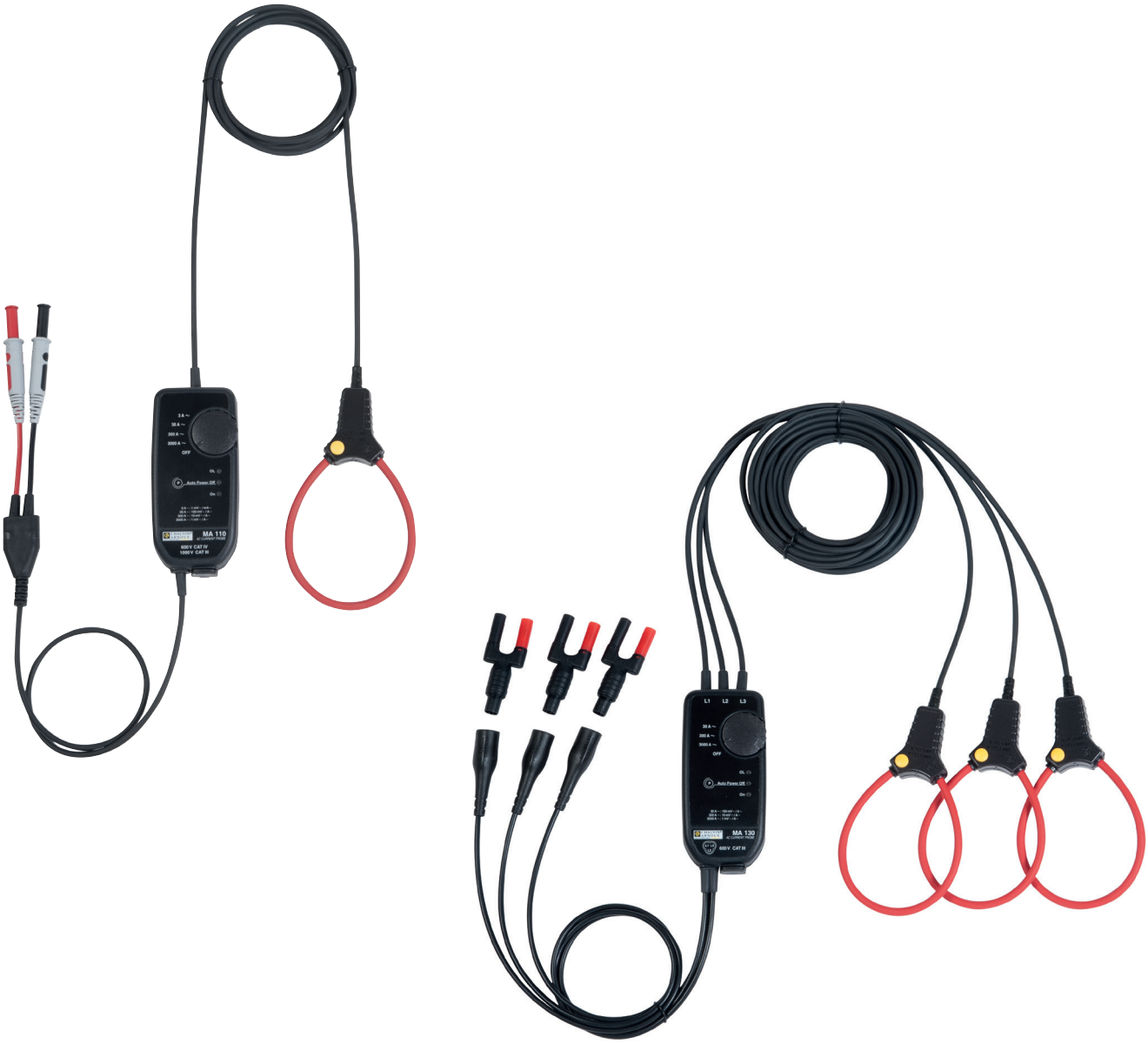
EN - User's manual

CHAUVIN ARNOUX

MiniFlex MA110
MiniFlex MA130



Flexible AC current sensors

Measure up

Thank you for purchasing a **MiniFlex MA110 or MA130 flexible current sensor.**

For best results from your instrument:
- **read** these operating instructions carefully,
- **comply** with the precautions for use.

WARNING, risk of DANGER! The operator must refer to these instructions whenever this danger symbol appears.

Caution, risk of electric shock. The voltage applied to parts marked with this symbol may be hazardous.

Must not be applied to or removed from conductors carrying dangerous voltage. Type B current sensor according to IEC/EN 61010-2-032.

Equipment protected by double insulation.

Battery.

Useful information or tip.

Direction of current.

Chauvin Arnoux has designed this instrument in the context of a global eco-design approach. A life cycle analysis was carried out to master and optimize the impact of this product on the environment. More precisely, the product exceeds the requirements of regulations as regards recycling and valuation.

The CE marking indicates compliance with the European Low Voltage Directive 2014/35/EU, the Electromagnetic Compatibility Directive 2014/30/EU, and the Directive on the Restriction of Hazardous Substances RoHS, 2011/65/EU and 2015/863/EU.

The rubbish bin with a line through it means that, in the European Union, the product must undergo selective disposal in compliance with Directive WEEE 2012/19/EU.

Definition of measurement categories

- Measurement category IV corresponds to measurements taken at the source of low-voltage installations.
  Example: power feeds, meters and protection devices.
- Measurement category III corresponds to measurements on building installations.
  Example: distribution panel, circuit breakers, machines or fixed industrial devices.
- Measurement category II corresponds to measurements taken on circuits directly connected to low-voltage installations.
  Example: power supply to electro-domestic devices and portable tools.

PRECAUTIONS FOR USE

The MA110 is protected against voltages up to 600 V with respect to earth in measurement category IV, or 1000 V in category III.
The MA130 is protected against voltages up to 600 V with respect to earth in measurement category III.

Failure to observe the precautions for use may create a risk of electric shock, fire, explosion, and/or destruction of the instrument and of the installations.

- The operator and/or the responsible authority must carefully read and clearly understand the various precautions to be taken in use. Sound knowledge and a keen awareness of electrical hazards are essential when using this instrument.
- If you use this instrument other than as specified, the protection it provides may be compromised, thereby endangering you.
- Comply with the conditions of use, that is to say temperature, humidity, altitude, degree of pollution and location of use.
- Do not use the instrument if it is open, damaged, or incorrectly reassembled. Before each use, check the integrity of the insulation on the coil, the leads, and the electronic unit.
- The application or withdrawal of the sensor on uninsulated conductors at dangerous voltages requires the use of suitable safety equipment.
- If it is not possible to power down the installation, follow safe operating procedures and use suitable means of protection.
- Use personal protection equipment systematically.
- All troubleshooting and metrological checks must be performed by competent and accredited personnel.

