



**High Frequency AC / DC Current Probe
CP1003B / CP503B**

User Manual

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Should a separate written agreement between Micsig and the user contain warranty terms covering the material in this document that conflict with these terms, the warranty terms in the separate agreement shall prevail.

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Warranty

The current probe body is guaranteed for 1 year. During the warranty period of the product, the company will be responsible for providing free maintenance for any faults caused by the quality of the product itself under normal use and has not been dismantled or repaired.

The warranty is invalid in the following cases, but maintenance services are provided, labor costs are waived, and only spare parts are charged:

- a. Accessories damage due to improper use, maintenance or storage.
- b. Damage caused by force majeure factors, such as natural disasters.

In the following cases, the company will refuse to provide maintenance services or provide maintenance services for a fee:

- a. Unable to provide product packaging or anti-counterfeiting labels on product packaging.
- b. The content of the anti-counterfeiting label has been altered, or is blurred and unrecognizable.
- c. It has been dismantled by unauthorized personnel by Micsig (eg: changing wires, dismantling internal components).
- d. There is no sales voucher or the content of the sales voucher does not match the product.

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General Safety Summary

Please read the following safety precautions carefully to avoid personal injury and prevent damage to this product or any product connected to this product.

To avoid possible danger, be sure to use this product as prescribed.

Only qualified personnel should perform repair procedures.

Avoid fire or personal injury

Connect and disconnect devices properly.

- * Do not plug or unplug probes or test leads while they are connected to a voltage source
- * Power off the circuit under test before connecting or disconnecting the current probe.
- * Before connecting the probe to the circuit under test, please connect the probe output to the measuring instrument.
- * Before connecting the probe input, please connect the probe reference lead to the circuit under test.
- * Before disconnecting the probe from the measuring instrument, please disconnect the probe input end and the probe reference lead from the circuit under test.

Observe all terminal ratings. To avoid fire or electric shock, observe all product ratings and markings. Before making connections to the product, please consult the product user manual for details on ratings. Do not connect the current probe to any wire with a voltage exceeding its rating.

Do not disassemble the machine. Do not use the product for measurements with covers or panels open.

Do not operate the product when it is suspected that the product is malfunctioning.

Have it inspected by service personnel designated by Micsig.

Keep away from exposed circuits. Do not touch exposed wiring and components while the power is on.

Do not operate in wet environments.

Do not operate in flammable and explosive environments.

Please keep the product surface clean and dry.

Terms in this manual



WARNING: A "WARNING" statement identifies conditions or actions that could result in personal injury or life-threatening conditions.



CAUTION: A "CAUTION" statement identifies conditions or actions that could cause damage to this product or other property.

Maintenance Safety

Only qualified service personnel with relevant qualifications should perform service operations. Please read this "Maintenance Safety Summary" and "General Safety Summary" before performing any repair operations.

Do Not Serve Alone: Do not make internal repairs or adjustments to this product unless someone else is on site to provide first aid and resuscitation.

Disconnect Power: To avoid electrical shock, disconnect power to the instrument before disconnecting the main power cord.

Pay attention when repairing with electricity: Hazardous voltages or currents may be present in this product. Disconnect power and test leads before removing protective panels, soldering, or replacing components.

To avoid electric shock, do not touch exposed connectors.

Compliance Information

This section lists the EMC (Electromagnetic Compatibility), safety and environmental standards to which the instrument complies.

Safety Compliance

Equipment Type

Test and Measurement Equipment.

Pollution Degree

The micro-environmental pollution levels used to determine clearances or creepage distances can be classified into 4 levels.

- ✧ Pollution degree 1: no pollution or only dry non-conductive pollution;
- ✧ Pollution degree 2: In general, there is only non-conductive pollution, and occasional temporary conduction caused by condensation occurs. typical office/home environment. Temporary condensation occurs only when the product is not in use;
- ✧ Pollution degree 3: There is conductive pollution, or dry non-conductive pollution becomes conductive due to expected condensation;
- ✧ Pollution degree 4: Causes persistent conductive pollution, such as pollution caused by conductive dust or rain and snow.

Pollution Degree

Pollution Degree 2

Overvoltage Class Description

The overvoltage level is divided according to the IEC60664 standard, which is divided into four levels: CAT I, CAT II, CAT III, and CAT IV.

- * **CAT I** is a low-voltage low-energy class with protective devices, generally referring to the internal voltage of electronic equipment;
- * **CAT II** is a low-voltage high-energy level, branched from the main power supply circuit, and the 220V voltage of the home lighting circuit belongs to this category;
- * **CAT III** refers to the high voltage and high energy level, refers to the fixed installation of the main power supply circuit, generally refers to 380V three-phase voltage;
- * **CAT IV** refers to three-phase lines at utility power connections, any outdoor conductors.

Overvoltage Category

CAT II

Environmental Considerations

This section provides information about the environmental impact of the product.

