CHAUVIN ARNOUX

DigiFlex

# MA400D
# MA4000D


## Flexible current meter

Measure up

Thank you for purchasing a **Digi*FLEX* MA400D** or **MA4000D current meter with flexible current sensor**.

For best results from your instrument:
- **read** this user's manual carefully,
- **comply with** the precautions for use.

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

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.

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 UKCA marking certifies that the product is compliant with the requirements that apply in the United Kingdom, in particular as regards Low-Voltage Safety, Electromagnetic Compatibility, and the Restriction of Hazardous Substances.

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

This instrument is protected against voltages of not more than 1000V with respect to ground in measurement category III or 600V in CAT IV between the sensor and the conductor of which it measures the current.

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.
- Do not exceed the rated maximum voltage and current or the measurement category.
- Observe the conditions of use, namely the temperature, the relative humidity, the altitude, the level of pollution, and the place.
- Before each use, check the integrity of the insulation on the coil, the cords and the housing. Do not use the instrument if it is open, damaged, or poorly reassembled, or its accessories if they appear damaged.
- The application or withdrawal of the sensor on uninsulated conductors at dangerous voltages requires the use of suitable safety equipment.
- Use personal protection equipment systematically.
- All troubleshooting and metrological checks must be performed by competent and accredited personnel.

# CONTENTS

# 1. PRESENTATION

## 1.1. DELIVERY CONDITION

The Digi*FLEX* MA400D is delivered in a blister pack with:
- two 1,5 V piles alkaline battery (LR03 or AAA),
- one Velcro fastener,
- one multilingual quick start guide,
- one multilingual safety data sheet,
- a verification certificate.

The Digi*FLEX* MA40000D is delivered in a blister pack with:
- two 1,5 V piles alkaline battery (LR03 or AAA),
- one Velcro fastener,
- one multilingual quick start guide,
- one multilingual safety data sheet,
- a verification certificate.

