TESTEC

AC/DC CURRENT PROBES

for oscilloscopes and digital multimeters

TT-CC series

220, 550, 770 und 990 models

Instruction Manual

English

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1. General

For product information, sales, service and technical support:

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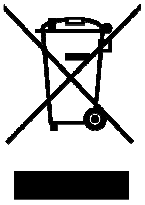
Notes on Disposal



This electronic product is subject to disposal and recycling regulations that vary by country and region. Many countries prohibit the disposal of waste electronics equipment in standard waste receptacles.

2. Package Contents

Unpack the current probe and check that you received all items listed.

- TT-CC series current probe
- BNC to BNC coaxial cable
- BNC to banana plug adapter
- AC power adapter
- Instruction Manual (English/German)

3. Important Safety Instructions

Please read the following safety instructions thoroughly to avoid personal injury and prevent damage to this product or any products connected to it. Use this product only as specified.

Only qualified personnel should perform service procedures.

3.1 Avoid Fire or Personal Injury

Connect and disconnect properly! Connect the probe output to the measurement instrument before connecting the probe to the circuit under test. Disconnect the probe input and the probe ground from the circuit under test before disconnecting the probe from the measurement instrument.

Observe all terminal ratings! To avoid fire or shock hazard, observe all rating and markings on the product. Consult the instruction manual for further ratings information before making connections to the product.

Replace batteries properly! Replace batteries only with the proper type and rating specified.

Do not operate without covers! Do not operate this product without the covers or panels.

Avoid exposed circuitry! Do not touch exposed connections and components when power is present.

Do not operate with suspected failures! If you suspect there is damage to this product, have it inspected by qualified service personnel.

Do not operate under wet or damp conditions!

Do Not Operate in an explosive atmosphere!

Keep product surfaces clean and dry.

3.2 Safety Terms And Symbols

These terms and symbols may appear in this manual and on the product:

DANGER or WARNING: Danger oder Warning statements identify conditions or practices that could result in injury or loss of life.

CAUTION: Caution statements identify conditions or practices that could result in damage to this product or other property.

Double insulated enclosure (Protection class II).

The signal words "Danger", "Warning" and "Caution" used in this manual indicate the degree of hazard that may be encountered by the user. These words are defined as:

DANGER - Indicates death or serious injury will result if proper precautions are not taken.

WARNING - Indicates death, serious injury or property damage can result if proper precautions are not taken.

CAUTION - Indicates some injury or property damage may result if proper precautions are not taken.

4. Compliance Information

This section lists the safety, and environmental standards with which the probes comply.

EC Declaration of Conformity – Compliance with Low Voltage Directive

Compliance was demonstrated to the following specification as listed in the Official Journal of the European Union:

Low Voltage Directive 73/23/EEC, as amended by 93/68/EEC.

EN 61010-1/A2:1995 – Safety requirements for electrical equipment for measurement control and laboratory use.

EN 61010-2-032:1995 – Particular requirements for hand-held current clamps for electrical measurement and test equipment.

4.1 Pollution Degree Description

A measure of the contaminants that could occur in the environment around and within a product. Typically the internal environment inside a product is considered to be the same as the external. Products should be used only in the environment for which they are rated.

Pollution Degree 1. No pollution or only dry, nonconductive pollution occurs. Products in this category are generally encapsulated, hermetically sealed, or located in clean rooms.

Pollution Degree 2. Normally only dry, nonconductive pollution occurs. Occasionally a temporary conductivity that is caused by condensation must be expected. This location is a typical office/home environment. Temporary condensation occurs only when the product is out of service.

These current probes are rated for **Pollution Degree 2** (as defined in IEC 61010-1).

NOTE *Rated for indoor use only!*

4.2 Measurement Categories Descriptions (Overvoltage Categories)

Terminals on this product may have different installation (overvoltage) category designations. The installation categories are:

Measurement Category I.	For measurements performed on circuits not directly connected to MAINS.
Measurement Category II.	For measurements performed on circuits directly connected to the low-voltage installation.
Measurement Category III.	For measurements performed in the building installation.

These current probes are rated for **Overvoltage Category II** (as defined in IEC 61010-1)

5. Current Probe Description

The TT-CC family of AC/DC current probes enable oscilloscope instruments to display AC, DC, and AC+DC current measurements up to 100 amps peak (TT-CC-220) and frequencies up to 1.5 MHz (TT-CC-990). Using supplied BNC to banana plug adapter the current probes will work with most modern Digital Multimeters (DMM).