Product End-of-Life Handling

Observe the following guidelines when recycling an instrument or component:

Equipment Recycling: Production of this equipment required the extraction and use of natural resources. The equipment may contain substances that could be harmful to the environment or human health if improperly handled at the product's end of life. In order to avoid release of such substances into the environment and to reduce the use of natural resources, we encourage you to recycle this product in an appropriate system that will ensure that most of the materials are reused or recycled appropriately.



This symbol indicates that this product complies with the relevant requirements of European Union Directives 2002/96/EC and 2006/66/EC on Waste Electronic and Electrical Equipment (WEEE) and Batteries.

Preface

This user manual describes the use of the high frequency AC / DC current probe CP1003B/CP503B, including basic probe operations and concepts. You can also visit the Micsig website www.micsig.com for this document and other related information.

Documentation

Information to be obtained	Documentation used
CP1003B/ CP503B probe: first operation, functional check, basic operating knowledge, technical specifications	Please read and use this manual
Oscilloscope related operations	Please obtain from corresponding oscilloscope user manual

Conventions used in this user manual

The diagrams in this manual use the following symbols to indicate the sequence of steps:

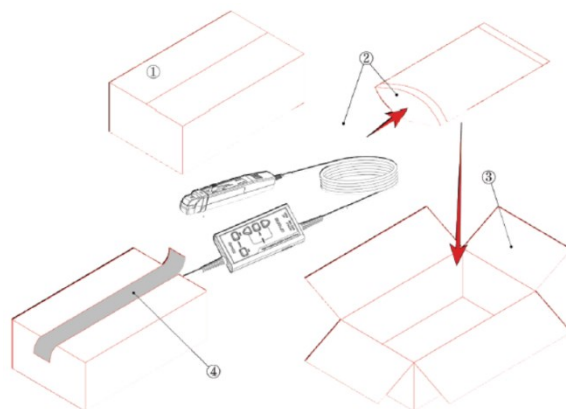
①、②、③、④、⑤、⑥、⑦、⑧、⑨

Factory Repair

If the probe requires service, the probe must be returned to Micsig. If the original packaging is unusable or missing, please follow the packaging guidelines below:

Shipment Preparation

1. Use a corrugated cardboard shipping container with internal dimensions at least 3 cm larger than the probe dimensions. The cardboard test weight of the box should be at least 90.72 kg.
2. Put the probe in an antistatic bag or wrap it to protect it from moisture.
3. Place the probe in the case and secure it with lightweight packing material.
4. Seal the box with shipping tape.
5. See Micsig Contact Information at the beginning of this manual for shipping addresses.

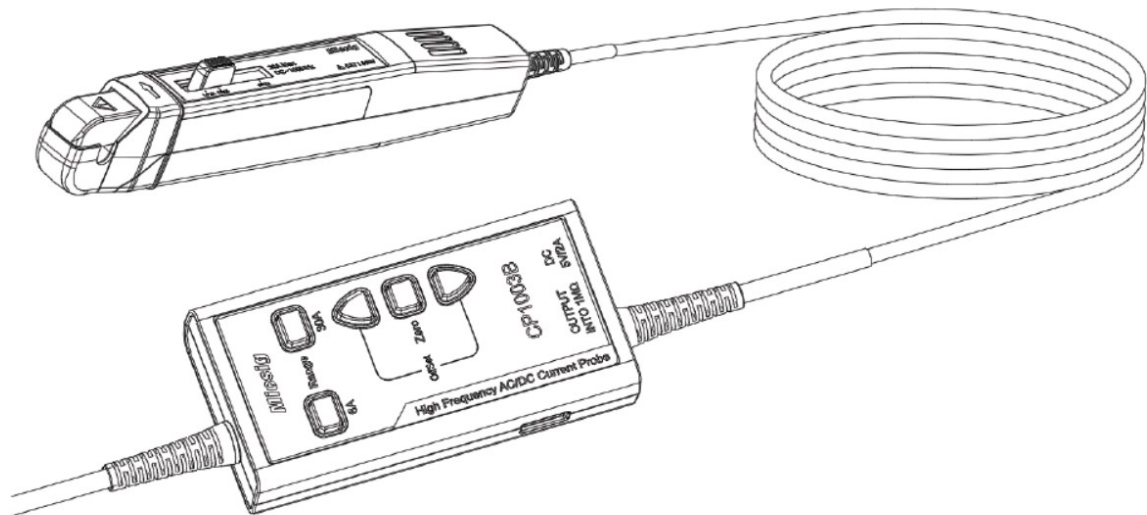


Main Functions

High frequency AC / DC current probes utilize Hall Effect technology to measure both AC and DC currents. It has the characteristics of high bandwidth and high precision, which can meet the needs of most test fields.