## 1.2. ACCESSORIES

Carrying bag 120 x 200 x 60 mm
Multi-function belt clip

## 1.3. REPLACEMENT PARTS

Set of 5 Velcro fasteners

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

## 1.4. FUNCTIONS

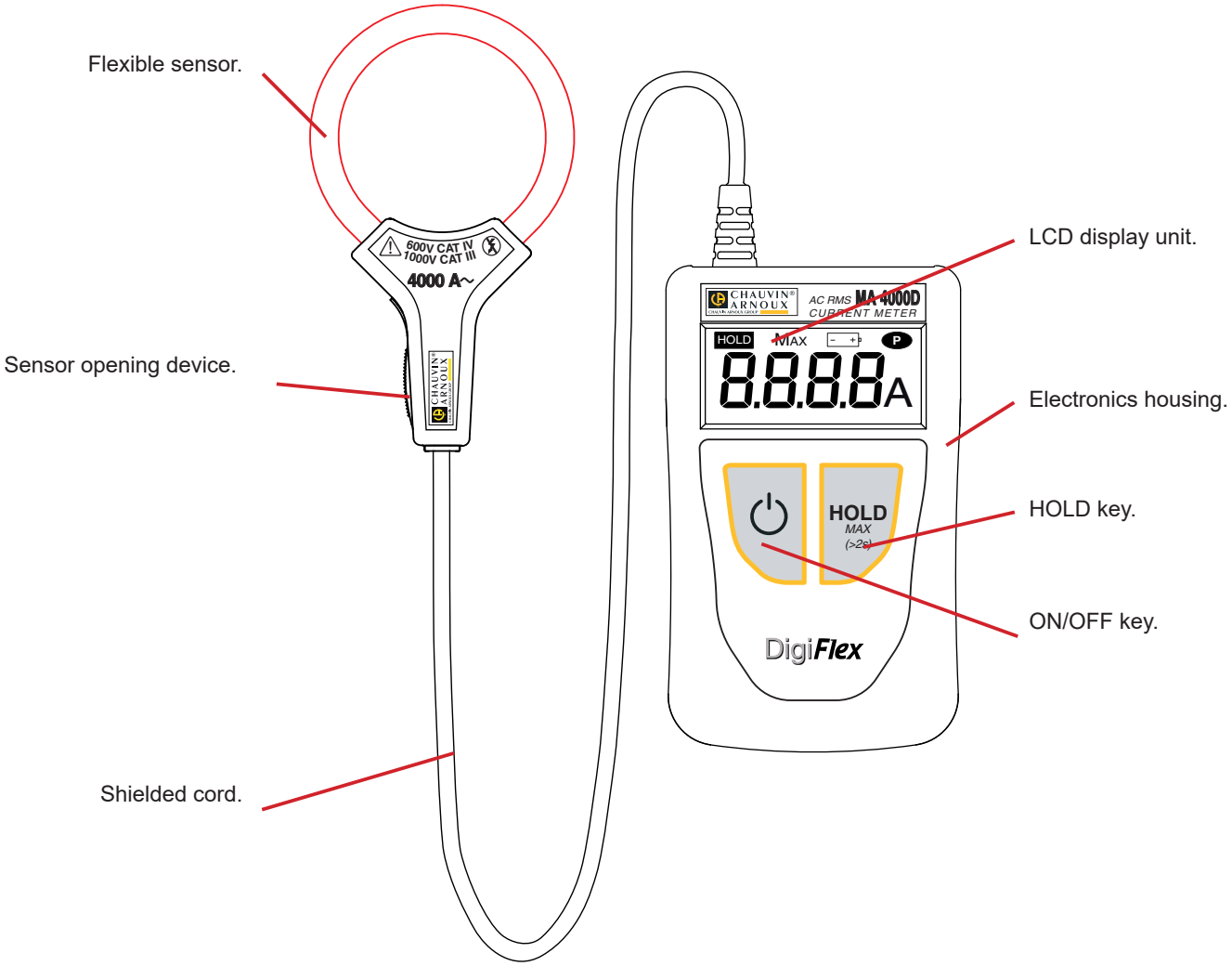
The Digi*FLEX* MA400D is used for RMS measurements of current, from 20 mA to 400 A.
The Digi*FLEX* MA4000D is used for RMS measurements of current, from 200 mA to 4000 A.

The sensor takes the form of a flexible coil
- 17, 25 or 100 cm long for the MA400D,
- 35 or 100 cm long for the MA4000D,

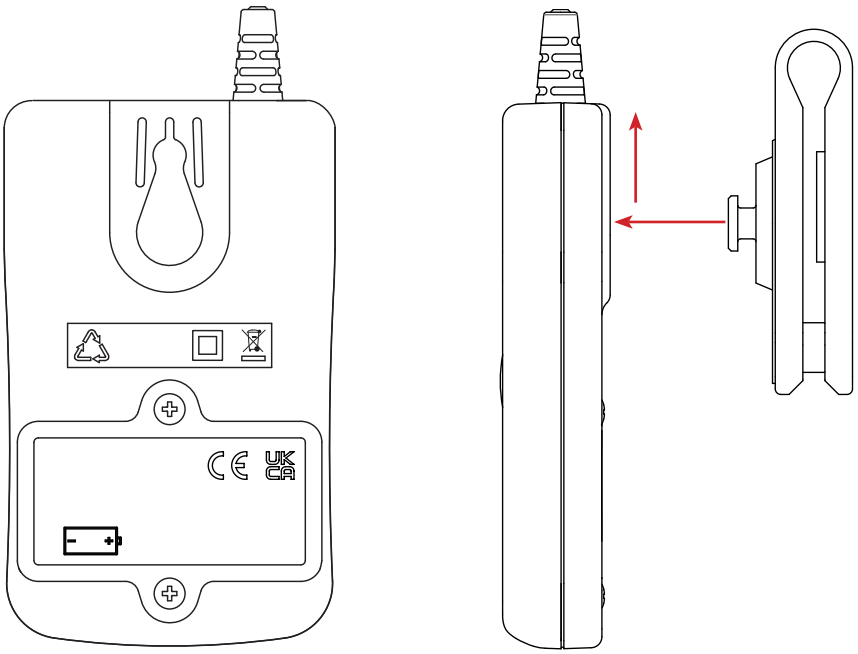
It is connected by a shielded cord to a small housing containing the signal processing electronics, supplied by a battery.

