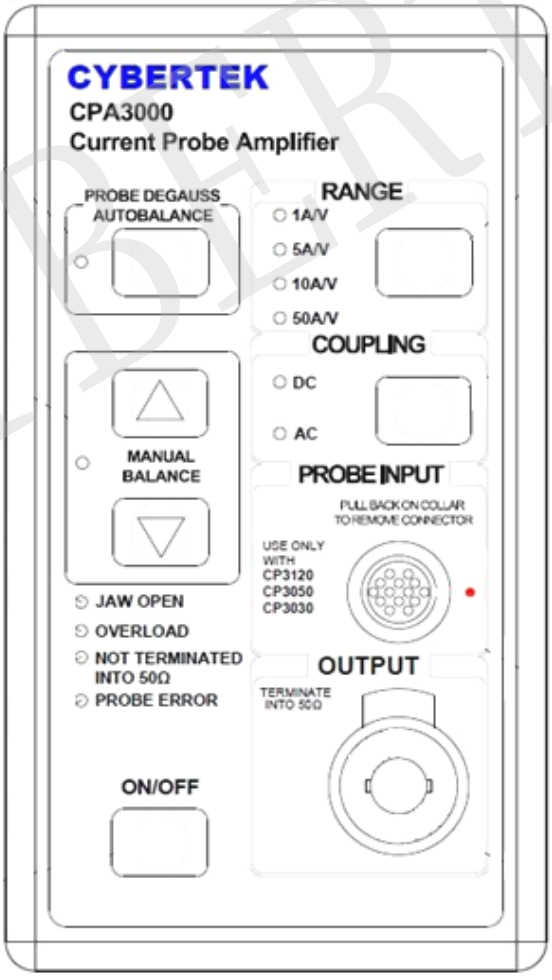

Figure 1：CPA3000

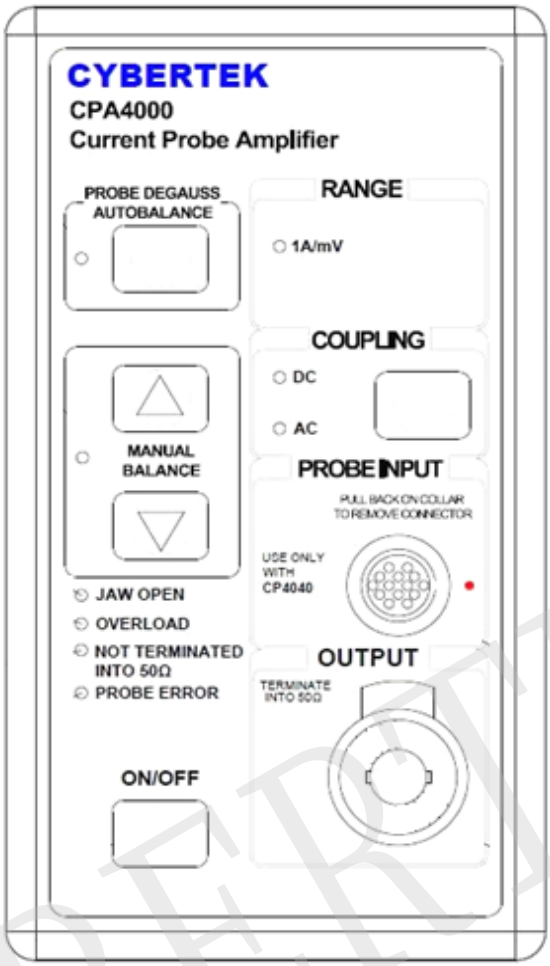

Figure 2：CPA4000

- **Degauss Auto Balance Button and Indicator Light**
  - When the current probe is detected to be degaussed, the indicator light beside the degauss button will blink red light. But the amplifier is not able to test all situations that probes needed to be degaussed, in order to test accurately, even when the indicator light is not on red, it is necessary to press the degauss button to degauss before proceeding.
  - Make sure the probe is locked when degaussing, the amplifier output is connected to 50 Ω loads, and ensure no current flows through the tested wire.
- **Range Selection Button**

  It is used to switch between two different ranges when the probe is connected (not available for CPA4000). Please refer to sheet 4 for specific switching ranges.
- **Manual Balance Button**

  It is used to fine-adjust DC offset from the amplifier.

  NOTE: Coupling mode of the amplifier and oscilloscope must be DC coupling when manually balance.
- **Probe Jaw Indicator Light**

  When the indicator light is on red, indicating the probe jaw is unlocked shut, now degaussing cannot be done or may cause inaccurate measurement results. The probe should be locked for normal use.

✧ **Overload Indicator Light**

When indicator light is continuously on red, indicating current measured is over range; when indicator light is on orange, indicating temperature of the current probe or the amplifier is too high.

NOTE: To avoid personal injury, please do not measure current beyond standard of the amplifier.

✧ **50Ω Load Indicator Light**

When the light is on, indicating the output end is not connected to 50Ω load, or not 50Ω load.

NOTE:

- When the amplifier output connects to 50Ω load, input impendence of oscilloscope should be set to 1MΩ; if input impedance of oscilloscope has been set to 50Ω, there is no need to connect the amplifier output to 50Ω load.
- The amplifier detects whether is connected to 50Ω only when degauss auto balance. If 50 Ω is disconnected or the oscilloscope is not se to 50 Ω input impedance after degauss auto balance is completed, the indicator light is not lit.

✧ **Probe Error Indicator Light**

When the light is on, indicating the amplifier is not able to identify the connected probe, please check the probe model number before connecting to the amplifier.

✧ **Power ON/OFF**

The amplifier doesn't work when power is off, but the internal linear voltage is still connected to power supply voltage (switch power supply).

✧ **Coupling Mode Selection Button**

It is used to switch coupling modes between current probes and amplifiers.

NOTE:

- When determining to measure AC current, the amplifier coupling mode can be set at AC, but now oscilloscope coupling mode should be set at DC coupling, if the oscilloscope coupling is also set to AC coupling, then it exceeds the amplifier dynamic output range , leads to measurement inaccuracy.
- If these two coupling indicator lights blink together, indicating error is tested by the amplifier during process of degaussing auto balance.