Key features:

- * >100 MHz bandwidth, $\leq 3.5\text{ns}$ rise time (CP1003B)
- * >50 MHz bandwidth, $\leq 7\text{ns}$ rise time (CP503B)
- * AC/DC measuring capability
- * Switchable Range 6A / 30A
- * 1% DC accuracy (typ.)
- * One step to degaussing/auto-zeroing
- * Support manual and auto zero calibration
- * Overload indicator light



Probe Structure

Probe Slider and Wire Grip

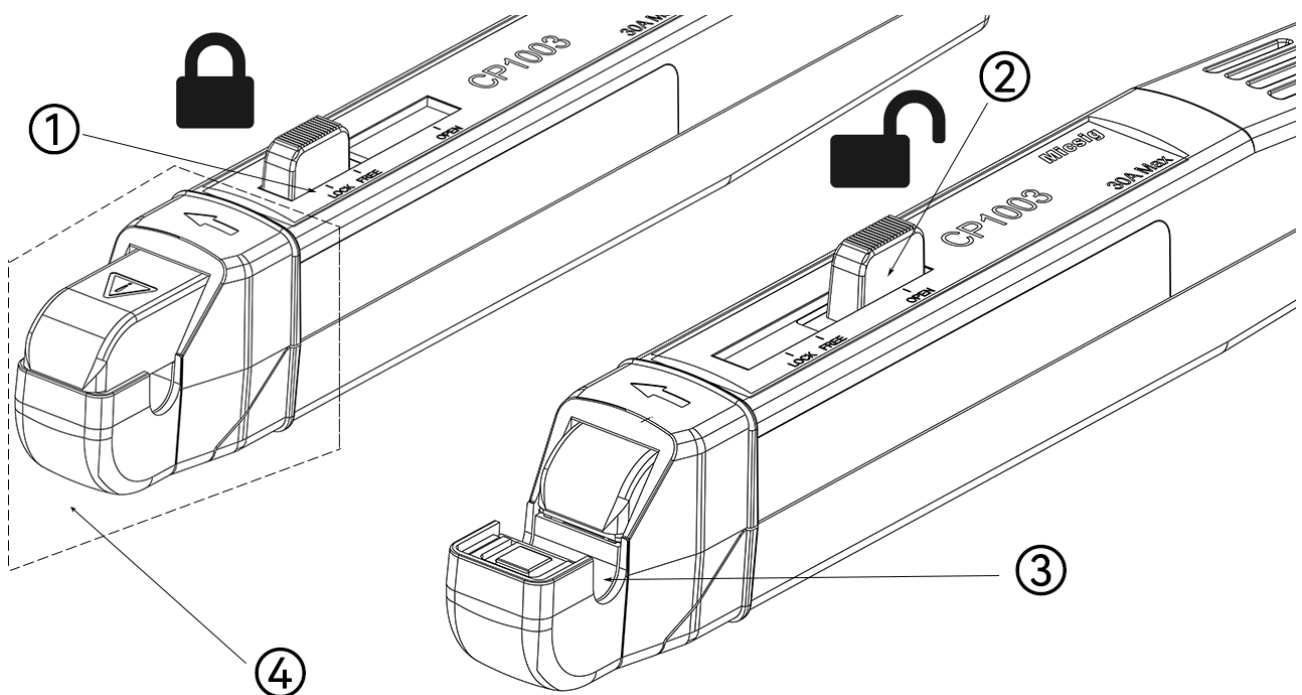
1. When the slider is in the "LOCK" position, you can degauss the probe and take measurements.
2. Move the slider to the "OPEN" unlocked position to insert or remove the wire from the wire clip.
3. The grip will accept wire diameters up to 5mm.
4. Place your finger behind the safe handling area (the area inside the dashed line in the figure) when measuring.

⚠ WARNING: Do not force wires larger than 5 mm into the grips, it may damage the probe.

⚠ WARNING: To avoid electric shock, do not touch areas within the safe handling area (the area within the dashed line in the diagram) when taking measurements.

⚠ Warning: Do not drop the probe or subject it to strong shocks, as this may result in damage to the probe.

⚠ Warning: Do not connect the current probe to any wire whose voltage or current exceeds the probe rating.



Probe Control Module

The CP1003B and CP503B function buttons and LED status indicators are located on the probe control module and are described as below:

Function Button

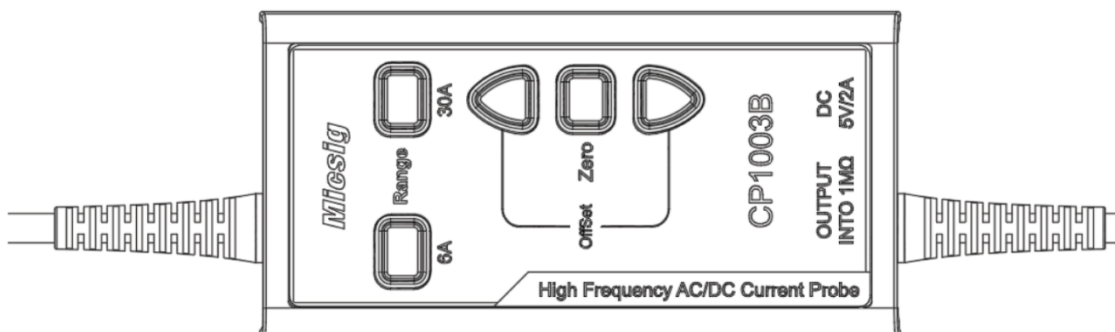
- * The Range button is the range switching button, which can be selected between 6A and 30A, and switches each time by lightly pressed.
- * " Δ " and " ∇ " are the degaussing and zero-calibration buttons. Press " Δ " and " ∇ " to adjust the zero manually.
- * The "Zero \square " button is the automatic zero-calibration button, single press will automatically degauss and zero-calibration.