The flexibility of the sensors makes it easier to wrap them round the conductor to be measured, whatever its type (cable, bar, strand, etc.) and its accessibility. The design of the snap-action coil opening and closing device allows it to be handled while wearing protective gloves.

## 1.5. MA400D AND MA4000D

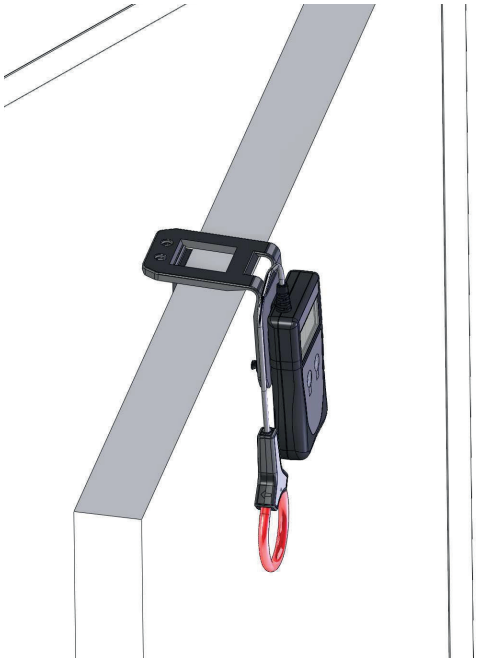



On the back of the electronics housing is a notch for the attachment of a belt clip (optional).



The multi-function belt clip can be used:

- to carry the electronic housing on your belt,
- to attach it to a metal surface using the built-in magnet,
- to hook it to a door or the edge of a table.



## 1.6. INSTALLING THE BATTERIES

- 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 flexible sensor is based on the Rogowski coil.

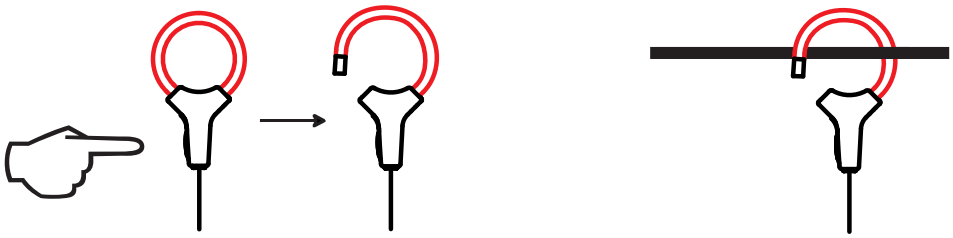
It combines:
- very good linearity with no saturation effect (and so no heating);
- light weight (no magnetic circuit).

## 2.2. CURRENT MEASUREMENT

### 2.2.1. CONNECTION

⚠ In the case of a live, uninsulated conductor, use personal protective equipment.

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

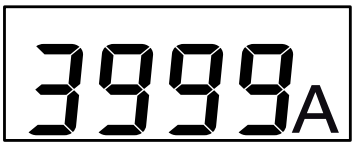


- Open it, then place it round the conductor through which the current to be measured flows (only one conductor in the sensor).
- Close the coil.
- In order to optimize measurement quality, it is best to centre the conductor in the coil and to make the shape of the coil as nearly circular as possible.
- Press the ⏻ key to switch the device on. The display unit lights.

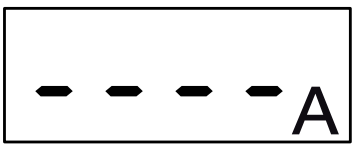
### 2.2.2. MEASUREMENT

Read the measurement on the display unit. The current is given in ARMS.