CONTENTS

1. DESCRIPTION

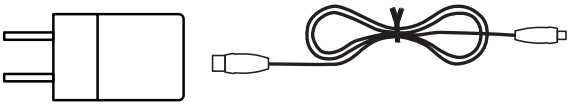
1.1. DELIVERY CONDITION

MiniFlex series MA110 single-phase sensor - 170, 250 or 350 mm
Supplied in a cardboard box with:
- two 1.5 V batteries (AA or LR6),
- one multilingual quick start guide,
- one multilingual safety data sheet,
- a verification certificate.

MiniFlex series MA130 three-phase sensor - 250 mm
Supplied in a cardboard box with:
- two 1.5 V batteries (AA or LR6),
- one set of 12 inserts and rings to identify the current sensors and the leads,
- 3 female BNC / 2 male plug adapters Ø 4mm (one red and one black), 19 mm centres,
- one multilingual quick start guide,
- one multilingual safety data sheet,
- a verification certificate.

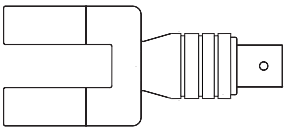
1.2. ACCESSORIES AND SPARES

Type B 5V 1A mains-micro USB adapter



Set of 5 Velcro fasteners
Set of inserts and rings to identify phases and current sensors

Set of 2 adapters, female BNC to 2 male plugs 4mm in diameter (one red and one black) with 19mm spacing



For the accessories and spares, consult our web site:
www.chauvin-arnoux.com

1.3. SPECIFIC MODELS

MiniFlex series MA110 single-phase sensor
- The sensors are available in specific lengths, from 20 to 100 cm in 5-cm increments.
- The connecting cable between the sensor and the electronic unit is available in specific lengths, from 50 to 1000 cm in 10-cm increments.

MiniFlex series MA110 three-phase sensor
- The sensors are available in specific lengths, from 20 to 100 cm in 5-cm increments.
- The connecting cable between the sensor and the electronic unit is available in specific lengths, from 50 to 1000 cm in 10-cm increments.
- The output can take the form of:
  - 3 leads (from 50 cm to 300 cm long, in 10-cm increments) with two stripped and tinned conductors (instrument 600 V cat. III provided that a 600V cat. III connector is added on the conductors)
  - 3 coaxial cables 50 cm long terminated by an insulated male BNC connector (instrument 600 V cat. III)
  - 3 leads 50 cm long terminated by 2 insulated 4mm banana plugs, one red and one black (instrument 600 V cat. IV)

The characteristics of the sensors will be identical to those of the MA110 and MA130, but the pass band will be specified only up to 5 kHz.

The length of the cables may introduce further influences.

In all cases, for specific models, get in touch with our sales staff.

1.4. FUNCTIONS

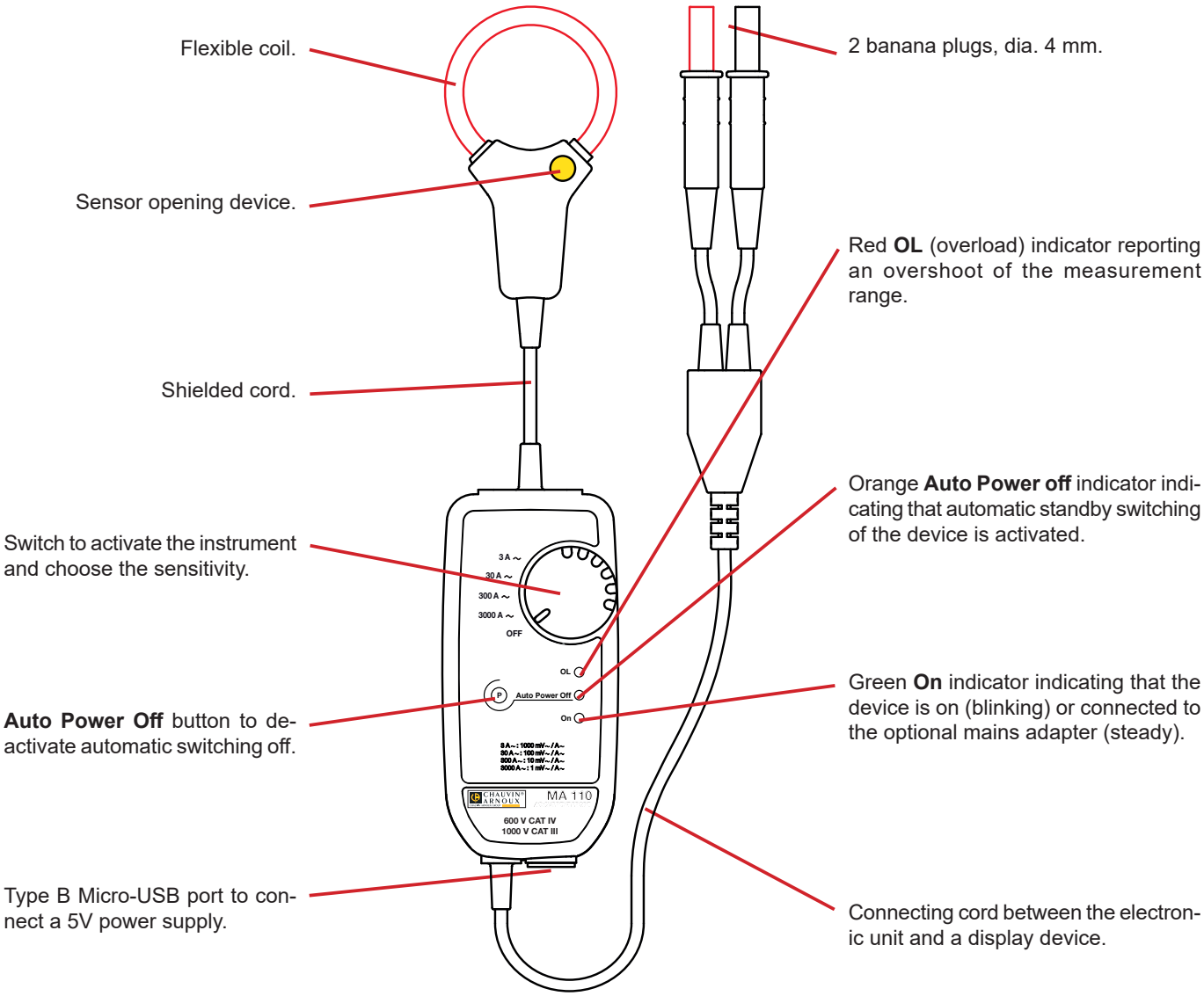
MiniFlex sensors take the form of a flexible coil connected by a shielded lead to a housing containing the signal processing electronics, powered by batteries.

The flexibility of the sensors facilitates the clamping of the conductor to be measured, whatever its nature (cable, bar, strand, etc.) and its accessibility. The design of the coil opening and closing device, by snap locking, allows handling while wearing protective gloves.