✧ **Probe Input**

Probe should be connected correctly, otherwise may result in unseen damage to the probe and amplifier.

✧ **Probe Output**

Connect the amplifier output to oscilloscope input with a standard BNC cable.

NOTE: Match the amplifier output terminal with 50Ω load.

■ Instruction for Probe Body

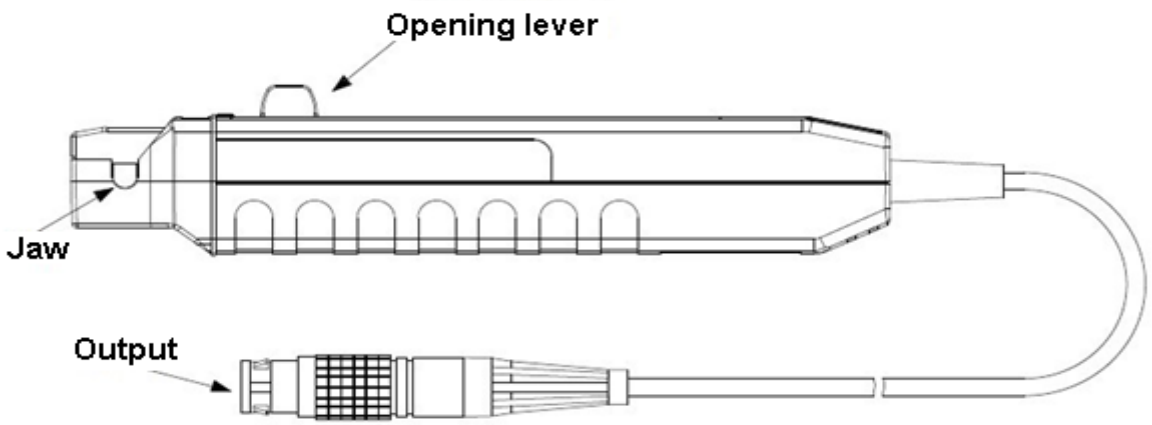

Figure 3：CP3120/CP3050 Structure Chart

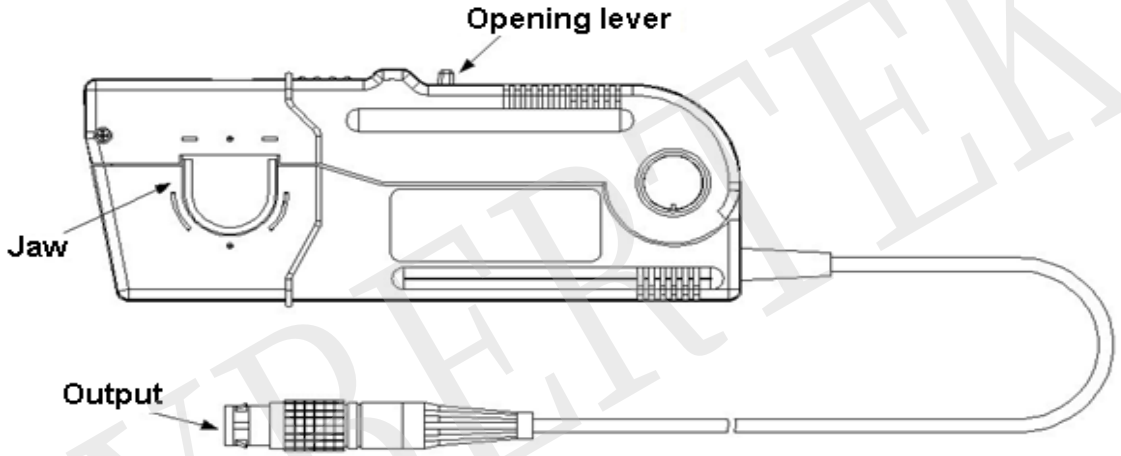

Figure 4：CP3030/ CP4040 Structure Chart

- **Jaw**
  Measure the tested wires. Note: The measured wires must not exceed jaw open diameter.
- **Opening lever**
  Pull the lever back to open the clamp. Make sure in LOCK statues to ensure measurement accuracy.
- **Output**
  Output connector, connect to Current Probe Amplifiers.

■ Products Accessories

- **Feed through 50Ω load**

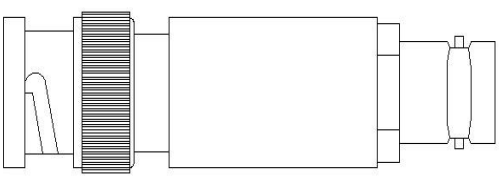

Figure 5: Standard 50Ω load: Frequency: DC-1GHz; Maximum Input Power:1 W

✧ **Coaxial Cable Connecting Lines**

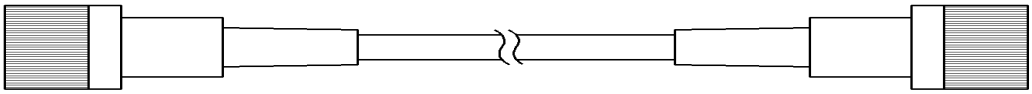

Figure 6: BNC Connecting Cable: 50Ω Impedance ;
Both BNC Male Plug Ends; 1m in Length

✧ **Power Supply Wires**

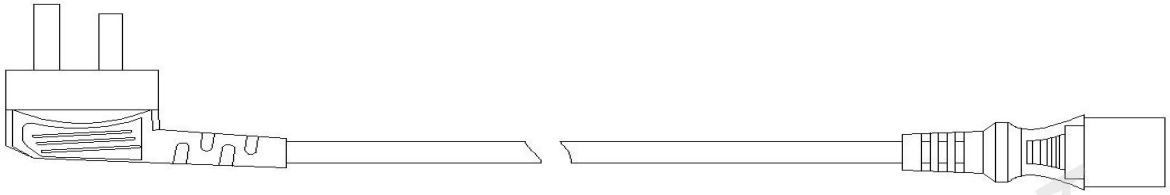

Figure 7: Standard Power Leads

Product Specification

✧ **Amplifier Technical Specification**

Product parameters measurement is obtained in the following circumstances:

- The probe and amplifier are calibrated under 23±5℃ environment.
- The probe and amplifier working environment is listed in Table 5.
- The current probe and amplifier have been warmed up for a period of at least 20 minutes.
- The probe is degauss/autobalance routine has been performed after the 20-minute warm-up period, and thereafter whenever the PROBE DEGAUSS/AUTOBALANCE light blinks.
- The amplifier output is correctly connected to 50 Ω load.