If the measurement exceeds the display capacity:
- 400 A for the MA400D, the device displays 399.9, blinking.
- 4000 A for the MA4000D, the device displays 3999, blinking.


If the measurement is too low (see § 3.2), the device displays dashes.



If the edges of the signal are too steep or its peak factor is too large, the device displays OL.

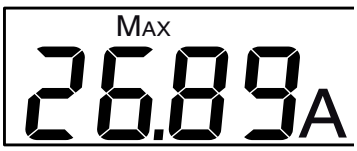

### 2.2.3. FREEZING THE MEASUREMENT

If you want to freeze the display of a measurement, press the **HOLD** key.
The **HOLD** symbol is displayed.


The device continues to make measurements, but the display is frozen. To release it, press the **HOLD** key again.

### 2.2.4. SEARCH FOR MAXIMUM

To search for a maximum, for example a spike lasting at least 100 ms, press the **HOLD** (MAX > 2s) key for more than two seconds.
The **MAX** symbol is then displayed; the device starts making measurements a few seconds later.




The device compares each new measurement to the one displayed. If the new measurement is greater than the old, it replaces it in the display.

To return to the real-time display mode, press the **HOLD** (MAX > 2s) key again.

### 2.2.5. DE-ACTIVATION OF AUTOMATIC SWITCHING OFF

In order to save the batteries, the device switches itself off automatically at the end of 10 minutes if the user has not pressed a key (unless the **MAX** function is active).


It is possible to deactivate automatic switching off. To do this, when you switch the device on, press the ⏻ and **HOLD** keys simultaneously. The **P** symbol (lit steadily) is then displayed.

To reactivate automatic switching off, switch the device off, then back on.

### 2.2.6. BATTERIES LOW

When the battery voltage drops and the remaining battery life of the device is only about one hour, the symbol blinks on the display unit.

When the battery voltage is too low to guarantee the accuracy of the measurements, the symbol lights steadily. The batteries must then be replaced (see § 4.2).

### 2.2.7. DISCONNECTING

- Switch the device off by pressing the ⏻ key.
- Press the yellow opening device to open the flexible core.
- Remove the flexible core from the conductor

# 3. TECHNICAL SPECIFICATIONS

## 3.1. REFERENCE CONDITION

| Quantity of influence | Reference values |
|---|---|
| Temperature | 23 ± 3°C |
| Relative humidity | 45 to 75% RH |
| Frequency of the signal measured | 40 to 65 Hz |
| Peak factor of the signal measured | $\sqrt{2}$ |
| Conductor diameter | ≤ 5 mm |
| Battery voltage | 2.8 - 3.2 V |
| External electric field | none |
| External DC magnetic field (earth field) | <40 A/m |
| External AC magnetic field | none |
| Position of the conductor | centred in the measurement coil |
| Shape of the measurement coil | nearly circular |

**Intrinsic uncertainty** is the error defined in the reference conditions.

## 3.2. ELECTRICAL CHARACTERISTICS

### 3.2.1. MA400D

| Display range (A) | 4 | 40 | 400 |
|---|---|---|---|
| Specified measurement range (A) | 0,020 - 3,999 | 4,00 - 39,99 | 40,0 - 399,9 |
| Resolution | 1 mA | 10 mA | 100 mA |
| Intrinsic uncertainty | ±(2% + 10 ct) | ±(1,5% + 2 ct) | ±(1,5% + 2 ct) |

In MAX mode:

| Display range (A) | 4 | 40 | 400 |
|---|---|---|---|
| Specified measurement range (A) | 0,100 - 3,999 | 4,00 - 39,99 | 40,0 - 399,9 |
| Resolution | 1 mA | 10 mA | 100 mA |
| Intrinsic uncertainty | ±(2% + 10 ct) | ±(1,5% + 2 ct) | ±(1,5% + 2 ct) |

### 3.2.2. MA4000D

| Display range (A) | 40 | 400 | 4000 |
|---|---|---|---|
| Specified measurement range (A) | 0.20 - 39.99 | 40.0 - 399.9 | 400 - 3999 |
| Resolution | 10 mA | 100 mA | 1 A |
| Intrinsic uncertainty | ±(2% + 10 ct) | ±(1.5% + 2 ct) | ±(1.5% + 2 ct) |