Button Status Indicator


- * The status indicator of the current range button will always be on to indicate the selected current range.
- * "Zero \square " button long ON, the probe will be degaussed and zeroed, and will turn off after completed, If the button flashes 5 times, it means zero calibration failed.
- * When the current is overloaded, the status indicator light of the corresponding range button will flash

Note

- * The probe will automatically go through a degaussing and zeroing procedure every time it is powered on.
- * Input current overload will magnetize the probe, please demagnetize the probe after the overload occurs.




Installation

 Caution: The probe head is a precision part. Do not drop the probe or physically shock it, twist it, or drastically alter its surroundings. Do not insert wires larger than 5.0 mm in diameter into the probe grip, as this may damage the probe.

Connecting to an oscilloscope

1. Connect the probe BNC cable to the channel interface of the oscilloscope;
2. Power the probe control module with the standard USB power adapter provided with the probe.

 Caution: Must use the adapter provided with the probe for power supply, DO NOT use USB port on the oscilloscope.

Degaussing and Zero


Note: **Before degaussing and zero the probe, be sure to verify that the probe head is locked.** When the oscilloscope recognizes the probe for the first time, the probe will automatically degauss and zero.

To ensure accurate measurements, degauss the probe under following conditions:

- * Turn on the measuring system and allow a 20-minute warm-up time
- * Before connecting the probe to the wire
- * Whenever there is a current or thermal overload
- * Whenever the probe is placed in a strong external magnetic field

Press the button "Zero □", the button lights up, probe will conduct degaussing and zero calibration. If the button light flashes 5 times, it means zero calibration failed.

Function Check and Basic Operation

CAUTION: Do not force wires larger than 5.0 mm in diameter into the probe jaws,  as this may damage the probe. The mating surface of the probe head transformer is precisely polished and should be handled with care. Dirt on the mating surface of the probe head transformer may reduce measurement accuracy.

Use the following steps to check if the probe is working properly:

1. Connect the probe to any channel of the oscilloscope.
2. Set the oscilloscope impedance to 1MΩ.
3. If the auto-zero calibration fails, press the Zero button, or press "Δ" "▽" to perform manual zero calibration.
4. Fix the probe into the circuit.
5. Adjust the oscilloscope settings or use the oscilloscope's auto-setup function to display a stable waveform. After seeing a stable waveform, it means that the probe is working normally.

Here are some basic operations that should be noted:

- * Before connecting the oscilloscope, please slide the probe slider to the LOCK position to lock the probe, otherwise it will affect the zero calibration accuracy.
- * Before connecting the probe to the lead, please check the oscilloscope, if there is a DC offset, please degauss and zero the probe. (See related page)
- * Please do not touch the conductor under test and the sensor head of the probe during measurement.
- * Close and lock the probe grip on the wire. For correct polarity readings, connect the probe from positive to negative so that the direction of current flow matches the arrow on the probe clip.

Application

The high-frequency AC / DC current probe can be used in many measurement fields, such as new energy vehicle design, switching power supply design, electrical engineering, semiconductor device design, avionics design, inverter/transformer design, electronic ballast design, Industrial control/consumer electronics design, engine drive digital design, power electronics and power transmission practical design, etc. Below we introduce several common measurement applications:

Inductance Measurement

Use a current probe to measure the coil inductance of a low- or high-impedance pulse source of known value:

Low impedance pulse source

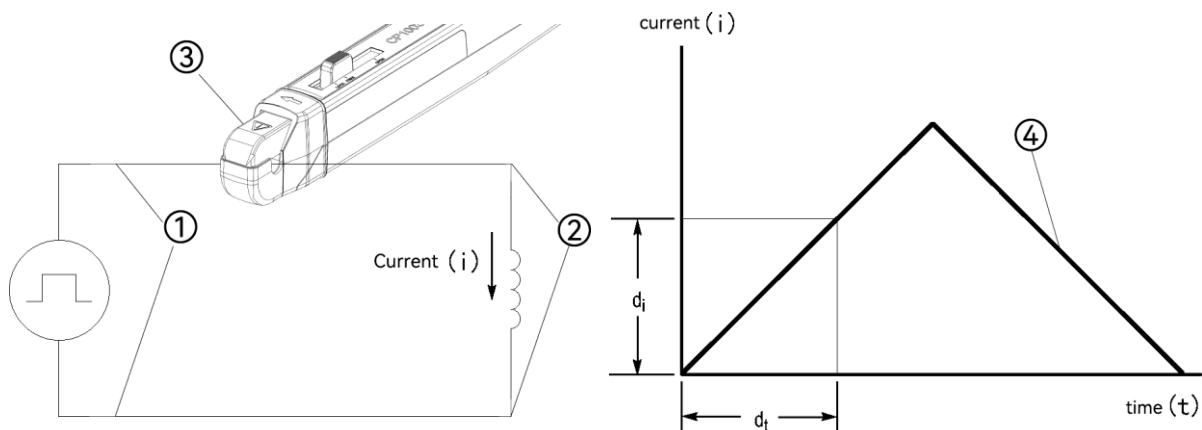
1. Connect the sensor to the output of the pulse generator.
2. Keep the voltage on the inductor constant.
3. Clip the current probe to one of the current source leads.
4. Measure current sawtooth. Inductance is effectively defined by the slope of the current sawtooth.
5. Calculate the inductance using the following formula