5.1 Indicators and Controls Overview

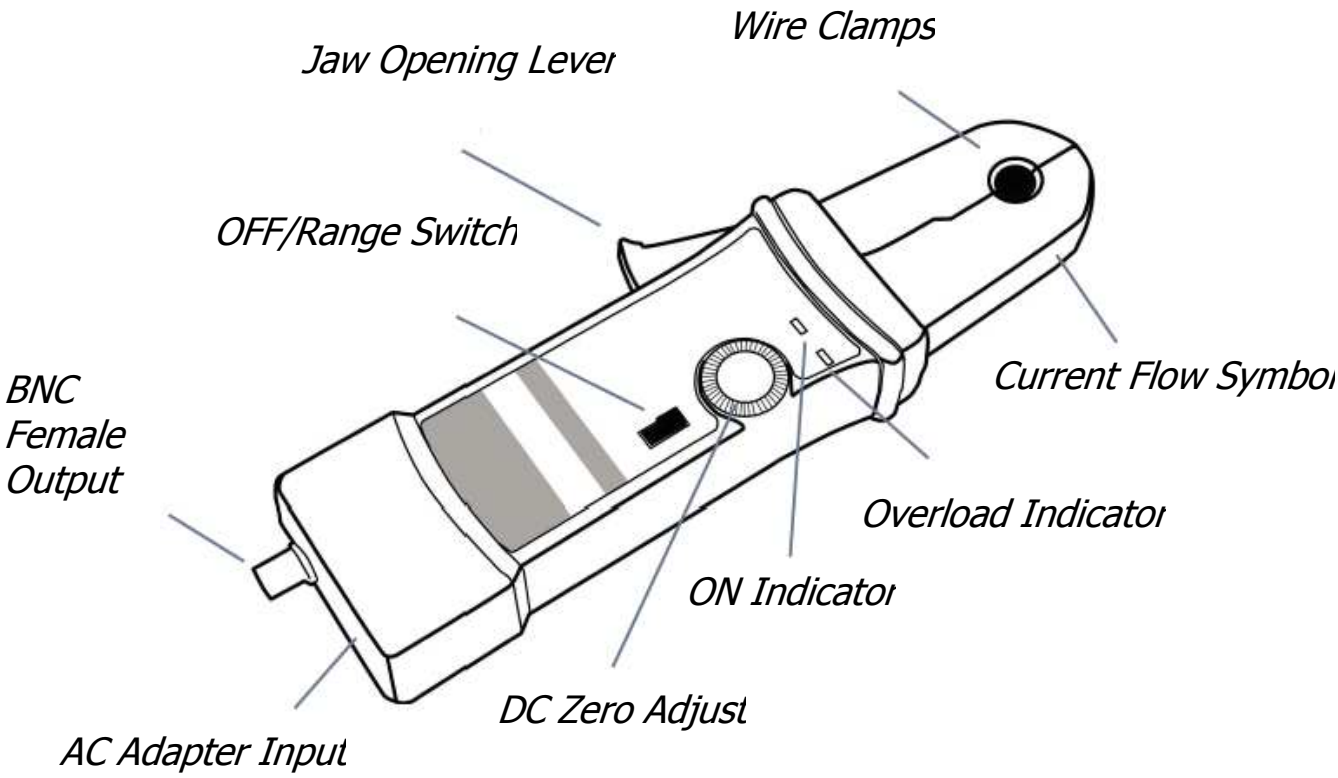
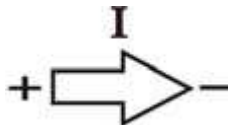
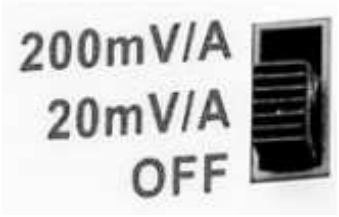


***Figure 1**: Controls and indicators on current probe*

***Table 1**: Current probes' controls and indicators*

Control/Indicator	Description
	**Current flow symbol.** The arrow shows the probe's polarity convention for measuring current flowing from positive to negative.
	**Zero adjustment.** Rotate to adjust the probe output to zero when there is no current present. It may also be used to offset a DC signal component. Zeroing is not needed for AC measurements unless your instrument cannot isolate a DC component (if present).
 *Measurement range for TT-CC-550 current probe*	**OFF/Range switch.** Slide the switch from OFF to either the low or high measurement range. When either range is selected, the probe is turned on, and the green battery indicator lights. If the indicator does not light, see "Battery and AC Power Adapter" and "Battery Installation/Removal".
	**ON indicator.** The green battery indicator lights when the probe is turned on. For more information, see "Battery and AC Power Adapter" and "Battery Installation/Removal".
	**Overload indicator.** The red overload indicator lights if the measured signal is greater than the selected range capacity. Switch the probe to higher measurement range, if possible, or remove the probe from the circuit.

