Multi range AC current clamps (1000A / 100A / 5A / 0.5A)

A 1281

Instruction manual

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METREL®

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CE Mark on your equipment certifies that this equipment meets the requirements of the EU (European Union) concerning safety and electromagnetic compatibility regulations.

Table of contents

Symbols and Warnings

To ensure a high level of operator's safety during using of A 1281 Multi range AC current clamps the following warnings has to be considered:

- ⚠ **Do not use the current clamp if any damage is noticed!**
- ⚠ **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 of a hazardous live condition if the operator ignores the required safety measures.**
- ⚠ **If the current clamps are used in a manner not specified in this User manual, the provided protection can be impaired!**
- ⚠ **Only a competent, authorized person is allowed to carry out service intervention!**
- ⚠ **Do not connect clamp output elsewhere than to Metrel PowerQ series of measuring instruments (PowerQ MI 2492, PowerQ^{plus} MI 2392, PowerQ4 MI 2592 and PowerQ4 Plus MI 2792)!**
-  **Symbol on the current clamp indicates the possibility to use the current clamp on non-insulated conductors.**
-  **Current clamps are protected by double insulation.**

Description of current clamps

The A 1281 multi range current clamps are designed for measuring alternating currents on low and medium power installations: 50 mA ÷ 1000 A.
They have electronic module, and can be connected only to Metrel PowerQ series of measuring instruments:

- PowerQ (MI 2492)
- PowerQ^{Plus} (MI 2392)
- PowerQ4 (MI 2592)
- PowerQ4 Plus (MI 2792)

Clamps have four current ranges 0.5A, 5A, 100A and 1000A, which are selected directly by the connected instrument. Embedded electronic module is powered directly from the connected instrument and does not need any additional power supply.

The current transducer is housed in a plastic case that maintains double insulation as defined in Main parts of the current clamps are shown on figure bellow:

1. handles,
2. safety barrier,
3. conductor opening,
4. clamps jaw,
5. cable connection with connector.

Figure 1: Multi range AC current clamps

Current clamps operation

Operation Instructions

Figure 2: Current clamps A 1281 - connection to the measuring instrument

Step 1

Connect A 1281 current clamps output connector to the appropriate (Metrel PowerQ series) measuring instrument's current input terminal.*(See figure 2)*

⚠ **Do not connect clamp output elsewhere than to Metrel PowerQ series of measuring instruments (PowerQ MI 2492, PowerQ^{plus} MI 2392, PowerQ4 MI 2592 and PowerQ4 Plus MI 2792)!**

Step 2

Switch on the measuring instrument. Set Smart clamps and range on instrument's measuring setup. *(For further information see Instruction manual of measuring instrument.)*

Step 3

Clamp the probe around the current-carrying conductor(s) to be measured. Make sure that probe jaws are tightly closed around the conductor(s).

⚠ **Do not extend hands over safety barrier to prevent of electric shock! Only handles are allowed to be touched during measurement!**

⚠ **Do not use the current clamp if any damage is noticed!**

⚠ **Consider all generally known precautions in order to avoid risk of electric shock while dealing with electric installations!**

Step 4

Make measurement. *(For further information see Instruction manual of measuring instrument.)*

Step 5

Disconnect clamps from the conductor(s).Use all safety measures as described in step 3.

Substitute Electric Model For Current Clamps

Equivalent circuit diagram for current clamp measurement:

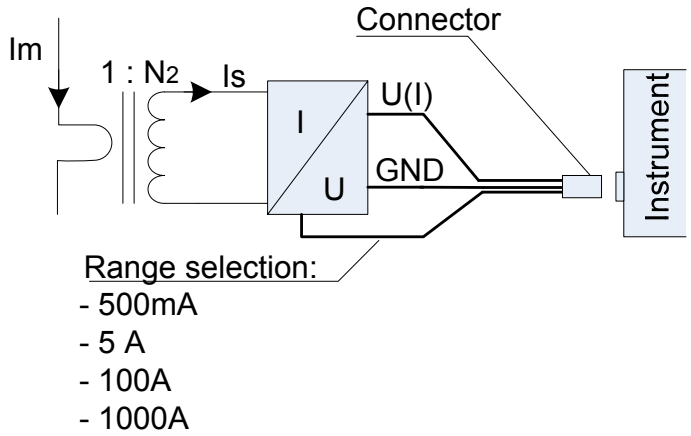

Figure 3: Current clamps A 1281 - block diagram

Symbols on circuit diagrams have following meaning:

Im Measured (AC) current, primary current
Is Measured current, current transformer secondary current
N2 Number of secondary turns (N2 = 1000)
U(I) Output voltage as function of current $U = k * Im$. Factor k depends on selected current range as shown in table bellow:

Range (A)	k (V/A)
0,5	2
5	0,2
100	0,01
1000	0,001

Typical applications

Power Quality Measurement

A 1281 current clamps have linear response through wide frequency bandwidth (see Figure 8). Therefore they are well suited for:

- Power Quality auditing,
- EN 50160 or troubleshooting. Particularly for:
- Current distortion measurement
- Inrush measurement
- Functional testing of appliances, machines, etc.