$$L = \frac{-E}{\frac{di}{dt}}$$

The L is the inductance in Henries. E is the voltage of the pulse generator, d_t is the time change, and d_i is the current change.

Note: The probe impedance is a significant part of the overall circuit inductance, the measurement accuracy will be affected. For information on probe insertion impedance, see Probe Specifications.

Figure below shows a constant voltage pulse generator with very low output impedance connected to a low resistance inductor.

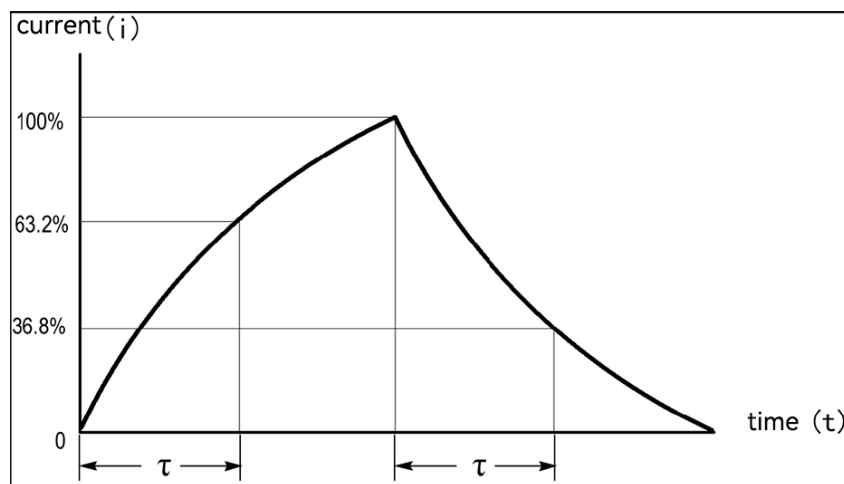


High impedance pulse

If the pulse source has a higher impedance of known resistance, and the output voltage drops as the current increases, the inductance of the coil can be calculated from the time constant of the charging curve. The current ramp shows how to derive the formula value for the inductance. Use this formula to calculate the inductance from the current measurement:

$$L = \tau R$$

The L is the inductance in Henrys. τ is the time required for the current to rise or fall to 63.2% of the total current value, and R is the source resistance of the pulse generator.

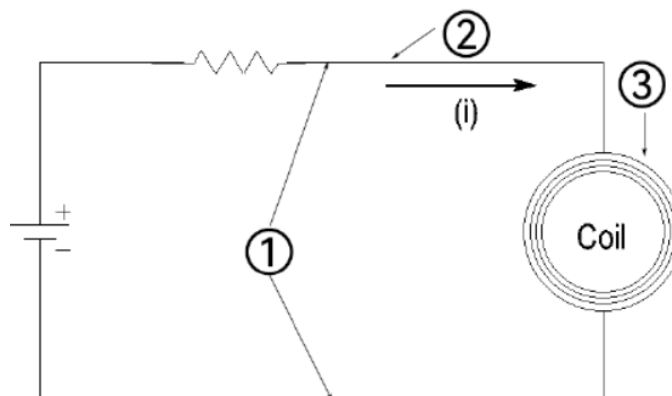


Measuring Inductor Turns

To get the approximate number of turns for the inductor, follow these steps:

1. Connect the inductor to the current limited power supply, shown as below.
2. Measure the input current in one of the inductor leads.
3. Clip the current probe to the inductor and record the current value.

The number of turns is equal to the ratio of the coil current to the input current. The accuracy of this method will be limited by the current measurement accuracy.

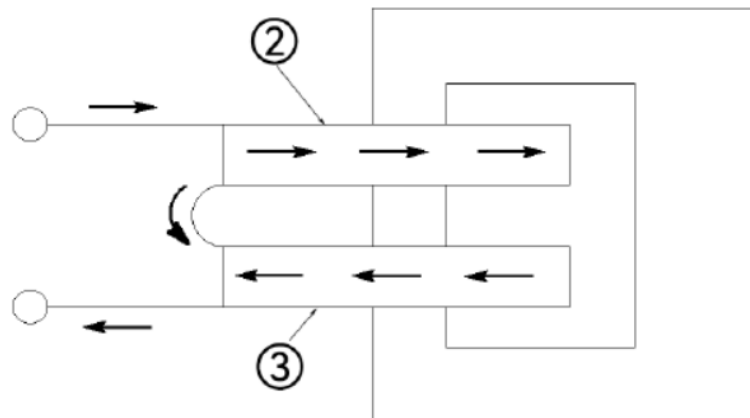


To get a more accurate number of turns, a coil with a known number of turns is needed