6. Basic Operation

Before using the probe a battery or specified power adaptor must be installed. See "Battery and AC Power Adapter" and "Battery Installation".

WARNING *Do not clamp the probe onto circuits with voltages greater than 600 VAC (600V CAT II, 300V CAT III). Personal injury or damage to the probe may result.*

Always connect the current probe to an instrument before clamping onto the circuit under test!

1. Connect the BNC cable to the current probe's BNC female output connector then connect the BNC cable to the oscilloscope's BNC input. Start by setting the oscilloscope's voltage input channel to DC and the voltage sensitivity to 0.1 V/div.
2. Move the OFF/Range switch to the low V/A or high V/A position. The green ON Indictor LED will light. If the green ON Indictor LED does not light, replace the battery or use included power adaptor.
3. Use the ZERO Adjust to zero or offset the probe output of residual magnetic DC charges.
4. Connect the probe to the circuit by opening the jaws with the Jaws Opening Lever and clamping around the conductor (see Figure 2).

NOTE: *Clamping around both the "hot" and "neutral" wires may give a zero reading.*

Remember to unclamp the probe from the conductor before disconnecting it from your meter or instrument.

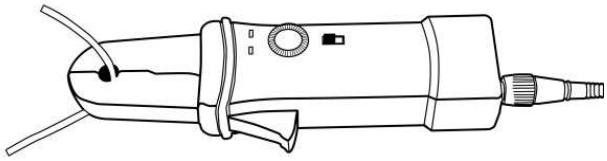


Figure 2: *Connecting the current probe*

5. Adjust the oscilloscope's channel amplitude and time base settings as necessary to get a clear and stable signal. Set the oscilloscope input to DC volts to see both the AC and DC currents; set the channel to AC to see the AC current only.

   The current drawn by selected devices can vary. While the RMS current can only be used in low frequency current, the transient peaks can be quite high. Figure 3 shows the difference between a line current drawn by a resistive load and a motor controller.

Resistive load

Motor controller

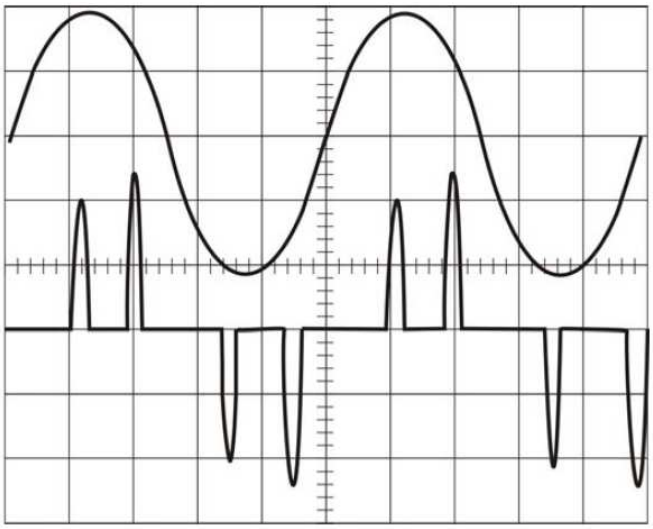


Figure 3: *Typical current waveforms*

When connecting the current probe to a Digital Multimeter (DMM), use the included BNC-to-banana adapter. Connect the black banana plug on the adapter to the DMM's COM or ground jack and the red banana plug to the VΩ jack.

To measure only AC current, set the meter to measure AC volts.

To measure DC current, set the meter to measure DC volts. Note the current

convention arrow on the probe to get the proper polarity reading.

To increase the measurement sensitivity of the current probes, loop additional turns of the wire under test through the jaws. See Figure 4. The sensitivity of the current probe is multiplied times the number of loops in the jaws. For example: 200 mV/A X 4 turns = 800 mV/A.

