

E-Clip 1 / E-Clip 2

Current Clamps

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1. Warnings

To ensure a high level of operator's safety during using of current clamps the following warnings have to be considered:

- ◆ **Do not use the current clamp if any damage is noticed!**
- ◆ **Do not leave open nodes of the current clamp with current output (E-Clip 1, E-Clip 2) during measurement to avoid damage and electric shock on secondary side, never enclose conductor in the jaw unless the clamp is connected to measuring instrument!**
- ◆ **Only a competent, authorized person is allowed to carry out service intervention!**
- ◆ **Consider all generally known precautions in order to avoid risk of electric shock while dealing with electric installations!**
- ◆ **Do not extend hands over safety barrier to prevent of electric shock! Only handles are allowed to be touched during measurement!**
- ◆  **Symbol on the current clamp indicates the possibility to use the current clamp on non-insulated conductors.**
- ◆  **Symbol on the current clamp indicates the possibility of a hazardous live condition if the operator ignores the required safety measures.**
- ◆ **If the current clamp is used in a manner not specified in this User manual, the provided protection can be impaired!**

2. Description of current clamps

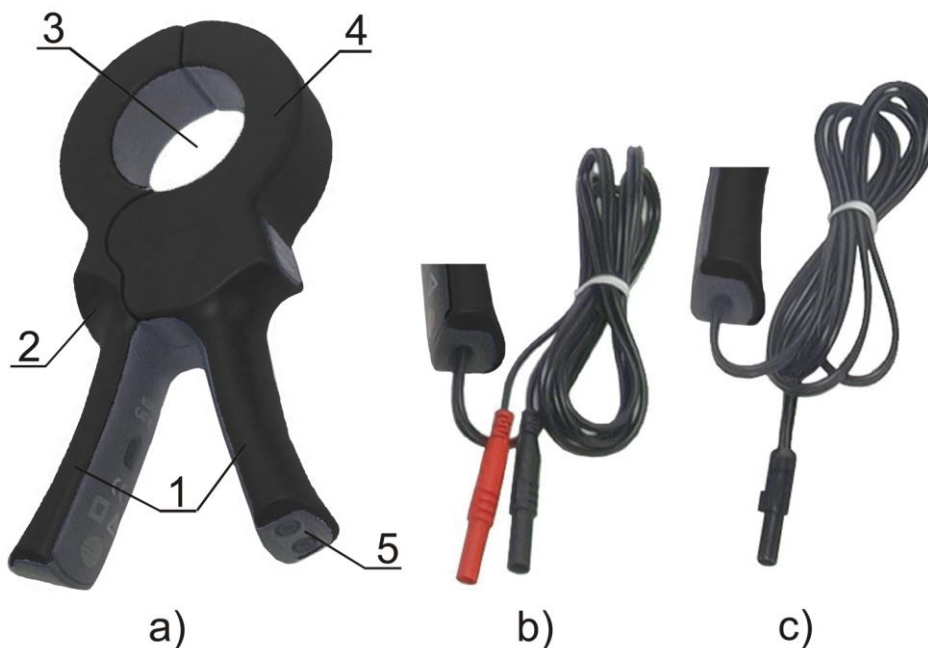
The E-Clip 1 and E-Clip 2 are 1000/1 ratio current clamps for measuring alternating currents in the range from 1 mA to 1000 A (depending on the type).

They can be connected to any power analyzer, energy analyzer, harmonics analyzer, multimeter, earth resistance meters, electrical installation testers and other measuring instruments with compatible voltage or current inputs.

In chapter 4 some typical current clamp applications are described.

The current transducer is housed in a plastic case that maintains the protection class defined in technical specifications. It consists of:

1. Handles,
2. Safety barrier,
3. Conductor opening,
4. Current transformer,
5. Connection with:
 - a) Safety banana sockets (E-Clip 2),
 - b) Cable connection (length = 1.5 m) with safety banana terminals (E-Clip 1),



3. Maintenance

3.1. Inspection

To maintain operator safety and ensure reliability of the current clamp it is good practice to inspect it on a regular basis. Check that the enclosure and optional connection are without defects such as scratches or breaks.

Jaw surface must be clean. Pollution on jaw surfaces reduces the current clamp sensitivity.