The electronic unit can be connected to the mVAC or VAC input of a measuring instrument having an input impedance of ≥ 1 MΩ.

1.5. SINGLE-PHASE MINIFLEX

MiniFlex series MA110 single-phase sensors constitute a line of three models, 17, 25, and 35 cm long, that convert alternating currents ranging from 3 to 3000 A into proportional AC voltages.

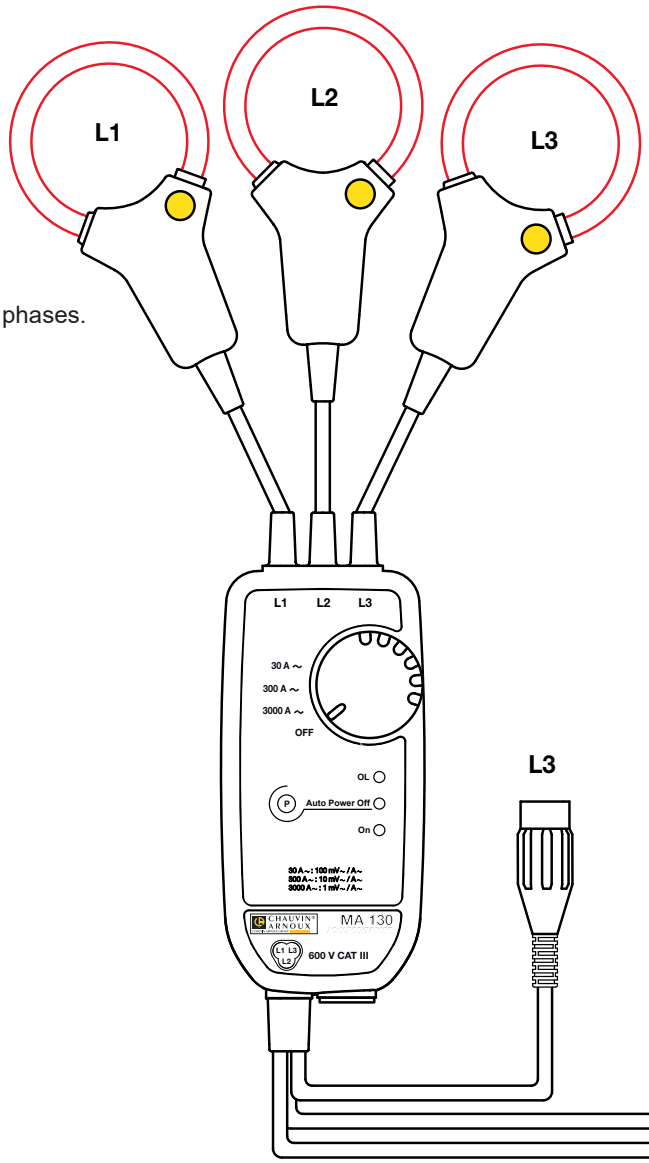


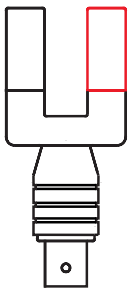
1.6. THREE-PHASE MINIFLEX

The MiniFlex series MA130 sensor converts alternating currents ranging from 30 to 3000 A into proportional AC voltages. It comprises 3 sensors 25 cm long connected to the electronic unit. The output is via 3 BNC connectors on which it is possible to place the adapters provided in order to obtain outputs with 2 safety plugs.

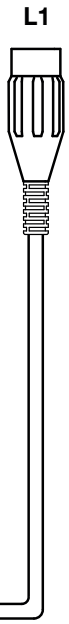
The three outputs of the electronic unit can be connected to a standard wattmeter (as auxiliary inputs), to multimeters, to a recorder, etc.

3 current sensors for 3 phases.





3 BNC / safety plugs (19 mm centres) adapters.

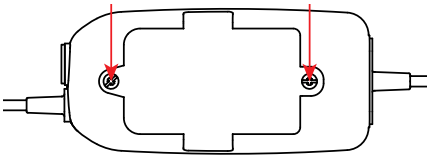


3 BNC connectors, each corresponding to a sensor.

The multimeter or instrument connected must have a maximum voltage and a measurement category at least equal to those of the MiniFlex sensor, since otherwise the maximum voltage and category of the assembly will be those of the lowest-rated component.

1.7. INSTALLING THE BATTERIES

- Disconnect the unit completely and turn the rotary switch to **OFF**.
- Use a screwdriver to unscrew the two screws closing the electronic unit.
- Insert the supplied batteries in their compartment, taking care with the polarities.
- Close the electronic unit and make sure that it is completely and correctly closed.
- Screw the two screws back in.



2. USE

2.1. MEASUREMENT PRINCIPLE

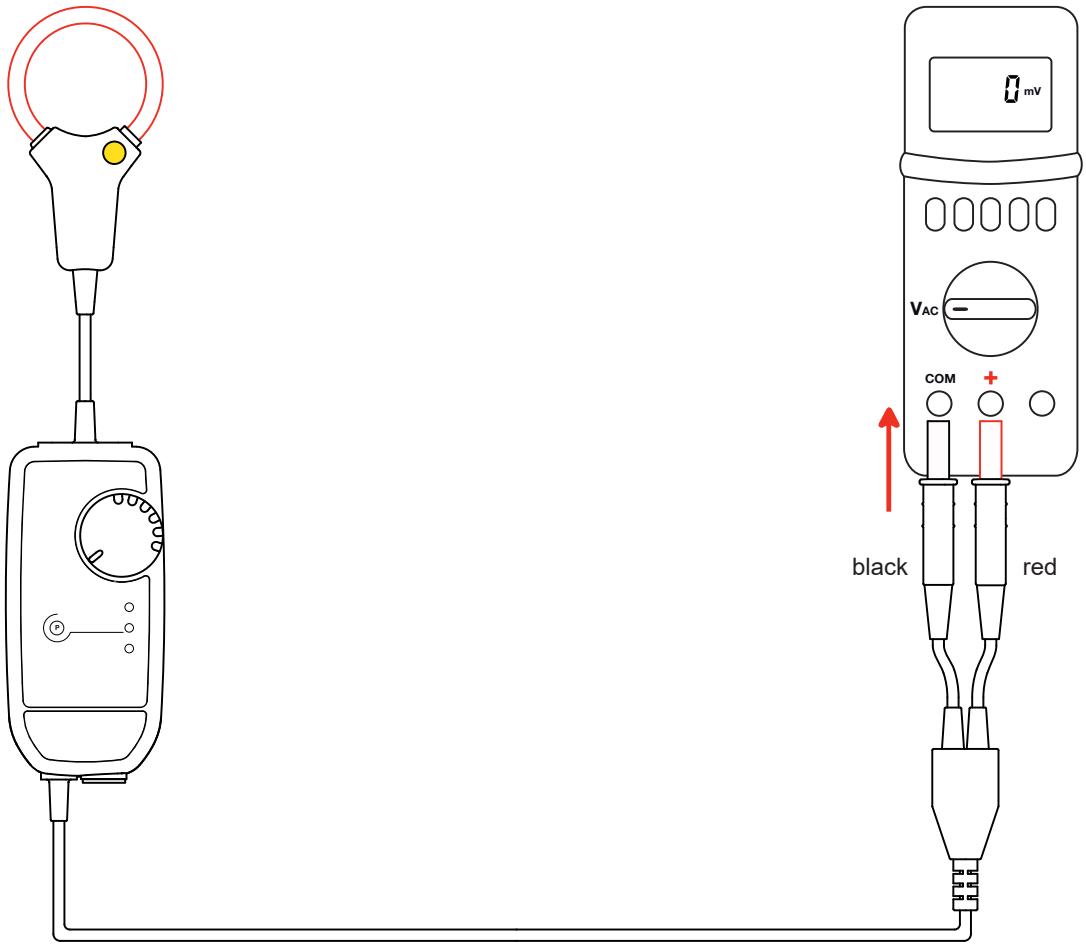
The sensors use the principle of the Rogowski coil.