High precision (see Figure 6) and wide measurement range can cover most of practical LV current measurements.

Power Measurement

A 1281 current clamps have small phase shift (see Figure 7 and Figure 9) over wide frequency range. Therefore they are well suited for:

- Power and energy measurements (active, reactive, apparent)
- Power factor measurements
- Power/Energy efficiency

Leakage Current Measurement

Measurement Of Leakage Current By Direct Method

This method is used when measuring the current through one (embraced) conductor.

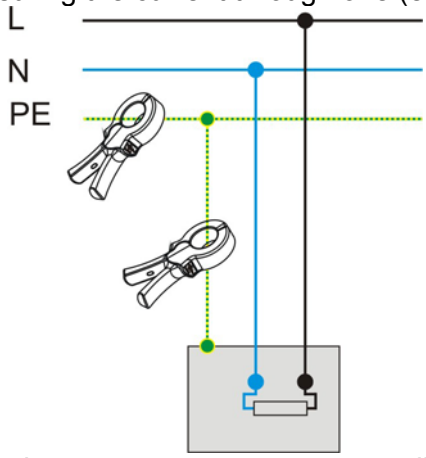

Figure 4: *Leakage current measurement – direct method*

Measurement Of Differential Current And/or Current Difference

The differential method sums the current passing through two or more active (embraced) conductors. If no current is leaking to earth,, the sum of the currents passing through active conductors must be exactly zero regardless of the load currents. If a leakage current is flowing to earth, it must be equal to the difference in current between the conductors contained in the current clamp (although, if alternative earth paths exist, this may not be equal to the current passing through the PE conductor).

Note

Note that the direction of currents in the conductors must be considered if the differential method is used.

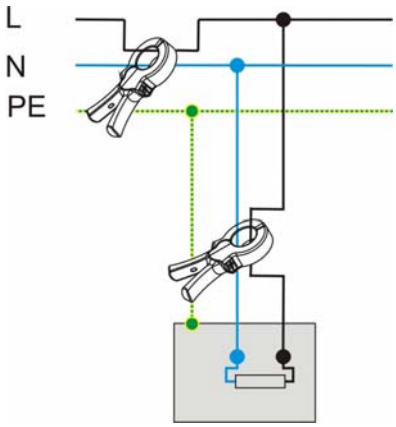

Figure 5: *Leakage current measurement – differential method*

Determining Problems In Lighting And Grounding Systems.

Faults in electrical installations and equipment can cause additional continuous or short-lasting leakage currents. Typical faults that can cause increased leakage currents are:

- Deterioration of insulation (because of pollution, moisture, corrosion). This is causing a gradual increase of the resistive leakage current.
- Faults in electronic equipment.
- If the neutral and PE wiring are connected together anywhere in the installation this can result in an improper current distribution through the neutral and PE conductors.

Note

Metrel Application note: *Measuring of leakage current* contain many practical aspects and examples of leakage current measurement.

Maintenance

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.

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.

⚠ **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.

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.

⚠ **Only a competent, authorized person is allowed to carry out service intervention!**

Technical Specifications

General

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

Environment conditions
Working temperature: -10 ^{0}C ÷ 50 ^{0}C
Storage temperature: -30 ^{0}C ÷ 70 ^{0}C
Humidity: 0 % ÷ 85 %,
Linearly decreasing for T > 35 ^{0}C
Altitude: ≤ 2000 m

Applied standards
Safety: EN/IEC 61010-1
EN/IEC 61010-2-32
EMC: EN/IEC 61326-1

Mechanical data
Jaw opening: 52 mm

Maximum conductor sizes:
Cable: < 50 mm
Bar: 1 bar 50 mm x 5 mm,
4 bars 30 mm x 5 mm

Housing flammability: UL94 – V-1
Dimension: 220 mm x 120 mm x 48 mm
Weight: 600 g

Accuracy And Phase Error

Reference conditions: Temperature: 23 ^{0}C ± 1 ^{0}C Humidity: 60 %		Current range			
Nominal current (I_{Nom})		0.5 A	5 A	100 A	1000 A
Current ratio		0.5 A/V	5 A/V	100 A/V	1000 A/V
Peak current		1.5 A_{PEAK}	15 A_{PEAK}	246 A_{PEAK}	1700 A_{PEAK}
Crest factor @ Nominal current		3,0	3,0	2,46	1,7
Accuracy	Current range*	50 mA ÷ 1 A	0.5 A ÷ 10 A	10 A ÷ 175 A	100 A ÷ 1200 A
	RMS Current Accuracy	0.5 % of m.v.	0.5 % of m.v.	0.5 % of m.v.	0.5 % of m.v.
	Frequency range	40 Hz ÷ 700 Hz (<0.5^0 phase error) 700 Hz ÷ 2500 Hz (<3^0 phase error)			
Continuity of measurements		1000 A continuous 1200 A (40 min / 20 min intermitted)			
Load impedance		< 1 kΩ			
Working voltage		600 Vrms			
Influence of neighbour conductor:		< 1 mA/A at 50 Hz			
Influence of conductor position:		< 0.3 % at f < 400 Hz			