Amplifier	**CPA3000**			**CPA4000**
DC gain accuracy	≤1%			≤1%
Probe Type	CP3120	CP3050	CP3030	CP4040
Bandwidth（-3dB）	DC-70MHz	DC-50MHz	DC-15MHz	DC-5MHz
Rise time（10%~90%）	≤5ns	≤7ns	≤23ns	≤70ns
DC gain accuracy: Warranted Typical	≤3% ≤1%	≤3% ≤1%	≤3% ≤1%	≤3% ≤1%
Input Voltage	110-240VAC（±10%）			
Maximum Power	50W			

Table 1 Amplifier Technical Specification Instruction

NOTE: 1. Guaranteed accuracy ≤3% testing environment temperature：10℃-40℃
2. Environment Temperature for typical accuracy testing : 23℃±5℃

✧ Amplifier （CPA3000/CPA4000）Mechanical Specification

Parameters		Specification
Length		165mm
Width		90mm
Height		162mm
Weight	CPA3000	1.08kg
	CPA4000	1.10kg

Table 2 Amplifier Mechanical Specification Instruction

✧ Current Probe Technical Specification (Typical)

Parameters		Model						
		CP3120		CP3050		CP3030		CP4040
Range		1A/V 10A/V		5A/V 10A/V		5A/V 50A/V		1A/mV
Minimum measured current		1mA		5mA		5mA		1A
Noise (Bandwidth limitation 20MHz)		≤75uArms		≤500uArms		≤500uArms		≤70mArms
Coupling mode		AC, DC						
Low frequency bandwidth of AC coupling（-3dB）		<7Hz						
Maximum current (Decreases as frequency increases Figure 14~17)	Range	10A/V	1A/V	10A/V	5A/V	50A/V	5A/V	1A/mV
	DC continuous	30A	5A	50A	25A	150A	25A	500A
	RMS (Positive wave)	21A	3.5A	35A	17.7A	150A	17.7A	500A
	Peak value	50A	50A	50A	50A	500A	500A	750A
Terminal load requirement		50Ω						
Delay	Current system	15ns		15ns		25ns		65ns
	BNC line 1m	5ns						
Maximum insulation wire voltage		300V CAT I		300V CAT I		600V CATII 300V CATIII		600V CATII 300V CATIII
Insertion impedance		Refer to Figure 18		Refer to Figure19		Refer to Figure 20		Refer to Figure 21

Figure 3 Probe Technical Specifications

✧ Current Probe Mechanical Specifications

Parameters		CP3120	CP3050	CP3030	CP4040
Probe handle size	length	175mm		175mm	
	width	40mm		26mm	
	height	18mm		65mm	
Jaw diameter		5mm（Figure 8）		20mm（Figure 9）	
Wire length		1.5m		2m	4m
weight		177g		450g	504g