The sensor used achieves:
- very good linearity and no saturation effect (and so no overheating);
- a wide measurement dynamic, up to several kA;
- insensitivity to DC (measurement of the AC component of any AC + DC signal);
- light weight (no magnetic circuit).

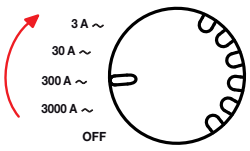
2.2. CURRENT MEASUREMENT

2.2.1. CONNECTING THE MA110

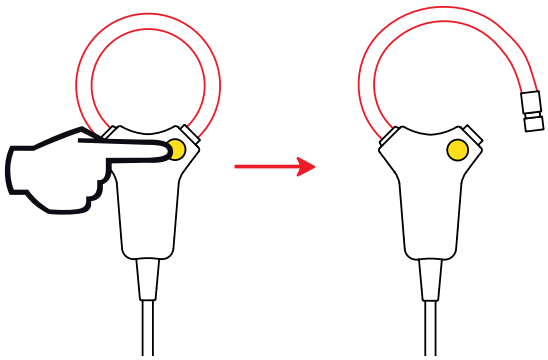
Connect the output leads to a measuring instrument having an input impedance ≥ 1 MΩ. Switch it on and set to AC voltage measurement.



Put the electronic unit into operation by turning the switch to some position. The green **On** indicator starts blinking.

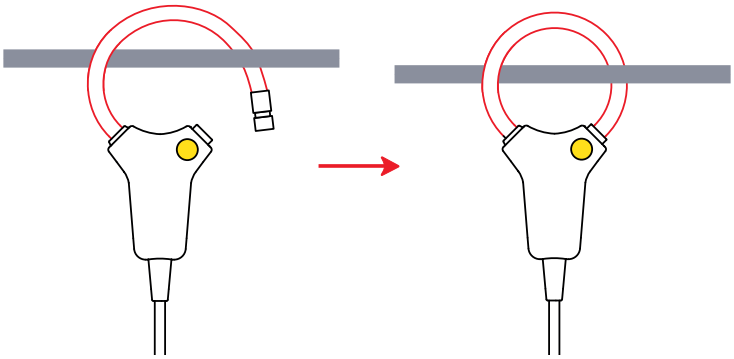


Press on the yellow opening device to open the flexible coil.



Open it and place it around the conductor carrying the current to be measured (only one conductor in the sensor). Close the coil. You must hear the “click”.

⚠ In the case of an uninsulated conductor at a dangerous voltage, use individual protection equipment.



To optimize measurement quality, centre the conductor in the coil.

Set the switch of the electronic unit to the range providing the best sensitivity and check that the red **OL** indicator is off (saturation of the electronics entailing a measurement error).
Read the measurement on the multimeter, applying the reading coefficient indicated on the label on the electronic unit corresponding to the setting of the switch.

3 A~ range	1000 mV~/A~
30 A~ range	100 mV~/A~
300 A~ range	10 mV~/A~
3000 A~ range	1 mV~/A~

Multiply the reading by the coefficient.
For example, a reading of 1 V on the measuring instrument corresponds to a current of $\frac{1\ V}{10\ mV/A}$ = 100 A in the 300 A~ range.

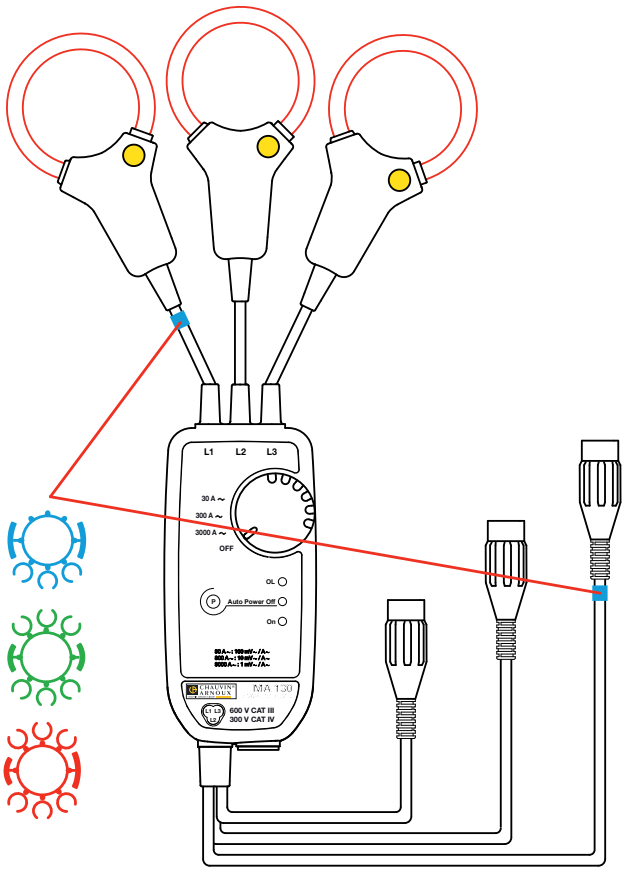
2.2.2. DISCONNECTING THE MA130

Withdraw the flexible coil from the conductor, set the switch to **OFF,** and disconnect the electronic unit from the multimeter.

2.2.3. 2.2.3. IDENTIFYING THE SENSORS OF THE MA130

To identify the sensors and the output leads, you can mark them with the coloured rings provided with the device.

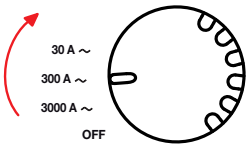
Clip rings of the same colour on the sensor and on the corresponding output leads.