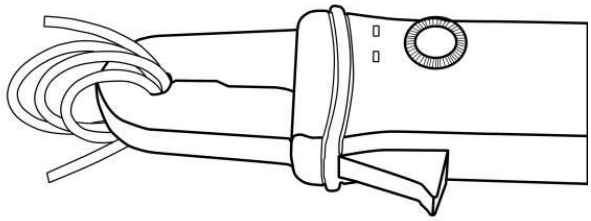


Figure 4: *Increasing the sensitivity*

7. Battery and AC Power Adapter

Use the information in this section to properly maintain the operation of your AC/DC Current Probe.

A TT-CC Series current probe uses a single square 9 V battery. As the probe is a high power product, please use the specified alkaline battery.

As the battery installed is drained, a significant gain error may occur. The green ON Indicator LED will continue to light until a low battery voltage of 6.5 V is reached.

If probe gain errors are detected, replace the battery with a fresh one.

As an alternative, an AC power converter can be used to avoid gain error due to poor battery durability. Switch to a square 9V battery only when there is no AC power supply available.

When using an AC power converter for an extended time, we suggest you remove the battery from the compartment. Prolonged exposure to extreme heat can result in battery leakage, and battery electrolyte will damage the circuit board, thus creating damage to the product. Furthermore, batteries are high pollution products and therefore by reducing their usage, we will in turn protect the environment.

The TT-CC series' current probes have in their design a priority external power circuit. Therefore it is safe to simultaneously install the battery and the external power supply. During usage, removing the external power supply will not produce waveform anomaly or any damage. However when external power is used for an extended time (more than 1 week), removal of battery is recommended. This will avoid leakage of battery since the quality of the batteries is something that is out of our control.

7.1 Battery Installation

1. Remove the probe from the circuit.
2. Open the battery compartment by loosening and removing the three screws on the back of the probe. Lift off the back cover.
3. Observing polarity, attach the new alkaline battery to the connector buttons and place the battery into the compartment, as illustrated in Figure 5.
4. Replace the back cover and lightly tighten the three cover screws.

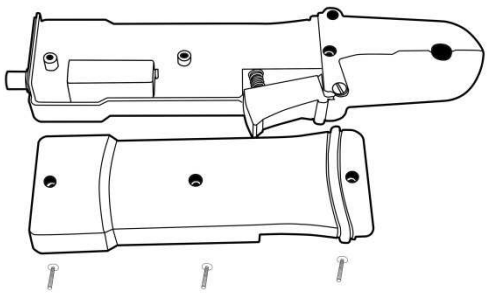


Figure 5: *Battery Change*

8. Cleaning

Clean only the exterior of the probe, cables and accessories. Use a soft cotton cloth moistened with a mild detergent and water solution.

To clean the core, open the jaw and clean the exposed core surfaces with a cotton swap dampened with isopropyl alcohol. Lubricate the jaws mating surfaces with light oil. Do not allow any portion of the probe to be submerged at any time.

NOTES *Dry the probe and accessory thoroughly before attempting to make any current measurements.*