Figure 4 Current Probe Mechanical Specification

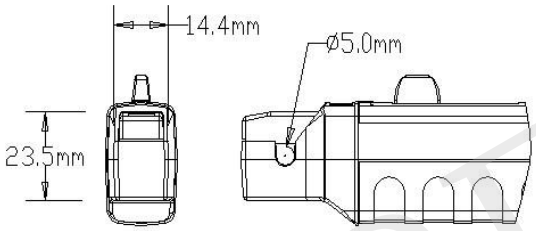

Figure 8 CP3120 and CP3050 Jaw Size Image

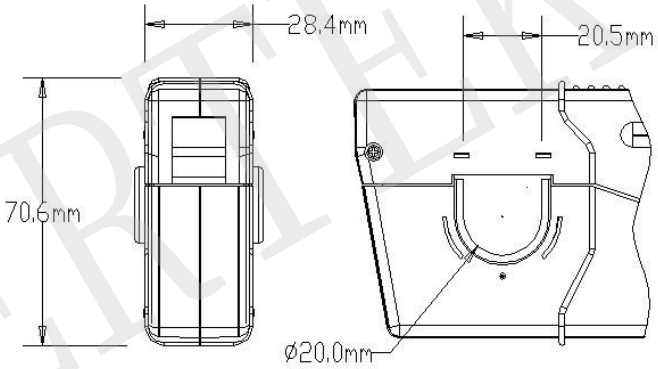

Figure 9 CP3030 and CP4040 Jaw Size Image

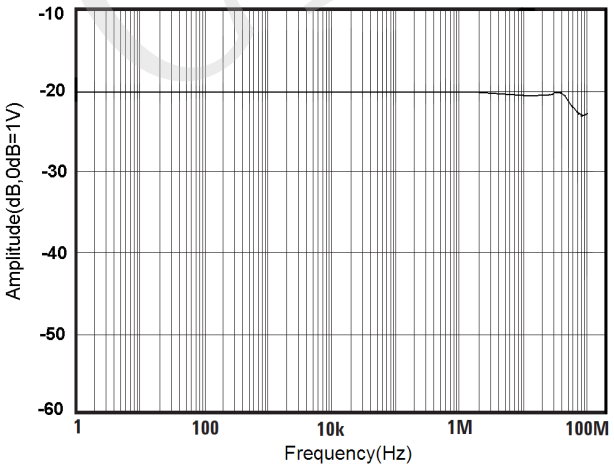

Figure 10 CP3120 Amplitude-frequency Curve

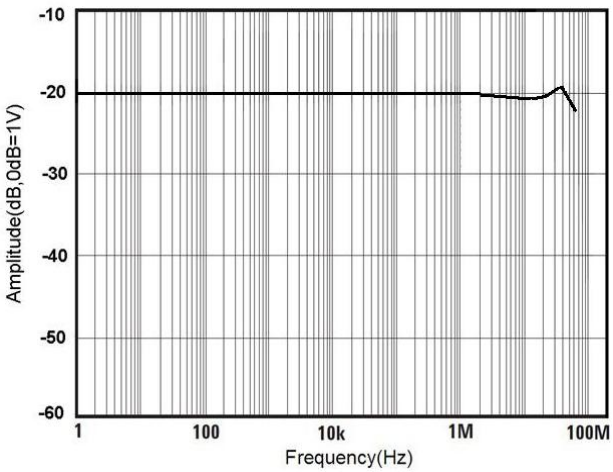

Figure 11 CP3050 Amplitude-frequency Curve

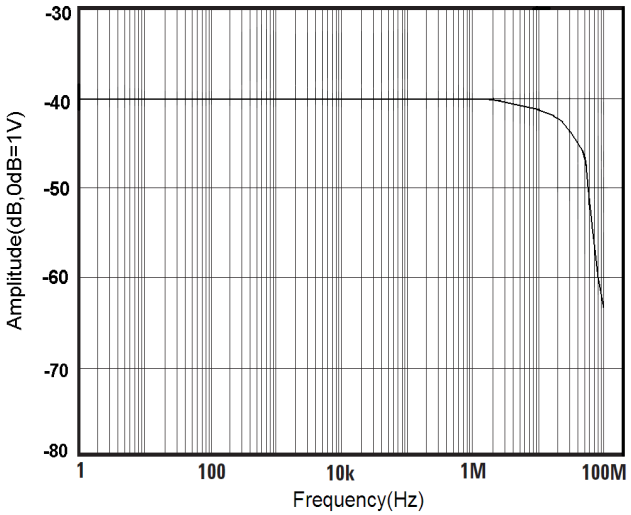

Figure 12 CP3030 Amplitude-frequency Curve

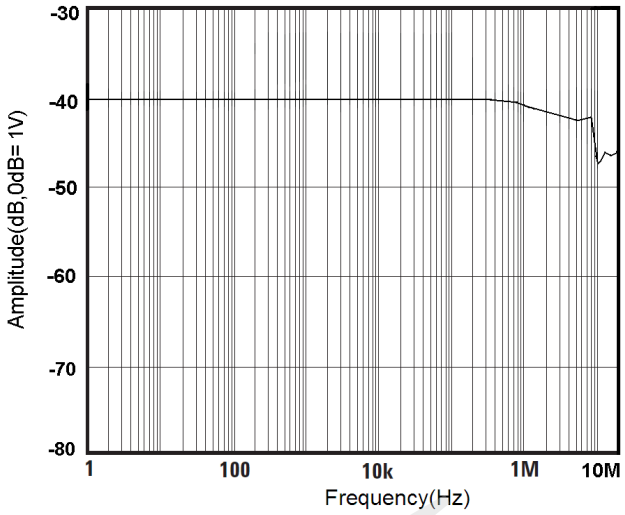

Figure 13 CP4040 Amplitude-frequency Curve

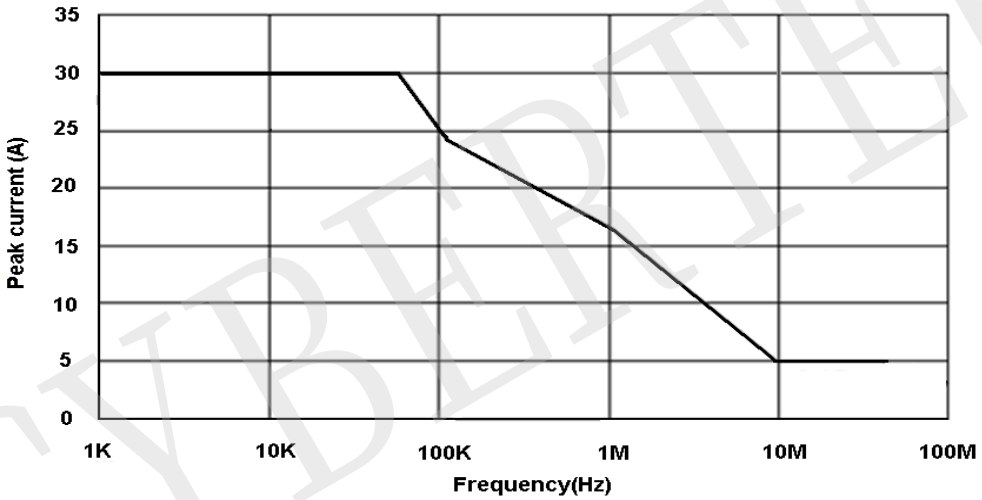

Figure 14 **CP3120 Maximum Peak Value Current vs Frequency Curve**

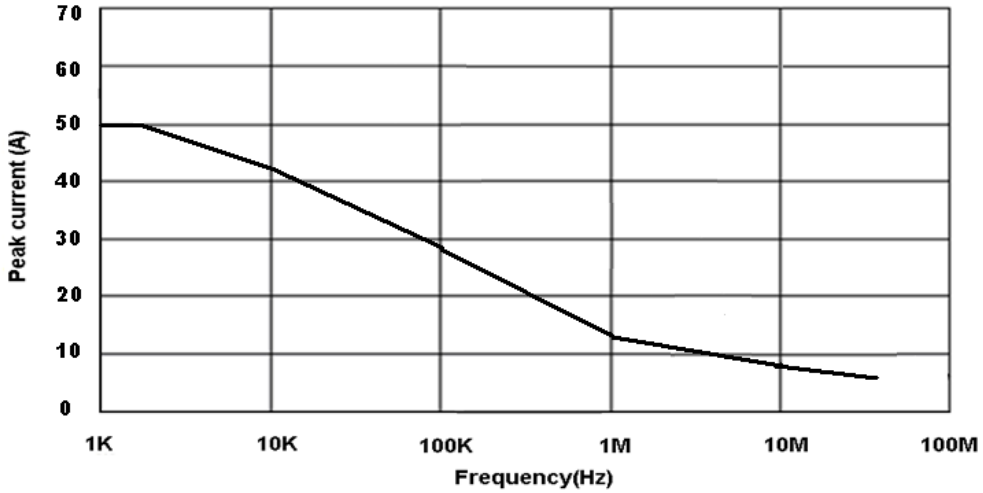

Figure 15 **CP3050 Maximum Peak Value Current vs Frequency Curve**

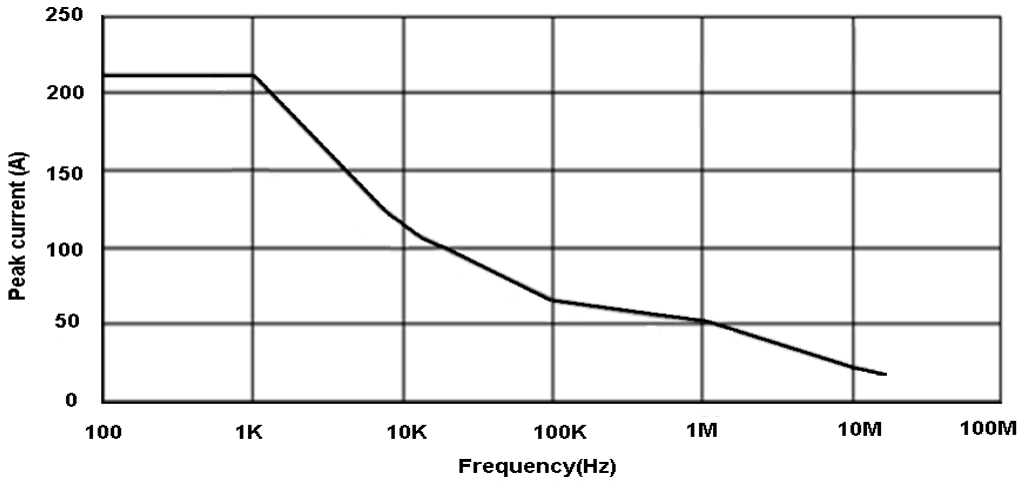

Figure 16 CP3030 **Maximum Peak Value Current vs Frequency Curve**

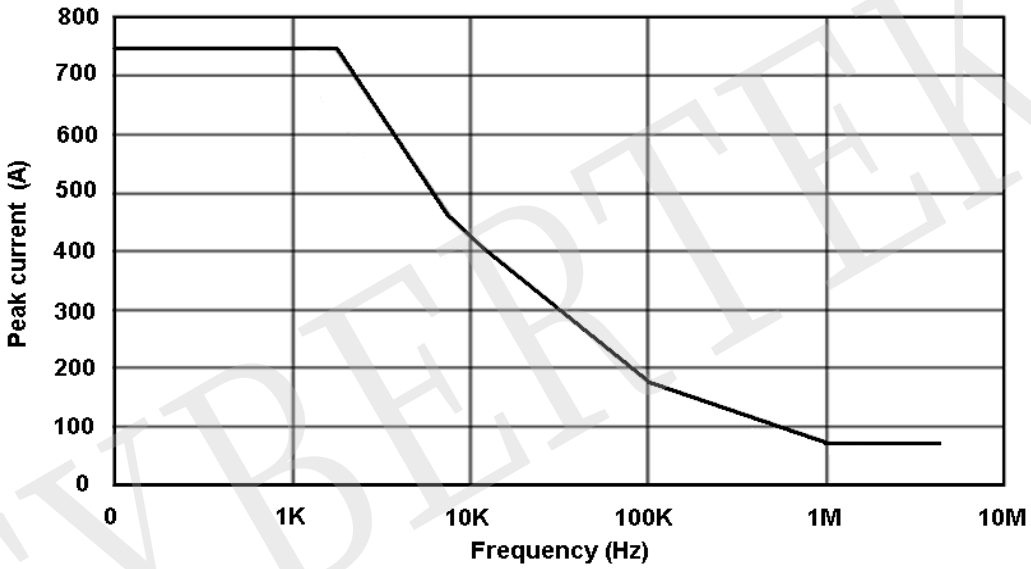