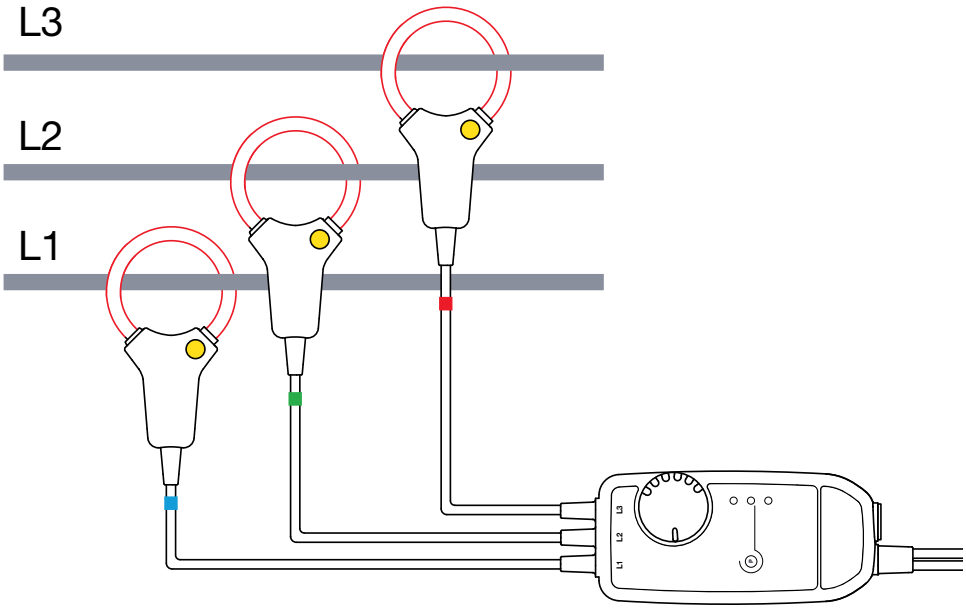
2.2.4. CONNECTING THE MA130

Proceed as for the MA110:

- Connect the output leads to a measuring instrument.
- Put the electronic unit into operation by turning the switch to some position. The green **On** indicator starts blinking.



- Open the 3 sensors and place them on the 3 phases.



- Set the switch on the electronic unit to the range providing the best sensitivity and check that the red **OL** indicator is off (saturation of the electronics entailing a measurement error).
- Read the measurement on the display device and apply the reading coefficient indicated on the label on the electronic unit corresponding to the setting of the switch.

30 A~ range	100 mV~/A~
300 A~ range	10 mV~/A~
3000 A~ range	1 mV~/A~

2.2.5. DISCONNECTING THE MA130

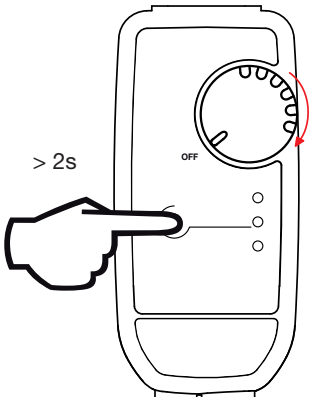
Withdraw the 3 sensors from the 3 conductors, set the switch to **OFF,** and disconnect the electronic unit from the display device.

2.2.6. AUTOMATIC SLEEP MODE

When the device is started up, it operates for 10 minutes, then automatically switches itself to sleep mode in order to save the batteries.

To report that the automatic power off function is active, the orange Auto Power Off indicator is lit.

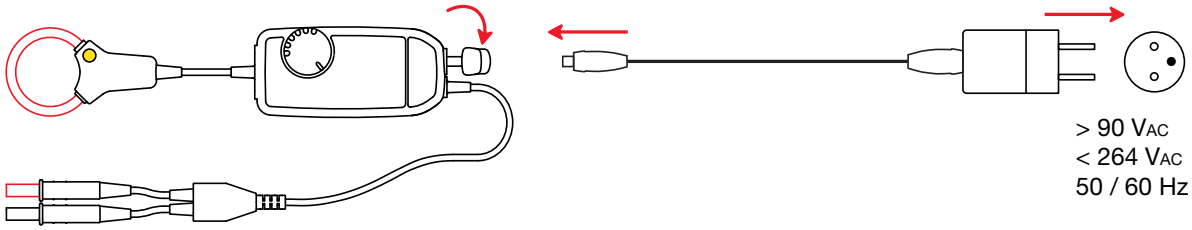
It is possible to override automatic power off. This is done by switching the device on by turning the switch to one of the measurement positions and at the same time pressing the Auto Power Off button for more than 2 seconds. The orange Auto Power Off indicator remains off.



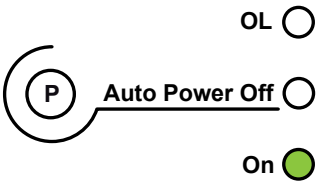
2.3. MAINS ADAPTER (OPTION)

For long-duration measurements, it is possible to connect the electronic unit to line power.

Withdraw the protection from the type B micro-USB connector, then connect the lead. You can use any mains/micro-USB adapter that delivers 100 mA or more.



The green **On** indicator remains on but its brightness varies to indicate that the batteries are OK.



While the external power supply is present, automatic power off is disabled. But if the supply is cut off, the batteries take over and automatic power off acts at the end of 10 minutes.
If you make long-duration records, you must deactivate automatic power off (see § 2.2.6).

The insulation between the type B micro-USB connector and the measurement output is 1000 V CAT III or 600 V CAT IV. That makes it possible to connect the device without risk to wattmeters having uninsulated inputs. The type B micro-USB connector must not be in contact with conductors or uninsulated parts at dangerous voltages

3. TECHNICAL SPECIFICATIONS

3.1. REFERENCE CONDITION

Quantity of influence	Reference values
Temperature	23 ± 5 °C
Relative humidity	20 to 75 % RH
Frequency of the signal measured	30 to 440 Hz
Type of signal	sinusoidal
Instrument turn-on time	1 minute
External electric field	null
External DC magnetic field (earth's field)	< 40 A/m
External AC magnetic field	null
Position of the conductor in the coil	centred
Shape of the measurement coil	circular, no applied stress
Input impedance of the display device connected to the electronic unit	≥ 1 MΩ

Intrinsic uncertainty is the error defined in the reference conditions.