*Accuracy for 0÷10% range is 0.1% · I_{Nom}
m.v. – measured value

Typical Performance Characteristics

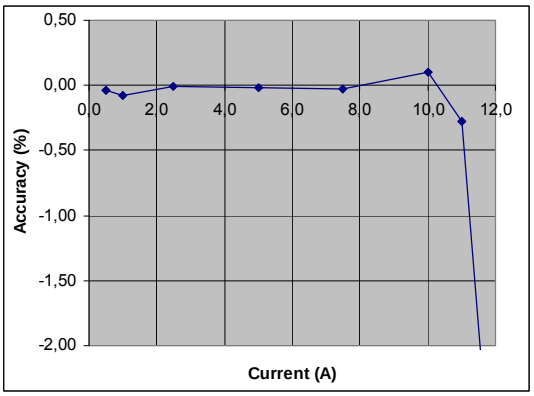

Figure 6: Accuracy vs. current (for 5A range)

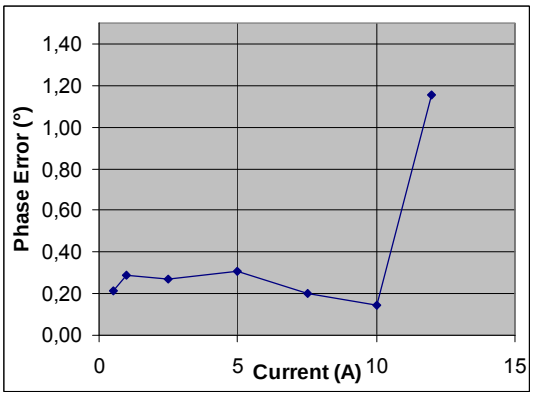

Figure 7: Phase error vs. current (for 5A range)

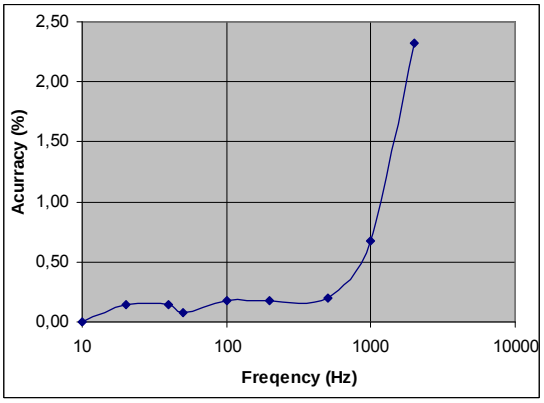

Figure 8: Accuracy vs. frequency (for 5A range)

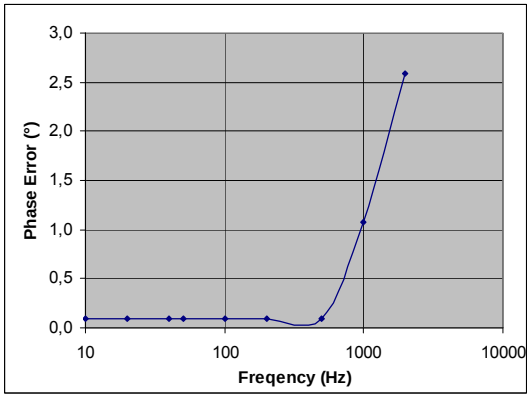

Figure 9: Phase error vs. frequency (for 5A range)

Electromagnetic Compatibility (EMC)

Current clamps A 1281 conforms to the directive 2004/108/EC for EMC, as defined by EN-61326-1:

- Emission: Class B (domestic and industrial use).
- Immunity: Intended for use in industrial locations, but can also be used for domestic purposes (Performance criteria B), with addition to the tables bellow:

*Table 1: Immunity to radiated RF fields**

Range	Operational conditions	Disturbance < 0,2 %	Disturbance > 0,2 %
0.5A	0.05 A ÷ 0.5 A	322 MHz ÷ 1 GHz	80MHz ÷ 322 MHz
5A	0.5 A ÷ 5 A	250 MHz ÷ 1 GHz	80MHz ÷ 250 MHz
100A	10 A ÷ 100 A	80 MHz ÷ 1 GHz	–
1000A	100 A ÷ 1000 A	80 MHz ÷ 1 GHz	–

* Field strength: 10V/m, Modulation: AM, 80%, 1 kHz

*Table 2: Immunity to Magnetic field**

Range	Operational conditions	Disturbance
0.5A	0.05 A ÷ 0.5 A	< 6 % of m.v.
5A	0.5 A ÷ 5A	< 0.5 % of m.v.
100A	10 A ÷ 100 A	< 0.2 % of m.v.
1000A	100 A ÷ 1000 A	< 0.2 % of m.v.

*Field strength: 30 A/m, Modulation: AM, 80%, 1kH.
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