1. Repeat steps 1 and 2 above with the following changes:
2. Insert the reference coil into the current probe.
3. Insert the test coil into the current probe so that the currents are in opposite directions to each other as shown. The polarity of the coil current must be observed to determine whether the test coil has more or fewer turns than the reference coil. The number of turns can be calculated using the following formula:

$$N_2 = N_1 \times (I_m \div I_1)$$

N_2 is the number of turns of the test coil, N_1 is the number of turns of the reference coil, I_m is the measurement coil current, and I_1 is the input current.



Technical Specifications

The technical specifications in the tables in this section are valid under the following conditions:

- * The probe has been calibrated at an ambient temperature of 23° C ±5° C.
- * The probe is connected to the host instrument using an input resistance of 1 MΩ.
- * The probe must have a warm-up time of at least 20 minutes in an environment that does not exceed the stated limits.

Specifications for the HF AC / DC current probes are divided into three categories: Warranted Characteristics, Typical Characteristics, Nominal Characteristics

Warranted Characteristics

Table 1: Warranted Electrical Characteristics

Warranted characteristics describe performance guaranteed to be achieved within tolerances or required by a particular test type.

Characteristics	CP1003B	CP503B
Bandwidth	DC-100MHz	DC-50MHz
Rise Time	≤ 3.5ns	≤ 7ns
DC Accuracy (Typical)	±1%±10mA (6A) ±1%±50mA (30A)	

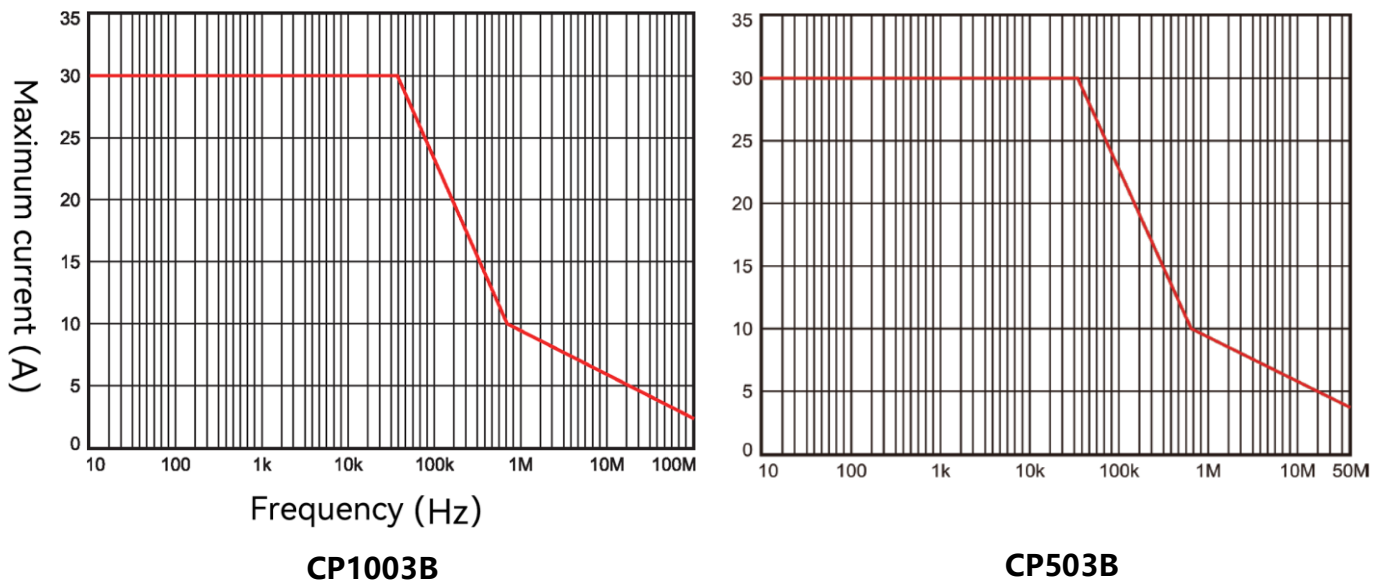
Typical Characteristics

Table 2: Typical Electrical Characteristics

Typical Characteristics describe typical but not guaranteed

Characteristics	Specifications
Delay	< 30ns (6A) < 30ns (30A)
Measuring range	20mA~6Apk (6A) 50mA~30Apk (30A)
Max. measuring current	30Apk, 60Apk-pk, 21.21Arms
Max. working voltage	CAT II 300V
Max. floating voltage	CAT II 300V

Figure 1: Maximum Current VS Frequency Curve



Warning: When measuring high-frequency current, be careful not to exceed the current value shown in the curve. Use of the maximum continuous current exceeding the curve will cause the probe to burn.