3.2. ELECTRICAL CHARACTERISTICS

Model	Single-phase 17, 25 and 35 cm		Three-phase 25 cm
Range	3 A	▪ 30 A ▪ 300 A ▪ 3 000 A	▪ 30 A ▪ 300 A ▪ 3 000 A
Specified measurement range	0,5 … 3 A	▪ 2 … 30 A ▪ 5 … 300 A ▪ 50 … 3 000 A	▪ 5 … 30 A ▪ 5 … 300 A ▪ 50 … 3 000 A
Output/input ratio (mV~/A~)	1000	▪ 100 ▪ 10 ▪ 1	▪ 100 ▪ 10 ▪ 1
Maximum peak factor	1.5 at IN (I nominal)		
Intrinsic uncertainty (% of output signal)	≤1% + 40 mV	▪ ≤1% + 4 mV ▪ ≤1.5% + 0.4 mV (I<10% IN) ≤1% + 0.4 mV (I≥10% IN) ▪ ≤1.5%+ 0.04 mV (I<10% IN) ≤1% + 0.04 mV (I≥10% IN)	▪ ≤1% + 4 mV ▪ ≤1.5% + 0.4 mV (I<10% IN) ≤1% + 0.4 mV (I≥10% IN) ▪ ≤1.5%+ 0.04 mV (I<10% IN) ≤1% + 0.04 mV (I≥10% IN)
Max. offset voltage	0 mVDC		
Phase shift at 50 Hz	≤1° (0.5° typical)		
Max. output voltage	- 4.5 Vpeak ≤ V ≤ + 4.5 Vpeak		
Frequency response *	10 Hz to 10 kHz	10 Hz to 20 kHz	10 Hz to 20 kHz

*: Beyond 300 ARMS, see the curve at § 3.5.

The peak value is limited only by the electronics of the measurement unit (red **OL** indicator on). The coil alone can briefly withstand higher peak factors with no risk of overheating or destruction.

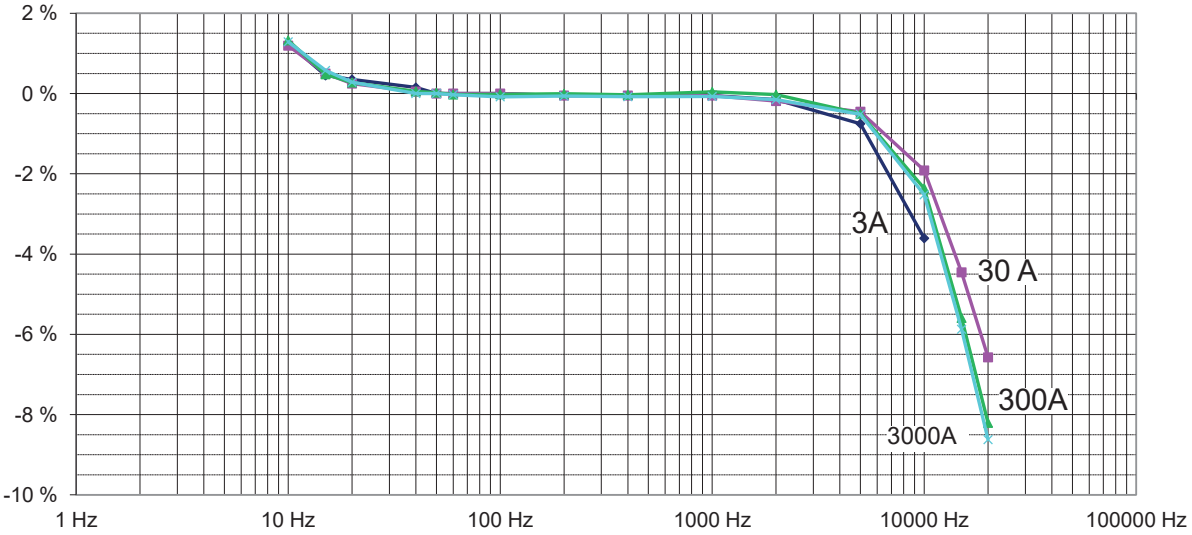
3.3. VARIATIONS IN THE RANGE OF USE

Quantity of influence	Range of influence	Error in % of reading	
		Typical	Maximum
Battery voltage	1.8 to 3.2V	0.02 %	0.1 %
Temperature	10 to + 55 °C	0.15 % / 10 °C	0.50 % / 10 °C
Relative humidity	10 to 90%RH	0.2 %	0.5 %
USB supply voltage	5 V	0.5 %	1.5 %
Position of the conductor in the undeformed sensor	Any position	1 %	2.5 %
Adjacent conductor carrying an AC voltage	Conductor touching sensor	0.2 %	1 % (2 % near snap lock)
Deformation of the sensor	Oblong shape	0.2 %	1 %
Common mode rejection	600 V between the jacket and the secondary	100 dB	80 dB
Input impedance of the measuring instrument	10 kΩ to 1 MΩ	0.1 %	