3.2. Cleaning

Use a soft cloth moistened with soapy water or alcohol to clean non-metallic surface of the current clamps and leave them to dry totally before using it.

Notes!

- Do not use liquids based on petrol or hydrocarbons!
- Do not spill cleaning liquid over the current clamps!

To clean jaw cut surfaces use slightly oiled soft cloth.

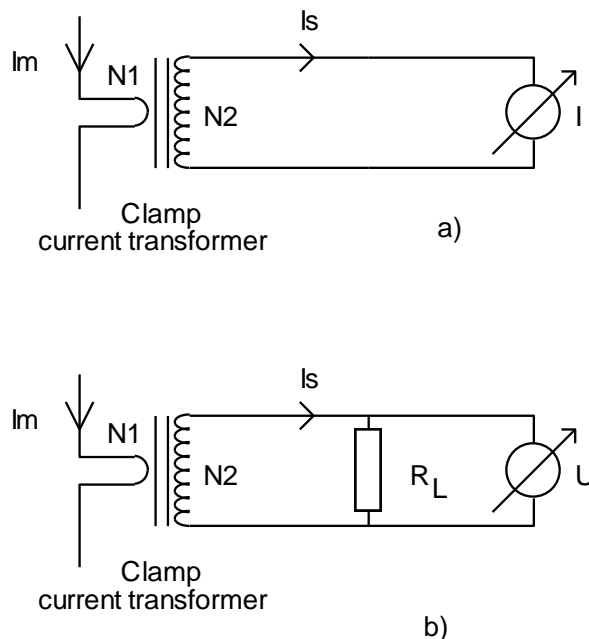
3.3. Service and calibration

It is essential that your clamp is regularly calibrated in order to guarantee the technical specification listed in this User manual. We recommend 2-year calibration interval. Metrel encloses an original calibration certificate with every new instrument and clamp. For recalibration and repairs under or out of warranty time please contact your distributor for further information.

4. Current clamp operation

4.1. Substitute electric model for current clamps

Equivalent circuit diagram for current clamp measurement:



Symbols on circuit diagrams have following meaning:

| | |
|-------|---|
| I_m | Measured (AC) current, primary current |
| I_s | Measured current, current transformer secondary current |
| N_1 | Number of primary turns - normally $N_1=1$ for current clamps |
| N_2 | Number of secondary turns (1000 for all types) |
| I | A-meter |
| R_L | Measuring resistor |
| U | V-meter |

Clamp current transformer must always have a low impedance load on its secondary side. This loading is realized with an A-meter (for current sensors with current output). Current clamp with voltage output already contains the load resistor and its output voltage is proportional to measured current.

The $N_1:N_2$ ratio (primary to secondary winding turns ratio) defines the step-down current ratio and sensitivity of current clamps. For $N_2 = 1000$ the sensitivity is defined as

1 mA / 1 A, i.e.: 1 mA of output current is generated from 1 A primary current for

$N_1 = 1$. The general formula for sensitivity are given below:

$$I_s = I_m \frac{N_1}{N_2} \text{ for current output, and } U = I_m \frac{N_1}{N_2} R_L \text{ for voltage output.}$$

N_1 is always integer and means number of passes of conductor carrying measured current through conductor opening of current clamp.

4.2. Typical applications

Some typical applications of current measurement for standard sensitive current clamps (E-Clip 2) in combination with appropriate measuring instrument:

- Harmonic analysis,
- Measuring electrical power,
- Measuring current and energy consumption,
- Functional testing of appliances, machines,
- Measuring equipment inrush current, etc.

Additional applications related to low current measurements can be covered with high sensitive type current clamps (E-Clip 1):

- Measurement of PE leakage current,
- Measurement of differential current and/or current difference,
- Contactless measurement of earth resistance,
- Determining problems in lighting and grounding systems.