Figure 2: Amplitude-frequency characteristic curve

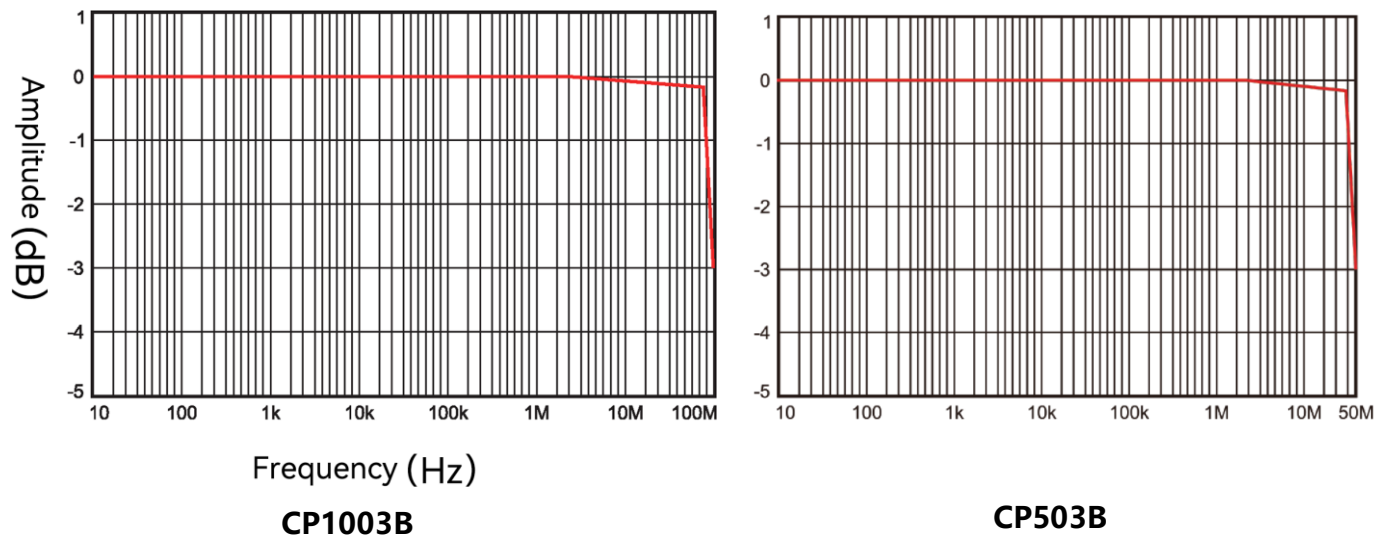
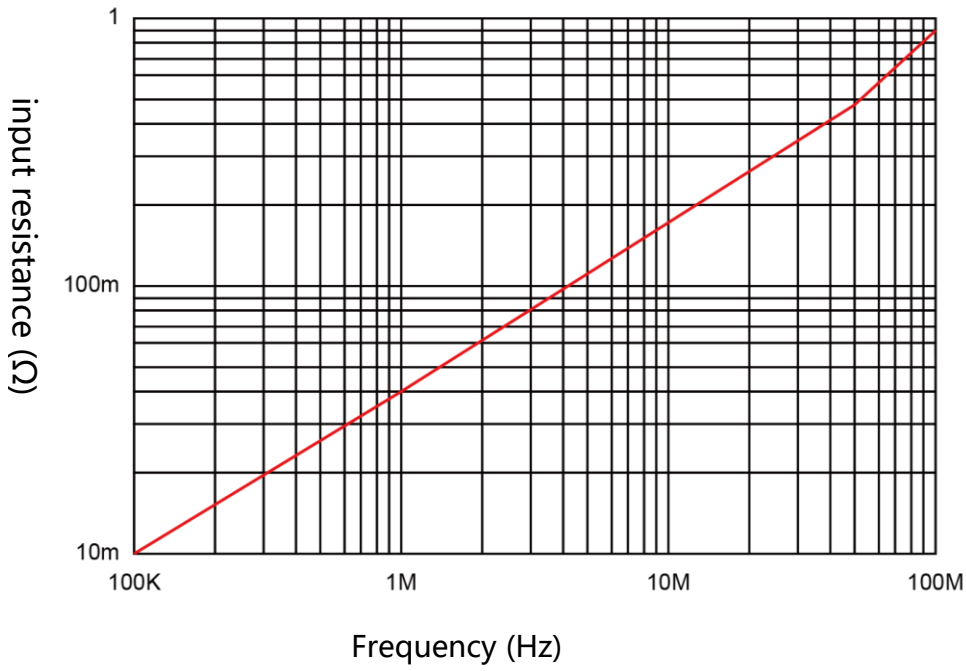
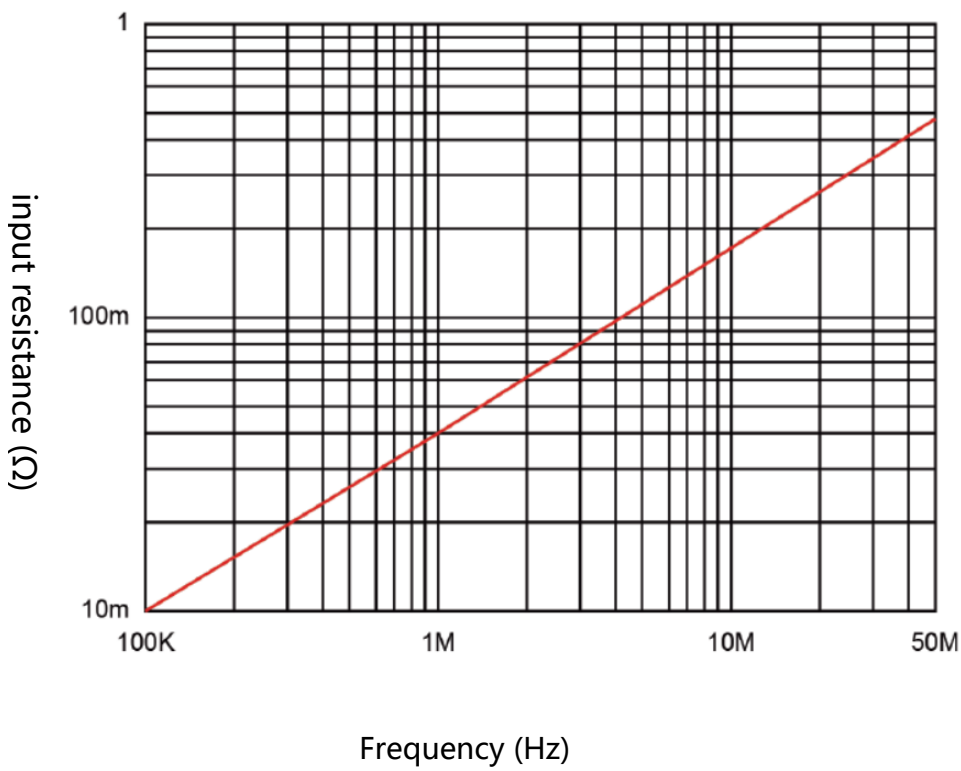