Figure 17 CP4040 **Maximum Peak Value Current vs Frequency Curve**

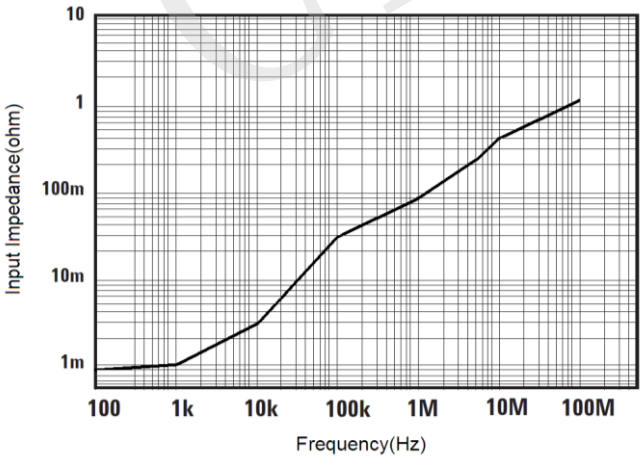

Figure 18 CP3120 insertion loss vs frequency curve

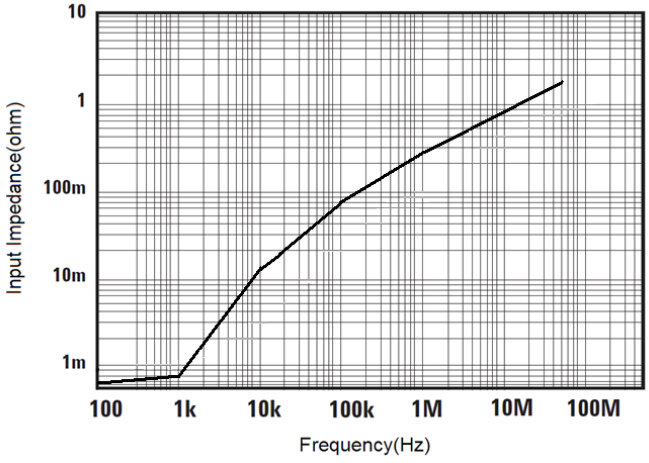

Figure 19 CP3050 insertion loss vs frequency curve

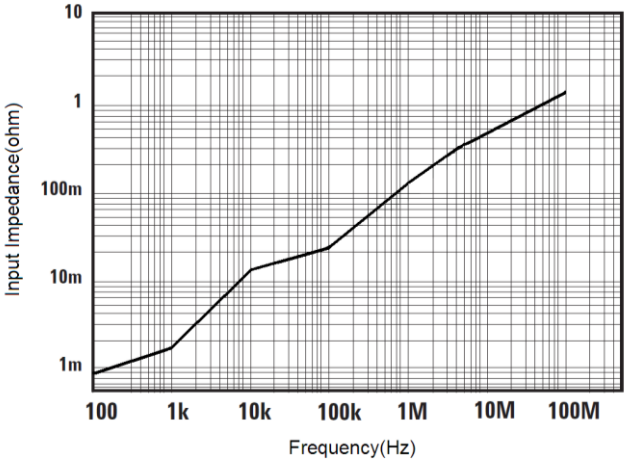

Figure 20 CP3030 insertion loss vs frequency curve

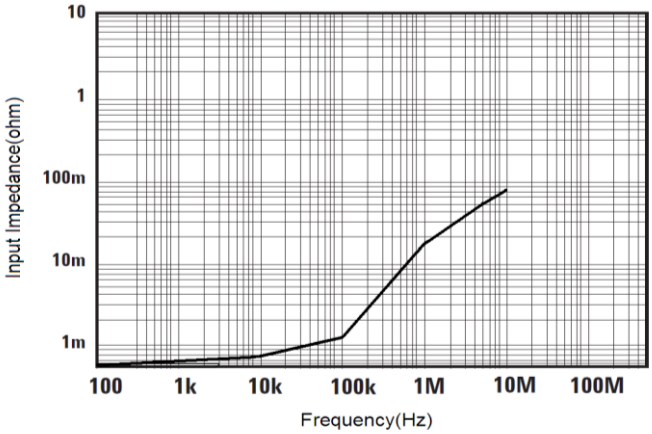

Figure 21 CP4040 insertion loss vs frequency curve

✧ **Environmental Characteristics**

Parameters	Values
Operating temperature and humidity	0℃~40℃，80% or less
Storage temperature and humidity	-40℃~75℃，80% or less
Operating altitude	Max 2000m
Storage altitude	Max 12000m

Table 5 Environmental Characteristics Specification

Test Platform Setup

The simplified Figure 22 shows equipments needed to set up the test platform and connecting methods.

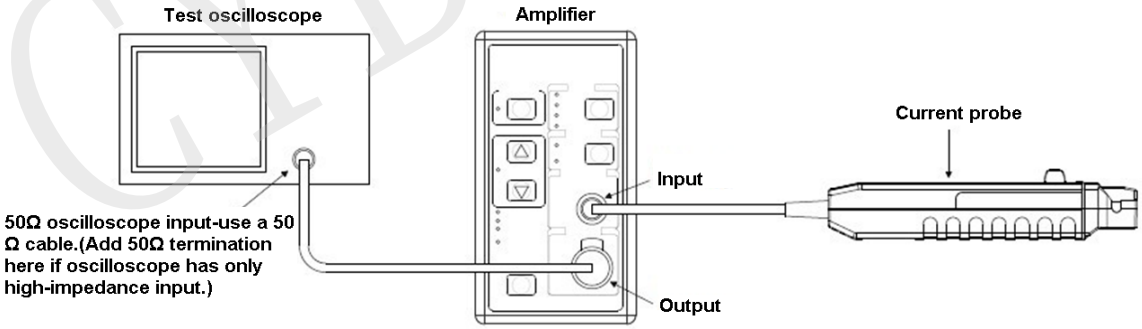

Figure 22 Diagrams for Test Platform Setup