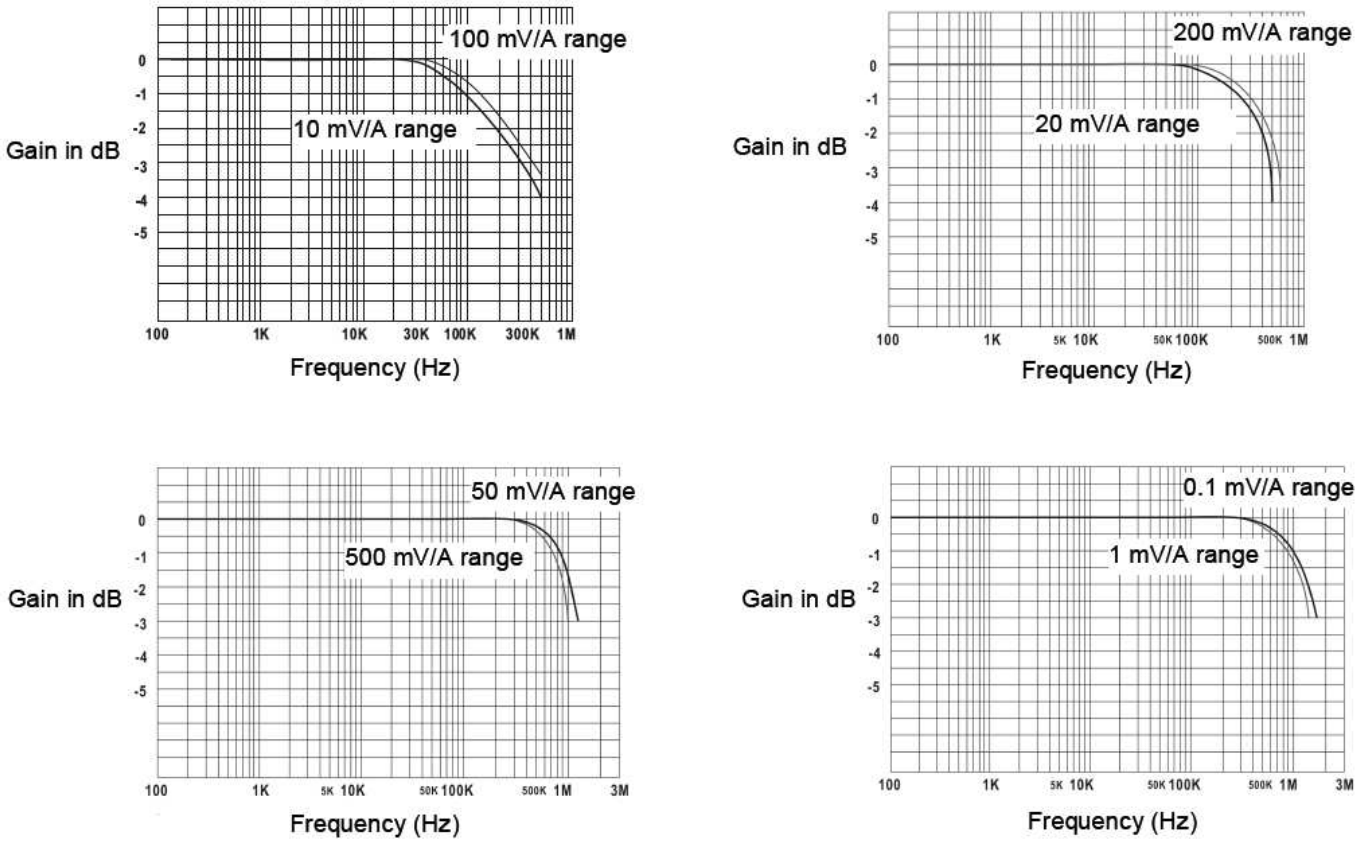
Do not subject the probe to solvents or solvent fumes as these can cause deterioration of the probe body, cables and accessories.