5. Specifications

5.1. General purpose current clamp with current output

Type: **E-Clip 2**

Rated current: 1000 A

Current ratio : 1000:1

Output: 1 mA/A, safety banana sockets Φ 4 mm

Electrical characteristics (at $R = 1 \Omega$):

Measuring range: 0.2 A \div 1200 A

Output signal: 0.2 mA \div 1.2 A (0.2 A \div 1200 A)

Accuracy and phase error:

| | | | | | | |
|--------------------------------|---------------|----------|------------|------------|------------|------------|
| Primary current [A] | 0.1 \div 10 | 10 | 50 | 200 | 1000 | 1200 |
| Accuracy of output current [%] | ≤ 2.5 | ≤ 2 | ≤ 1.5 | ≤ 0.9 | ≤ 0.7 | ≤ 0.7 |
| Phase error [$^\circ$] | n.a. | ≤ 3 | ≤ 1.7 | ≤ 0.9 | ≤ 0.7 | ≤ 0.7 |

Frequency range: 40 Hz \div 5 kHz

Continuity of measurements: 1000 A r.m.s. ($f < 1$ kHz) continuous

1200 A r.m.s. (40 min / 20 min intermitted)

Load impedance: $\leq 10 \Omega$

Working voltage: 600 V max.

Influence of neighbor conductor: < 1 mA/A at 50 Hz

Influence of conductor position: < 0.3 % at $f < 400$ Hz

Influence of loading: 2Ω to 10Ω : 1 % and 1°

Influence of DC current offset: < 2.5 % for $I_{DC} < 30$ A

5.2. Sensitive current clamps with current output

Type: **E-Clip 1**

Rated current: 1000 A

Current ratio : 1000:1

Output: 1 mA/A, safety banana plugs Φ 4mm

Electrical characteristics ($R = 1 \Omega$)

Current measuring range: 0.001 A \div 1200 A

Output signal: 1 μ A \div 1.2 A (1 mA \div 1200 A)

Accuracy and phase error

| | | | | | |
|--------------------------------|------------------|--------------|-------------|---------------|-----------------|
| Primary current [A] | 0.1m \div 100m | 0.1 \div 1 | 1 \div 10 | 10 \div 100 | 100 \div 1200 |
| Accuracy of output current [%] | ≤ 3 | ≤ 2 | ≤ 1.2 | ≤ 1 | ≤ 0.5 |
| Phase error [$^\circ$] | n.a. | n.a. | ≤ 2.2 | ≤ 1 | ≤ 0.7 |

Frequency range: 40 Hz..5 kHz

Continuity of measurements: 1000 A r.m.s. ($f < 1$ kHz) continuous

1200 A r.m.s. (40 min / 20 min intermitted)

Load impedance: $\leq 10 \Omega$

Working voltage: 600 V max.

Influence of neighbor conductor: < 1 mA/A at 50 Hz

| | |
|---------------------------------|---|
| Influence of conductor position | <0.3 % at $f < 400$ Hz |
| Influence of loading: | 2Ω to 10Ω : 1 % and 1° |
| Influence of DC current offset: | <2.5 % for $I_{DC} < 15$ A |

5.3. General (all types)

Safety specification

Over voltage category: 600 V CAT III,
Pollution degree: 2
Double insulation

Environment conditions

Working temperature: $-10^\circ\text{C} \div 50^\circ\text{C}$
Storage temperature: $-30^\circ\text{C} \div 70^\circ\text{C}$
Humidity: 0 % \div 85 %, linearly decreasing for $T > 35^\circ\text{C}$
Altitude: working 0 to 2000 m

Applied standards

Safety: EN/IEC 61010-1
EN/IEC 61010-2-32

Mechanical data

Jaw opening: 52 mm

Maximum conductor sizes:
cable: Φ 50 mm

bar: 1 bar 50 mm x 5 mm,
4 bars 30 mm x 5 mm

Flammability of plastic housing:
UL94 – UV1

Dimension: 220 mm x 120 mm x 48 mm
Weight: 600 g

Other outputs availability

Contact manufacturer or local distributor for further information.

**Repair and Replacement Parts Service
DKD Calibration Lab
and Rental Instrument Service**

When you need service, please contact:

GMC-I Service GmbH
Service-Center
Beuthener Straße 41
90471 Nürnberg • Germany
Phone +49 911 8602-0
Fax +49 911 8602-253
E-Mail service@gossenmetrawatt.com

This address is only valid in Germany.
Please contact our representatives or subsidiaries for service in other countries.

Product Support

When you need support, please contact:

Gossen Metrawatt GmbH
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Phone +49 911 8602-931
Fax +49 911 8602-709
E-Mail support@gossenmetrawatt.com