✧ **Connect Amplifier to Oscilloscope**

Connect the oscilloscope with 50Ω BNC cable if the oscilloscope channel input impedance can be set as 50Ω. You can also connect the feed through 50Ω load in the oscilloscope input if the oscilloscope has impedance 1MΩ only.

✧ **Connects the Current Probe to the Amplifier**

Select relevant amplifier for different current probes. If the current probe is connected to a wrong amplifier (e.g. connects CP4040 to CPA3000), PROBE ERROR indicator light will be on. The connector connecting and disconnecting method is as follows:

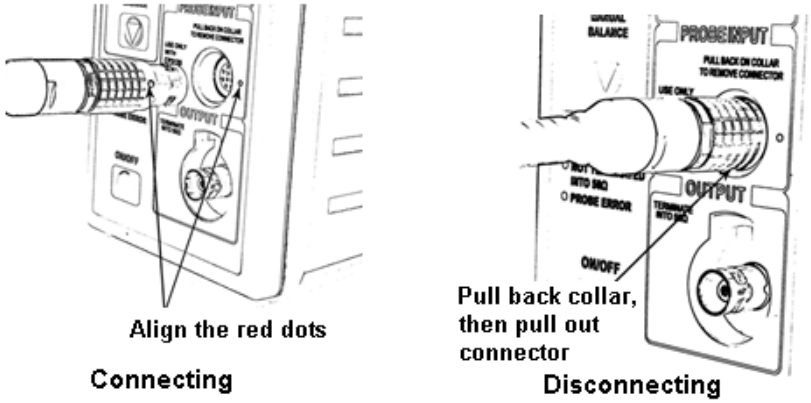

Figure 23 Diagrams for Probe Connecting and Disconnecting to Amplifier

Instruction for operation

✧ **Probe Online Degaussing**

When no current flows through the wire embedded in jaw, under most conditions, we can degauss online. It can effectively compensate disordered voltage caused by the residual DC magnetic field.