In MAX mode:

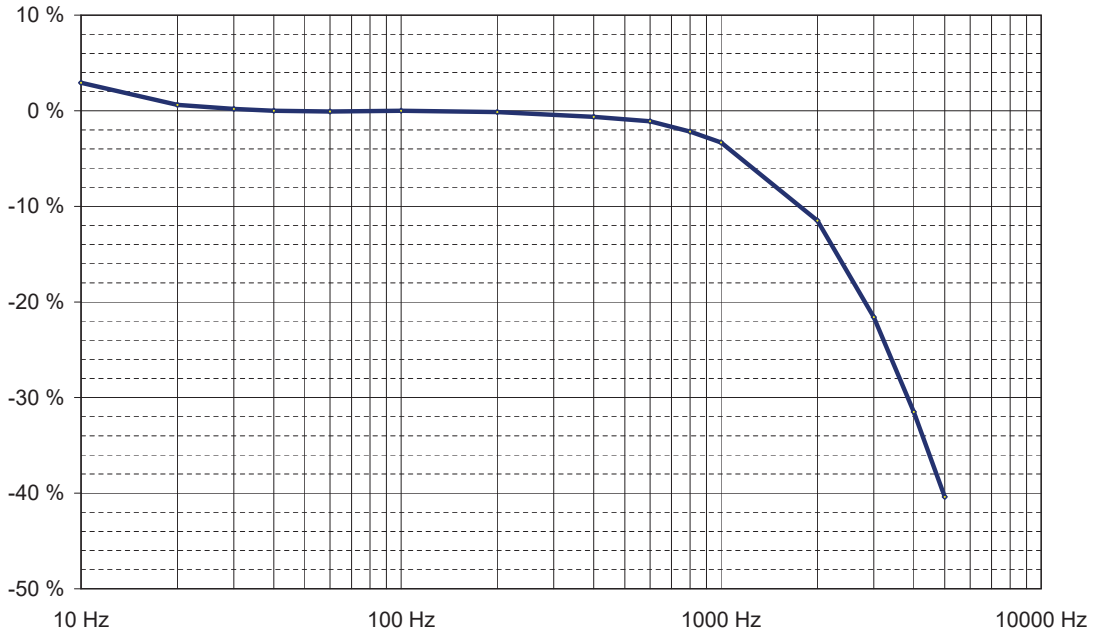
| Display range (A) | 40 | 400 | 4000 |
|---|---|---|---|
| Specified measurement range (A) | 1.00 - 39.99 | 40.0 - 399.9 | 400 - 3999 |
| Resolution | 10 mA | 100 mA | 1 A |
| Intrinsic uncertainty | ±(2% + 10 ct) | ±(1.5% + 2 ct) | ±(1.5% + 2 ct) |