Figure 3: Input Impedance VS Frequency Curve



CP1003B



CP503B

Table 3: Environmental Characteristics

Features	Parameters
Operating temperature	0~50°C
Storage temperature	-20°C ~80°C
Operating humidity	5%~95%(0~40°C ,non-condensing) 5%~65%(40°C ~50°C ,non-condensing)
Working height	≤ 3000m
Storage height	≤ 12000m

Table 4: Mechanical Characteristics

Features	Parameters
Probe head size	17.5x2x2.9cm
Probe Control Module Dimensions	10.8*5.6*2.6cm
Maximum conductor diameter	5mm
Cable Length (Probe Head to Control Module)	1m

Nominal Characteristics

Table 5: Nominal Characteristics

Nominal characteristics describe guaranteed characteristics, but these characteristics are not subject to tolerance limits.

Features	Parameter
Input coupling	DC
Range	6A (2X) / 30A (10X)
Output sensitivity	1V/2A (6A) 1V/10A (30A)
Terminals	Connect the output terminals to 1M Ω
Compatibility	Compatible with any BNC interface oscilloscopes

Maintenance

This section provides maintenance information for the probe.

Troubleshooting

LED status lights on the probe can indicate the current probe status or errors. If the probe LED status light does not glow as expected, or if some function of the probe is not working properly, there may be an error. See the table below.

Table 6: Probe Troubleshooting

Malfunctions	Possible Cause
Degaussing and auto-zero failed	The wire claw is not locked; The probe is clamped on the working circuit under test when the probe is degaussing and zero.
Unable to measure DC signal	Check whether the probe is powered properly; Check the oscilloscope coupling method.
The amplitude of the measurement signal is too small.	Check whether the input impedance of the oscilloscope is 50Ω. Please adjust it to 1MΩ to work properly.
LED status light does not glow	The oscilloscope channel may be damaged, please try to replace other channels or other oscilloscopes. After plugging in the oscilloscope, all LED status lights should light up for a short time; if the probe works normally on other channels or oscilloscopes, it is considered to be caused by the oscilloscope channel and has nothing to do with the probe; If the probe does not work on other channels or on the oscilloscope, the probe may be defective, please contact the Micsig after-sales department for repair.

Cleaning

Do not expose the probe to harsh weather conditions, the probe is not waterproof.

⚠ CAUTION: To prevent damage to the probe, do not expose it to sprays, liquids or solvents. When cleaning the outside of the probe, avoid wetting the inside, the probe is not waterproof.

Do not wipe the probe with chemical cleaners, they may damage the probe. Avoid chemicals containing gasoline, benzene, toluene, xylene, acetone, or similar solvents.

Clean the outside of the probe with a soft, dry, lint-free cloth or a soft bristle brush. If dirt remains, clean with a soft cloth or cotton swab dipped in 75% isopropyl alcohol solution and rinse with deionized water. Cotton swabs can be used to clean the tight spaces of the probe with any solution that can dampen the swab or soft cloth.

Do not use abrasives on any part of the probe.

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