NOTE:

- Make sure no current flows through the tested wires, otherwise cause inaccurate measurement.
- If the impedance of your circuit is higher than that shown in Table 6, the degauss procedure will succeed because the amplifier will be able to saturate the probe core. While degauss occurs, the probe will induce a voltage in the unpowered circuit. This also appears in Table 6. Your circuit must be able to absorb this induced voltage. With low impedance circuits, several amperes may be induced in the circuit being measured. This may be of concern when you are using very small conductors.

Probe type	Minimum circuit resistance	Maximum introduced voltage
CP3120	10mΩ	40mV 200Hz
CP3050	10mΩ	40mV 200Hz
CP3030	5mΩ	30mV 200Hz
CP4040	1mΩ	15mV 200Hz

Table 6: Unpowered circuit degauss limits

✧ **Measuring the Differential Current**

As shown in Figure 24, we can use the current probe to measure current differential between two wires, so that two sets of current measurement system are unnecessary.

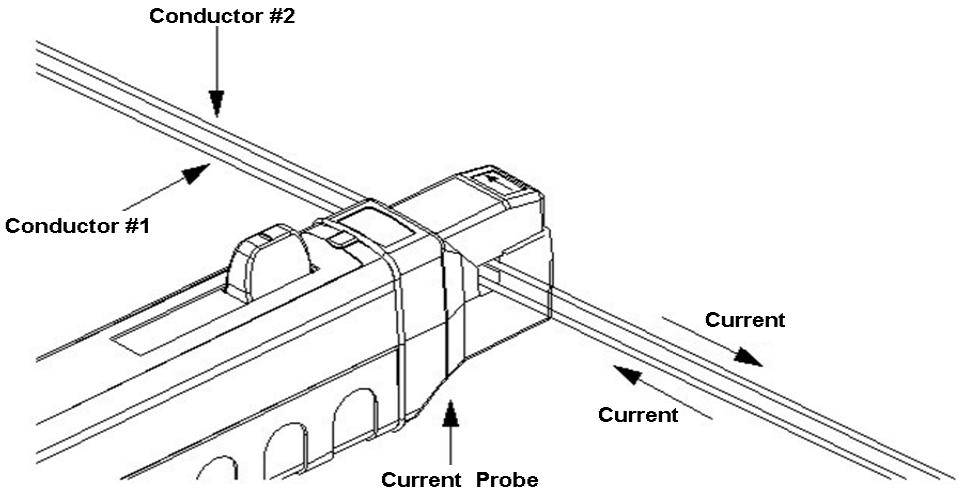

Figure 24: Measuring Method for Current Differential

NOTE:

- Do no put no insulation layer wires in CP3120 jaw; do no simultaneously put two or more than two no insulation layer wires in CP3030 or CP4040 jaws.
- When wires cannot be put into the jaw, must not forcefully close the jaw, otherwise the testing result is inaccurate.

✧ **AC and DC Coupling**

You can choose coupling modes between the signal and the amplifier. DC coupling will display DC and AC components, and AC coupling may remove DC component, only displays AC component. When using AC coupling, make sure that the input DC current does not exceed the probe specifications. When frequency of the measured waveform is higher than the low frequency bandwidth of AC coupling, the measurement is affected. As shown in the following Figure 25:

Figure 25 Waveform of AC and DC Coupling

If you are trying to examine a low-frequency signal that is superimposed on a comparatively large DC component, you can resolve the signal by performing these steps:

- Select the range setting that will display the maximum detail without exceeding the dynamic range of the signal.
- Adjust the oscilloscope V/div sensitivity, to display maximum signal detail.

✧ **Improve measurement sensitivity**

When measure AC signal with small amplitude or low frequency AC signal, we can make more

turns for the measured wires to the same direction, to improve measurement sensitivity. For example, if 10mA is measured with 10-turn wires, then the practical current of the measured wire is 1mA. As shown in the following Figure 26.

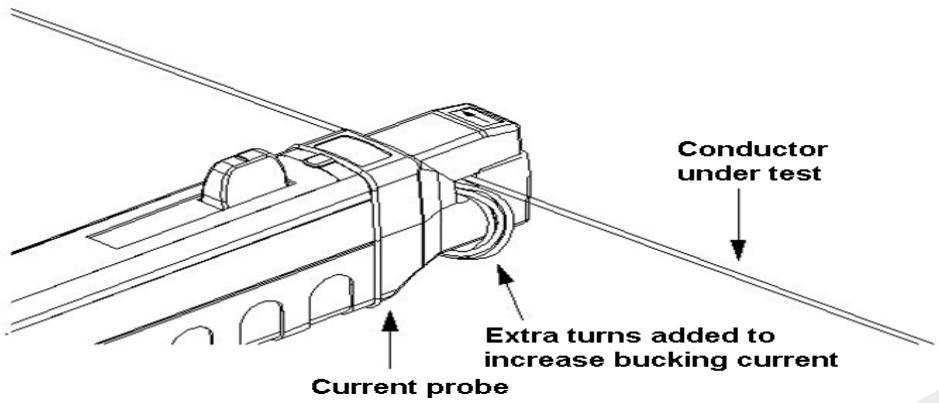

Figure 26 Measurement Method for Low current

NOTE:

- Such method only applies for measuring DC or low frequency signal.
- More turns may increase the insertion impedance of the probe, and the probe bandwidth may decrease too.

✧ **Maximum Range for Current Probe**

The current probe has three maximum rated current: Continuous current, pulse current and current time product. Exceed any of the three may saturated and magnetize the probe and lead to error of the measurement results.