## 3.3. VARIATIONS IN RANGE OF USE

| Quantity of influence | Range of influence | Error on the measurement | |
|---|---|---|---|
| | | Typical | Maximum |
| Battery voltage | 1.8 to 2 V | < 1 ct | ±(2% + 1 ct) |
| Temperature | 0 °C to 50 °C | ± 0.25 % / 10 °C | ±( 0.5 % / 10 °C + 2 ct) |
| Relative humidity | 10 to 90% RH | 0.2% | ± (0.3 % + 2 ct) |
| Frequency response | 10 to 20 Hz<br>20 Hz to 30 Hz<br>30 Hz to 400 Hz<br>400 to 1000 Hz<br>1000 to 3000 Hz | See § 3.4 | ± (5 % + 1 ct)<br>± (1 % + 1 ct)<br>± (0.5 % + 1 ct)<br>± (6 % + 1 ct)<br>- 3 dB typical |
| Position of the conductor in the sensor (f<400 Hz) | Any position on the interior perimeter of the sensor | ± 0.5 % | ± (1.5 % ± 1 ct) |
| Adjacent conductor carrying alternating current | Conductor touching the exterior perimeter of the sensor | **MA400D**<br>Away from opening: 33 dB<br>At opening: 30 dB | **MA400D**<br>Away from opening: ≥ 28 dB<br>At opening: ≥ 25 dB |
| | | **MA4000D**<br>Away from opening: 55 dB<br>At opening: 55 dB | **MA4000D**<br>Away from opening: ≥ 45 dB<br>At opening: ≥ 45 dB |
| Peak factor | 1.4 to 3.5<br>limited to 6000 Apeak | at 16.66 Hz : ± (2 % + 1 ct)<br>at 50 Hz : ± (0.5 % + 1 ct)<br>at 440 Hz : ± (30 % + 1 ct) | ± (6 % + 1 ct)<br>± (3 % + 1 ct)<br>- |
| Serial mode rejection ratio in AC | 0 to 400 Adc | < 1 ct | ≥ 50 dB |
| Common mode rejection, 50/60 Hz | 0 to 600 Vrms | < 1 ct | ≥ 60 dB |
| Influence of a 50/60 Hz external magnetic field | 0 to 400 A/m | Housing: 43 dB<br>Sensor: 50 dB | Housing: ≥ 30 dB<br>Sensor: ≥ 40 dB |

## 3.4. TYPICAL FREQUENCY RESPONSE CURVES

at 39 Aac



## 3.5. POWER SUPPLY

The device can be powered:
- either by two 1.5 V LR03 or AAA alkaline batteries,
- or by two NiMH storage batteries of the same size.

Batteries mass: approximately 2 x 12 g

The nominal operating voltage is between 1.8 and 3.2 V.
The battery life in continuous operation is:
- 70 hours with super-alkaline batteries,
- 50 hours with NiMH storage batteries having a capacity of 1200 mAh.

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

## 3.6. ENVIRONMENTAL CONDITIONS

The instrument must be used in the following conditions:
- Temperature in use 0°C to +50°C
- Storage temperature: -20°C to +70°C (without batteries)
- Relative humidity in use 80% RH to 50°C
- Relative humidity in storage 90% RH (up to 45°C)

The sensor can withstand a temperature of 90°C.

For indoor use.
Level of pollution: 2.
Altitude: <2000 m.

## 3.7. MECHANICAL CHARACTERISTICS

Dimensions
- Housing: 100 x 60 x 20 mm
- Connecting cable: 0.70 m
- Sensor

| | MA400D | | | MA4000D | |
|---|---|---|---|---|---|
| Length (mm) | 170 | 250 | 1000 | 350 | 1000 |
| Clamping diameter (mm) | 45 | 70 | 320 | 100 | 320 |

Mass of the device: approximately 130 g

Index of protection: IP 50 per IEC 60529
IK 04 per IEC 62262

Afterflame time: V0 (per UL 94)

The flexible coil is resistant to oils and aliphatic hydrocarbons.

## 3.8. COMPLIANCE WITH INTERNATIONAL STANDARDS

Electrical safety per IEC/EN 61010-2-032 for type B sensors Ⓧ. Rated voltage 600 V with respect to earth in category IV.

Double insulation: ⧈

## 3.9. ELECTROMAGNETIC COMPATIBILITY

Emissions and immunity in an industrial setting compliant with IEC/EN 61326-1 for portable devices.

# 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 everything connected to the instrument and switch it off.

Use a soft cloth, dampened with soapy water. Rinse with a damp cloth and dry rapidly with a dry cloth or forced air. Do not use alcohol, solvents, or hydrocarbons.

Make sure that no foreign body interferes with the operation of the snap device of the sensor.

## 4.2. REPLACEMENT OF THE BATTERIES

The battery must be replaced when the − + symbol is displayed.

- Disconnect everything connected to the instrument and switch it off.
- Use a screwdriver to unscrew the two closing screws of the housing.
- Replace the old battery with a new battery, 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 housing; make sure that it is completely and correctly closed.
- Screw both 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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