9. Specifications

9.1 Overview of TT CC series current probes

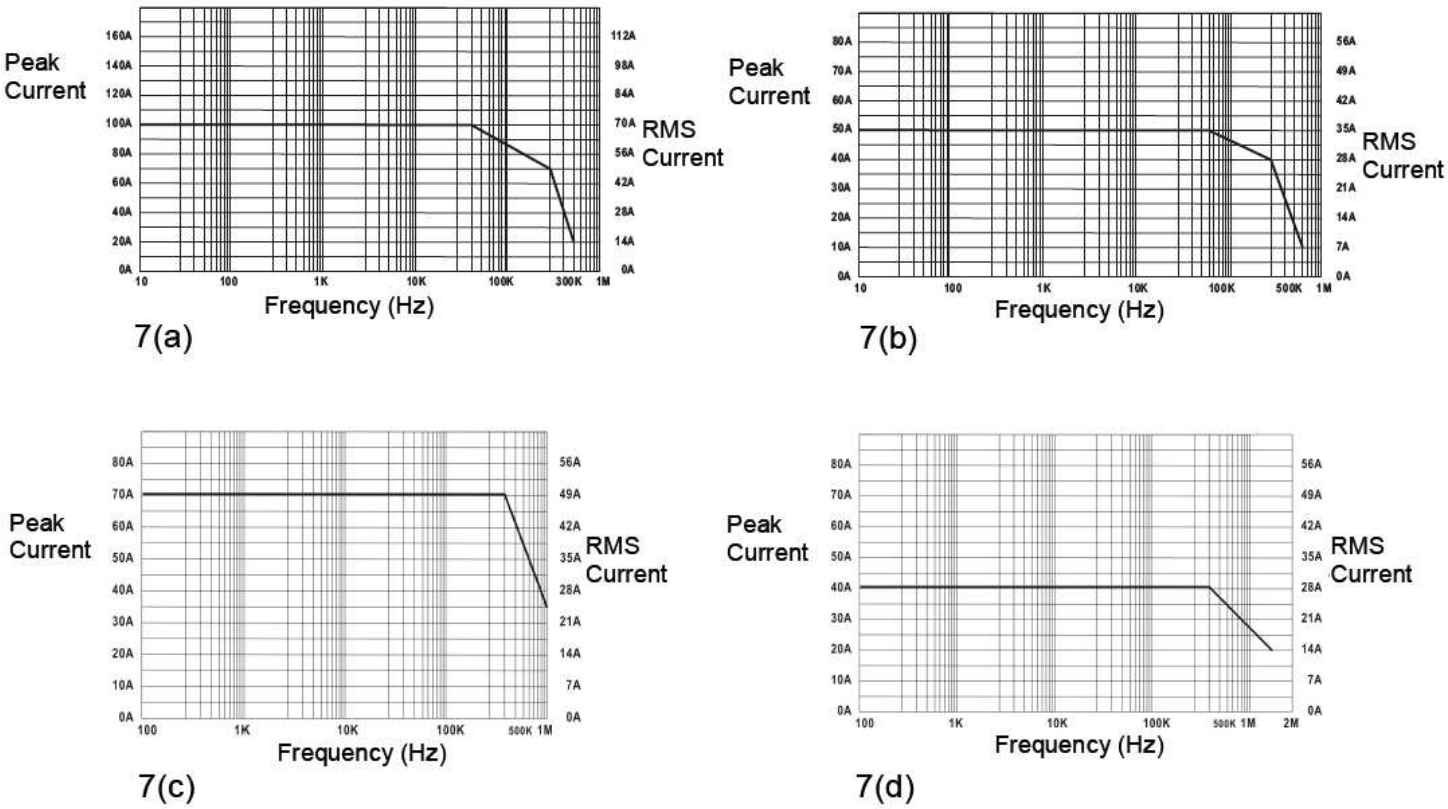
MODEL	TT-CC-220	TT-CC-550	TT-CC-770	TT-CC-990
Measurement Ranges	100 mV/A – 10 mV/A	200 mV/A – 20 mV/A	500 mV/A – 50 mV/A	1 V/A – 100 mV/A
Current (DC + peak AC)	10 A – 100 A	5 A – 50 A	7 A – 70 A	4 A – 40 A
DC Measurement Accuracy (typical)	±3% ±50 mA @ 100 mV/A (50 mA to 10 A peak) ±4% ±50 mA @ 10 mV/A (500 mA to 40 A peak) ±15% max @ 10 mV/A (40 A peak to 100 A peak)	<±3% ±30 mA @ 200 mV/A (30 mA to 5 A peak) ±4% ±300 mA @ 20 mV/A (300 mA to 20 A peak) ±15% @ 200 mV/A (20 A peak to 50 A peak)	<±3% ±20 mA @ 500 mV/A (20 mA to 14 A peak) ±4% ±200 mA @ 50 mV/A (200 mA to 100 A peak) ±15% @ 50 mV/A (100 A peak to 140 A peak)	<±3% ±10 mA @ 1 V/A (10 mA to 8 A peak) ±4% ±100 mA @ 100 mV/A (100 mA to 80 A peak)
Bandwidth	DC – 300 kHz	DC – 500 kHz	DC – 1 MHz	DC – 1.5 MHz
Phase Shift	See Figure 9	See Figure 9	See Figure 9	See Figure 9
Rise and Fall Time	1.2 µs (typ.)	0.7 µs (typ.)	0.35 µs (typ.)	0.23 µs (typ.)
Max. Working Voltage	600 VAC RMS CAT II / 300 VAC RMS CAT III			
Max. Floating Voltage	600 VAC RMS CAT II / 300 VAC RMS CAT III			
Battery Type	9 V Alkaline (NEDA 1604A, IEC 6LR61)			
Typ. Battery Life	8 h		6 h	4 h
Operating Temperature	0 to 50 °C			
Storage Temperature	-20 to 80 °C			
Max. Operating Humidity	95 % humidity, 0 to 40°C 45 % humidity, 40 to 50°C			
Pollution Degree	2		2	
Dimensions	280 mm x 70 mm x 32 mm (11 x 2.8 x 1.3 inch)		262 mm x 81 mm x 36 mm (10.3 x 3.2 x 1.4 inch)	
Maximum Conductor	11 mm (0.43 inch)		10.3 mm (0.4 inch)	
Cable Length	100 cm	100 cm	100 cm	100 cm
Weight (without battery)	260 g	260 g	310 g	310 g