- Maximum continuous current refers to the maximum current can be measured when measure DC or specific AC frequency. The maximum current can be measured decreases when frequency increases.
- Maximum pulse current refers to the maximum peak value of the pulse current can be measured accurately by the current probe (has no connection with the pulse width of the pulse current, but should be within normal bandwidth range).
- Current time product indicates when the measured pulse current peak value is between maximum continuous current and maximum pulse current, the duration of the current probe in measuring pulse peak value (i.e. the maximum pulse width for the measured current.)

E.G.: The maximum current time product for CP3120 is 500A*us at 10A/V, if the peak value current of the measured pulse current is 40A (higher than maximum continuous current 30A and lower than maximum pulse current 50A), then the maximum pulse width allowed is 12.5us (40A is divided by 500A*us). If it is known that the maximum pulse width of the tested current is 15us, then the maximum peak value current allowed is 33.3 A (15us is divided by 500A*us).

✧ **Use CP4040 to measure discontinuous current**

When use CP4040 to measure, in order to ensure accuracy, you must pay attention to the following factors: peak value, continuous current and duty cycle of the discontinuous current, and environment temperature. All that affect maximum time the current probe can measure.

NOTE: When the measured current equals to peak value current or close to peak value current, the probe head will get hot. To avoid injury, please do not touch the probe head.

Trouble Shooting Methods

The following table list some potential malfunctions and solutions, this table may help you to solve the problems quickly; please do not disassemble for repair, in case of accidents.

Malfunctions	Solutions
The amplifier cannot be start	check whether the amplifier connects to the power supply
All indicator lights blink	Indicating the amplifier is thermal shutdown, you should cut off power, cooling for at least 15 minutes.
OVERLOAD indicator light is still on red after removing the probe from the circuits	The amplifier or probe main panel is damaged, it should be returned for repair in time
OVERLOAD is on orange all the time	First degauss to zero, if remains orange, disconnect the probe from the amplifier, degauss again after 15 minutes, if indicator light still lit up, then probe main panel or Hall sensor maybe broken. Connect another probe to the amplifier, or connect the probe that may contain a problem to another amplifier to determine whether the problem of the probe or amplifier is.
Current probe head cannot be degaussed	☞ Possibly the current probe is not locked shut. Lock shut the current probe. ☞ The current probe is not connected to amplifier correctly. ☞ The amplifier output is not connected to 50Ω load. ☞ The current probe is damaged or not the modal match with amplifier.
More than 10 seconds to degauss zero	➢ There flows current through the measured wires. Take out the probe from the measured circuit, degauss again. ➢ Probe damaged (probe mother panel or Hall device broken, producing loud noise or zero drift). ➢ If no problem is found in the probe, possibly the amplifier motherboard is damaged.

Fail to measure current (no amplifier output)	☞ The current probe jaw is not locked shut. Lock shut the jaw. ☞ The current probe is not correctly connected to the amplifier. ☞ The amplifier coupling mode is AC. Set DC coupling as the coupling mode. ☞ Degauss zero is not completely successful. Re-degauss zero. ☞ The Oscilloscope or amplifier is not displayed with appropriate calibration. ☞ Connecting cable between the oscilloscope and amplifier is damaged.
Fail to manually degauss zero	➢ The oscilloscope and amplifier coupling modes should be set at DC. ➢ The Oscilloscope or amplifier is not displayed with appropriate calibration.
Disordered waveform is found during measurement	☞ The measured current exceeds range, or the current probe is exposed in severe magnetic field circumstances. Press the Degauss Balance button to degauss. ☞ Manually Degauss zero.
Inaccurate Measurement	➢ Degauss the current probe ➢ The amplifier output is not connected to 50Ω load or to a load not 50 Ω. ➢ The measured current exceeds the current probe range; change the probe with larger measurement range. ➢ The amplifier of the current probe is not calibrated. ➢ Dirt on jaw. Disassemble the probe, clean it, and put some lubricant. ➢ The current probe main panel is damaged.
Frequency response decreases at high frequency	☞ Oscilloscope bandwidth is limited. Set full bandwidth. ☞ Do not measure current exceeds the probe maximum frequency, otherwise may cause probe overheated and damage it.
Loud noise with measurement result	➢ The current probe is not locked shut. Lock shut the probe. ➢ The current probe is not well connected to amplifier. ➢ The amplifier output terminal is not connected to 50Ω load. ➢ The current probe main panel is damaged.

Measurement result delays or pulse responds slowly.	☞ The amplifier output terminal is not connected to 50Ω load. ☞ Speed of the measured current exceeds transformation speed of the current probe. It is recommended to change higher frequency current probe. ☞ The oscilloscope bandwidth is limited or oscilloscope bandwidth is not enough.
Current probe jaw can't be easily opened and locked	Mechanical components of probe jaw are stained. Open the probe to clean.

Figure 7 Simple Troubleshooting Methods

Storage and Maintenance

- Please keep the amplifier and probe clean and dry.
- If need to clean, please wipe with soft and dry cloth, do not clean with chemicals.
- When not in use, please put the probe in the package, and put it in cool, clean and dry places.
- Please must put it in the package supplied by our company when transporting, shock can be prevented.
- Please disconnect the wires from the power strip when do not use for an extended period.

Packing List

Product	Amplifier		Current Probe			
Name	CPA3000	CPA4000	CP3120	CP3050	CP3030	CP4040
Body	1 unit	1 unit	1 unit	1 unit	1 unit	1 unit
Feed through 50Ω load resistance	1 unit	1 unit	--	--	--	--
Coaxial-cable lines	1 pcs	1 pcs	--	--	--	--
Power wires	1 pcs	1 pcs	--	--	--	--
Instruction manual	1 pcs	1 pcs	1 pcs	1 pcs	1 pcs	1 pcs
Testing report	1 sheet	1 sheet	1 sheet	1 sheet	1 sheet	1 sheet
Warranted card	1 sheet	1 sheet	1 sheet	1 sheet	1 sheet	1 sheet

NOTE:--indicates not accessories for the product

CYBERTEK

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