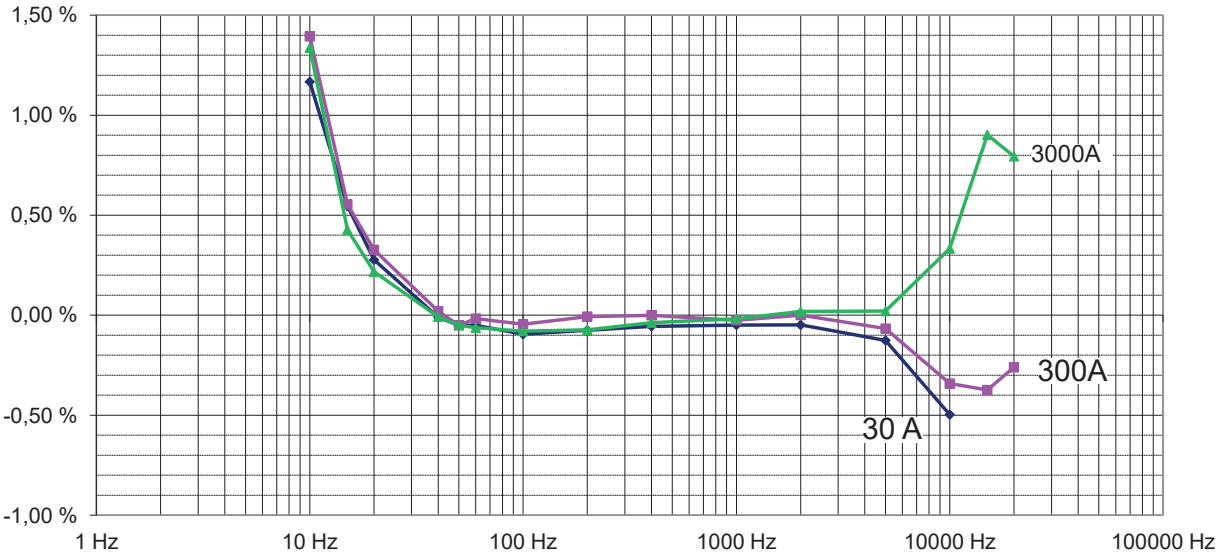
3.4. TYPICAL FREQUENCY RESPONSE CURVES

3.4.1. AMPLITUDE ERROR

Single-phase, 3A, 30A, 300A, and 3000A ranges

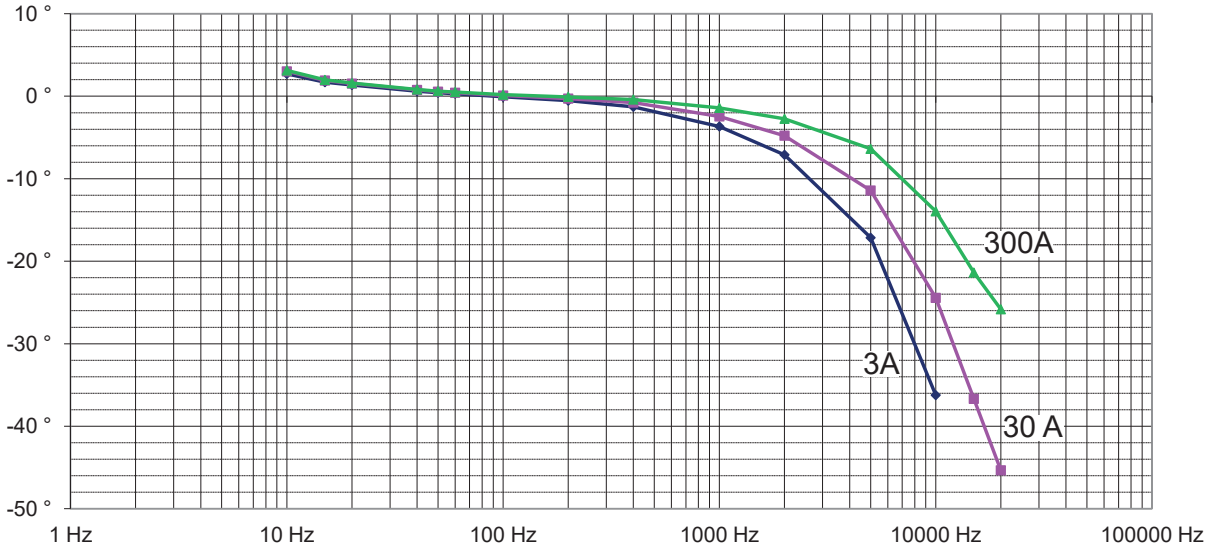


Three-phase, 30A, 300A, and 3000A ranges

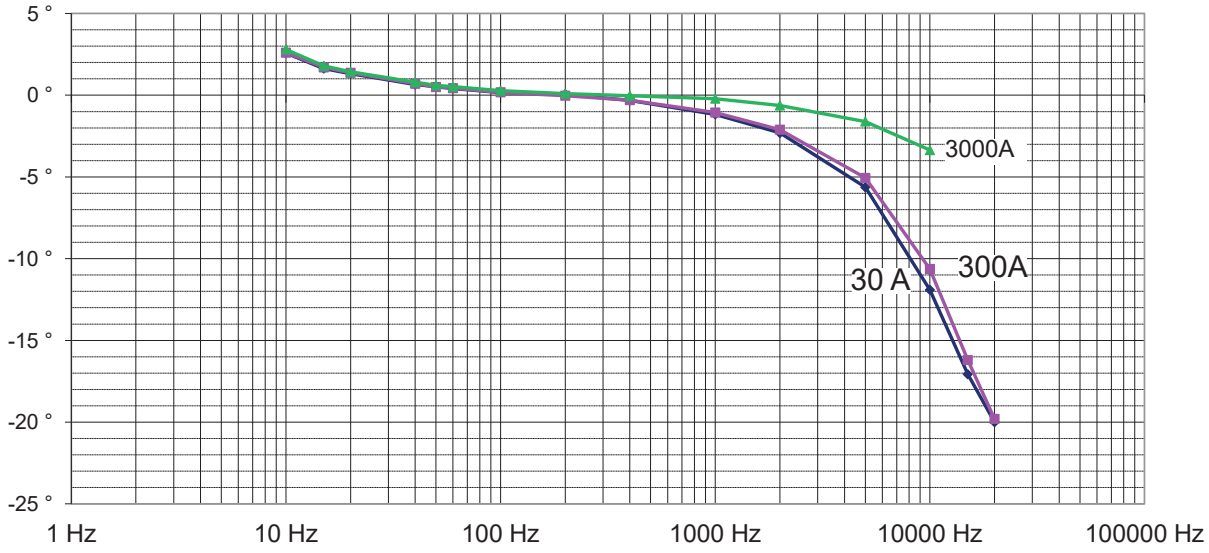


3.4.2. PHASE ERROR

Single-phase, 3A, 30A and 300A ranges



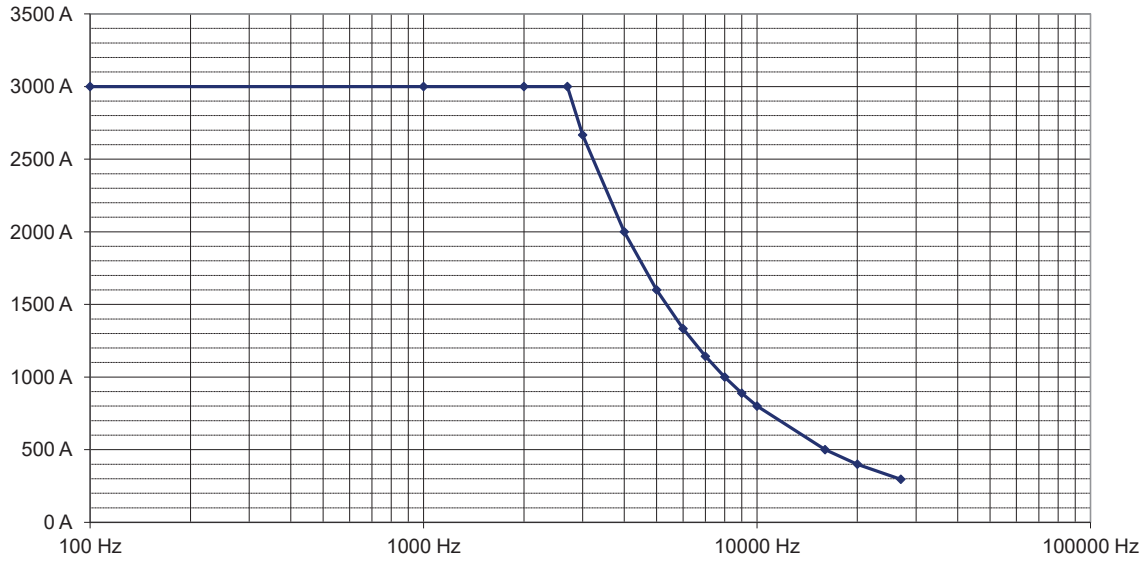
Three-phase, 30A, 300A and 3000A ranges



3.5. FREQUENCY LIMITATION AS A FUNCTION OF AMPLITUDE

In the 3A, 30A, 300A and 3000 A ranges:
With a frequency ≤ 20 kHz, there is no frequency derating.