9.2 Comparison Graphs



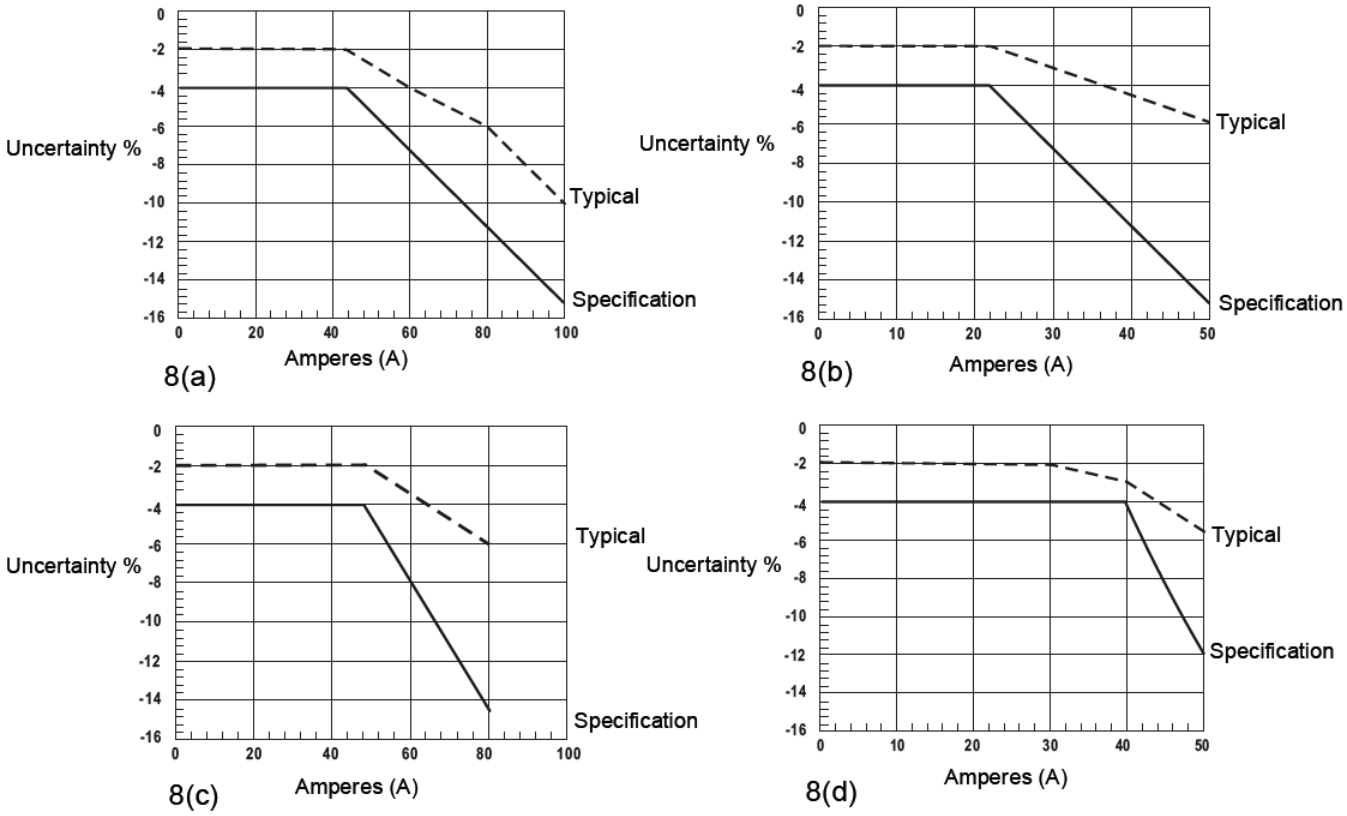
6 (a) – 6 (d) refers to the different models TT-CC 220, TT-CC 550, TT-CC 770, TT-CC 990