3000A range



3.6. POWER SUPPLY

3.6.1. BY BATTERIES

The device is powered by two 1.5 V alkaline batteries (type AA or LR6).
Mass of batteries: approximately 2 x 24 g.

The nominal operating voltage is lies between 1.8 and 3.2 V.

The mean battery life is:
- MA110 single-phase
  - 300 h in continuous operation
  - 1,800 10-minute measurements
- MA130 three-phase
  - 500 h in continuous operation
  - 3,000 10-minute measurements

When the device is not connected to line power and the green **On** indicator goes off, the batteries must be replaced (see § 4.2).

For an extended period of non-use or storage, withdraw the batteries from the electronic unit.

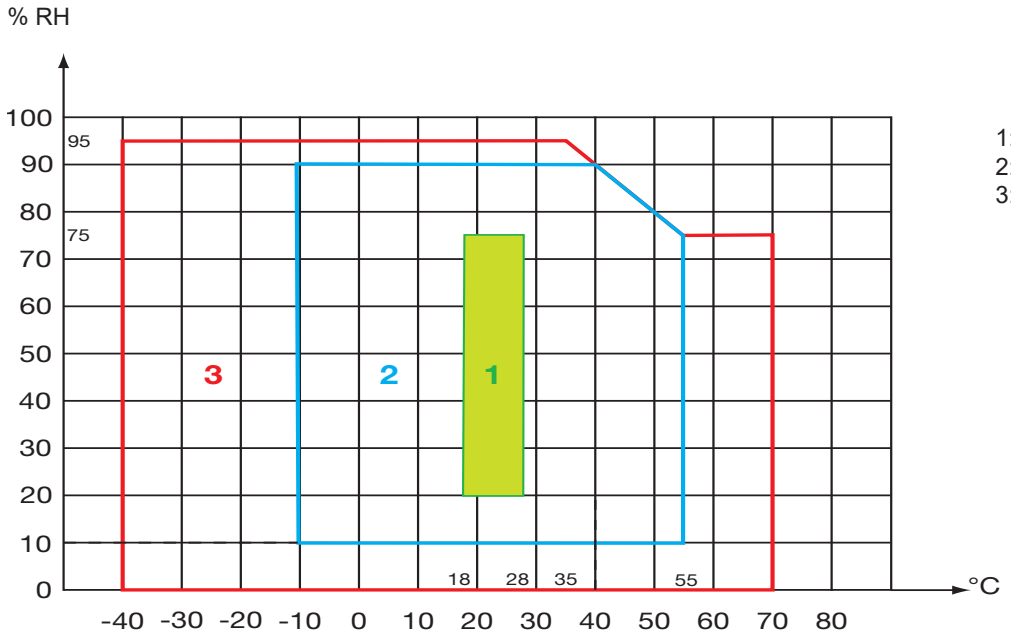
3.6.2. MAINS ADAPTER (OPTION)

The device can be powered by a standard mains adapter (5 VDC, 100 mA) with a type B micro-USB connector.

When the adapter is connected and the switch is set to **OFF**, the **On** indicator is lit steadily.
When the device is on, the brightness of the **On** indicator varies to indicate that the batteries are OK. If the indicator remains on steadily, the batteries must be replaced.

3.7. ENVIRONMENTAL CONDITIONS

The device must be used in the following conditions:



1: Range of reference
2: Operating range
3: Storage range (without battery)

The sensor by itself can withstand a maximum temperature of 90°C for 10 minutes.

Indoor or outdoor use without rain
Degree of pollution: 2.
Altitude: < 2000 m.

3.8. CONSTRUCTION SPECIFICATIONS

Coil

Length (mm)	170	250	350
Clamping diameter (mm)	45	70	100

Shielded lead 4 mm in diameter between the sensor and the electronic unit:
MA110: 2 metres long
MA130: 3 metres long

Electronic unit:
Overall dimensions: 120 x 58 x 36 mm
MA110: Output by a cable 50 cm long and 2 plugs 4 mm in diameter.
MA130: Output by a cable 50 cm long and 3 BNC connectors.

Mass of the device:
- MA110: approximately 300 g.
- MA130: approximately 500 g.

Protection index:
IP 54 for the electronic unit and IP 67 for the flexible sensor per IEC 60529.

The flexible coil stands up well to oils and aliphatic hydrocarbons.

3.9. CONFORMITY TO INTERNATIONAL STANDARDS

Electrical safety per IEC/EN 61010-2-032 for type B ⓧ sensors.

Single-phase electronic unit and connecting cable to the measuring instrument	Three-phase electronic unit and connecting cable to the measuring instrument	Sensor and connecting cable to the electronic unit
Double insulation	Double insulation	Double insulation
Measurement category: IV	Measurement category: III	Measurement category: IV
Rated voltage: 600V *	Rated voltage: 600 V	Rated voltage: 600V *

*: or 1000 V in category III.

Double or reinforced insulation ⧈.

The 250 V mains adapter (option).

3.10. ELECTROMAGNETIC COMPATIBILITY (CEM)

Emissions and immunity in an industrial environment per IEC/EN 61326-1.

4. MAINTENANCE

Except for the batteries, the instrument does not contain any parts that can be replaced by untrained and unauthorized personnel. Any unauthorized repair or replacement of a part by an “equivalent” may gravely impair safety.

4.1. CLEANING

Disconnect all connections from the clamp and set the switch to **OFF**. Also ensure that no cables are clamped.

Use a soft, slightly damp cloth and dry quickly with a dry cloth. Do not use alcohol, solvents, or hydrocarbons.

See to it that no foreign body interferes with the operation of the snap lock device of the sensor.

4.2. REPLACING THE BATTERIES

The batteries must be replaced when the **On** indicator remains off upon switching on.

- Disconnect the unit completely and turn the rotary switch to OFF.
- Use a screwdriver to unscrew the two screws closing the electronic unit.
- Replace the spent batteries with new batteries taking care with the polarities.

Used batteries and accumulators must not be treated as household waste. Take them to the appropriate collection point for recycling**.**

- Close the electronic unit and make sure that it is completely and correctly closed.
- Screw the two screws back in.

5. WARRANTY

Except as otherwise stated, our warranty is valid for **24 months** starting from the date on which the equipment was sold. The extract from our General Conditions of Sale are available on our website.
www.group.chauvin-arnoux.com/en/general-terms-of-sale

The warranty does not apply in the following cases:

- inappropriate use of equipment or use with incompatible equipment;
- modifications made to the equipment without the explicit permission of the manufacturer's technical staff;
- work done on the instrument by a person not approved by the manufacturer;
- adaptation to a particular application not anticipated in the definition of the equipment or by the user manual;
- damage caused by shocks, falls, or floods.

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