***Figure 6**: Gain vs. Frequency at 1 A peak (typical)*



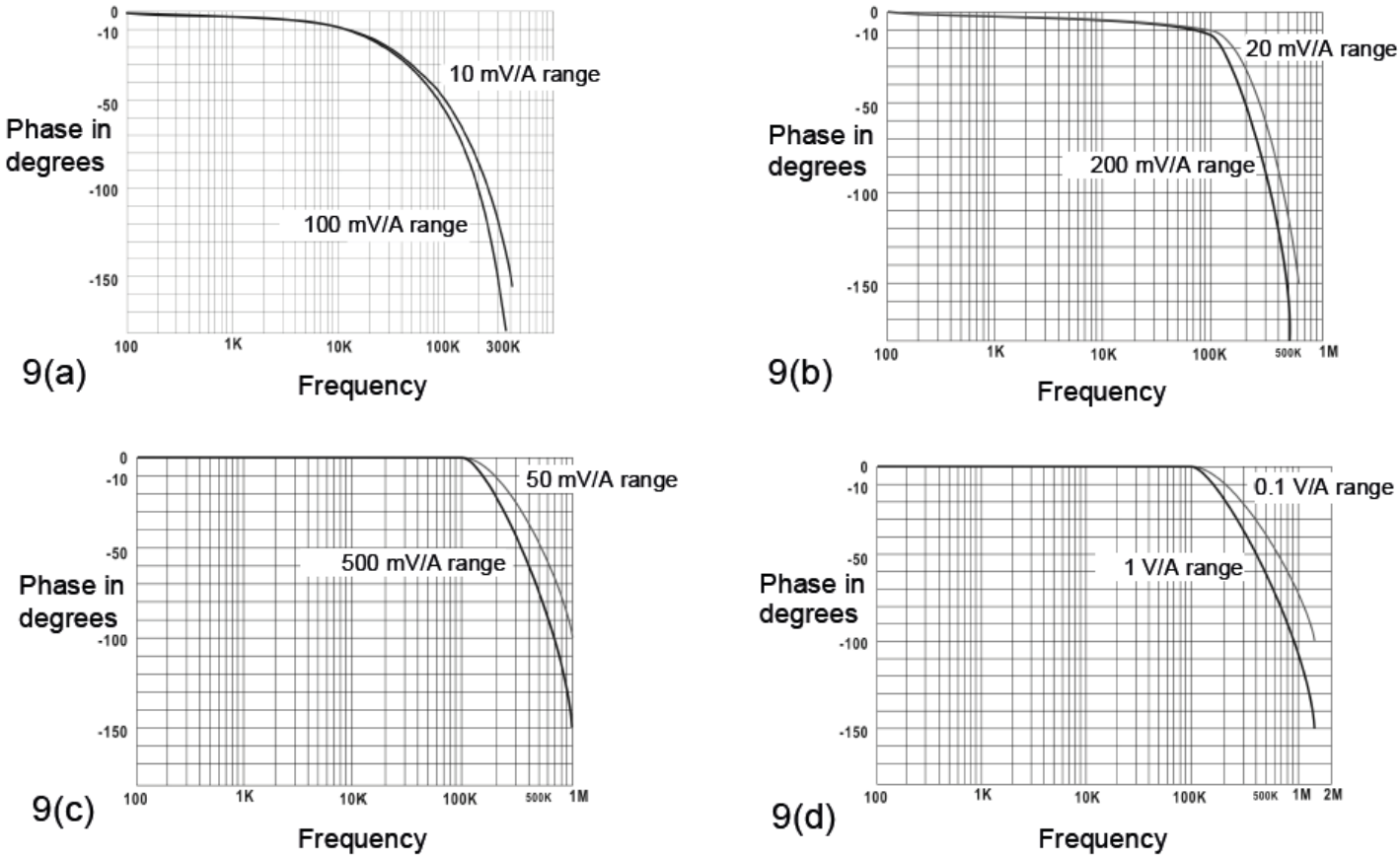
7 (a) – 7 (d) refers to the different models TT-CC 220, TT-CC 550, TT-CC 770, TT-CC 990

***Figure 7**: Max. Current vs. Frequency*



8 (a) – 8 (d) refers to the different models TT-CC 220, TT-CC 550, TT-CC 770, TT-CC 990

***Figure 8**: DC Signal Linearity in the 0.1 V/A range (typical)*



9 (a) – 9 (d) refers to the different models TT-CC 220, TT-CC 550, TT-CC 770, TT-CC 990

***Figure 9**: Phase vs. Frequency at 1 A peak (typical)*

10. Warranty

TESTEC warrants its probes for normal use and operation within specification for a period of one (1) year from the date of shipment (accessories and manual not included).

In exercising its warranty, TESTEC, at its option, will either repair or replace any assembly returned within the warranty period. However, this will be done only if the product is determined by TESTEC's examination to be defective because of workmanship or materials, and the defect is not caused by misuse, neglect, accident, abnormal conditions of operation, or damaged by attempted repair or modifications by non-authorized facility.

The customer will be responsible for the transportation and insurance charges for the return of products.

This warranty replaces all other warranties, expressed or implied, including, but not limited to, any implied warranty of merchantability, fitness, or adequacy for any particular purpose or use. TESTEC shall not be liable for any special, incidental or consequential damages, whether in contract or otherwise.

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