

- **SONDES DE COURANT AC ISOLÉES FLEXIBLES POUR OSCILLOSCOPE**
- **INSULATED FLEXIBLE AC CURRENT PROBES FOR OSCILLOSCOPE**
- **ISOLIERTE AC-STROMSONDEN FÜR OSZILLOSKOP**
- **SONDE DI CORRENTE AC ISOLATE FLESSIBILI PER OSCILLOSCOPIO**
- **SONDAS DE CORRIENTE AC AISLADAS FLEXIBLES PARA OSCILOSCOPIO**

MiniFLEX MA200



User's manual

ENGLISH

Thank you for purchasing a **MiniFLEX MA200 insulated flexible AC current probe for oscilloscope**. For best results from your instrument:

- **read** these user's manual carefully,
- **comply with** the precautions for use.



WARNING, risk of DANGER! The operator must refer to this user's manual whenever this danger symbol appears.



Equipment protected throughout by double insulation.



Must not be applied to or removed from bare conductors carrying dangerous voltages. Type B current sensor as per EN 61010 2 032.



The CE marking indicates conformity with European directives, in particular LVD and EMC.



The rubbish bin with a line through it indicates that, in the European Union, the product must undergo selective disposal in compliance with Directive WEEE 2002/96/EC. This equipment must not be treated as household waste.



Battery.

Definition of measurement categories:

- Measurement category IV corresponds to measurements taken at the source of low-voltage installations.
- Measurement category III corresponds to measurements on building installations.
- Measurement category II corresponds to measurements taken on circuits directly connected to low-voltage installations.

PRECAUTIONS FOR USE

This instrument is protected against voltages of not more than:

- 600V with respect to ground in measurement category III or 300V in CAT IV on the output cord side.
- 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.

The peak maximum rated current is equal to 1.5 times the upper range limit.

The protection provided by the instrument may be impaired if the instrument is used other than as specified by the manufacturer.

- Do not exceed the rated maximum voltage and current or the measurement category. Do not use your instrument on networks of which the voltage or category exceeds those stated.
- Observe the conditions of use, namely the temperature, the relative humidity, the altitude, the level of pollution, and the place.

- Do not use the instrument if it is open, damaged, or poorly reassembled, or its accessories if they appear damaged. Before each use, check the integrity of the insulation on the coil, the cords, and the housing.
- The sensor must not be applied to or removed from uninsulated conductors at dangerous voltages.
- If it is not possible to disconnect the installation from any voltage, employ safe operating procedures and wear suitable protective gear.
- All troubleshooting and metrological checks must be done by competent, accredited personnel.

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1. PRESENTATION

1.1. OF THE LINE

MiniFLEX series MA100 sensors constitute a line of 3 standard models that can be used to convert alternating current from 0.5 to 3000 A into proportional alternating voltages.

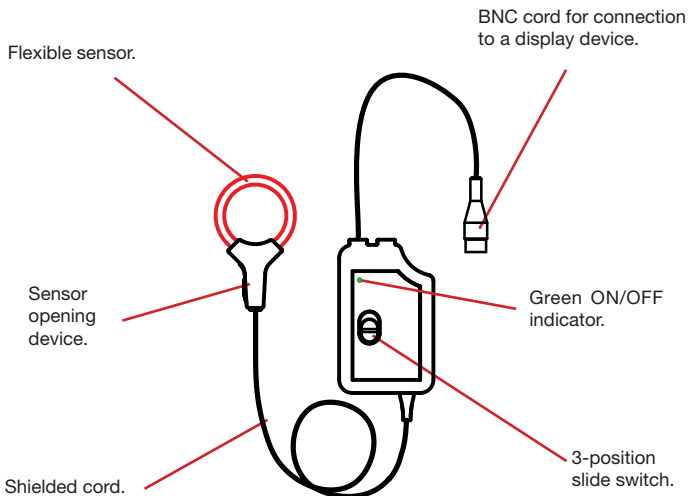
These probes are intended in particular for the viewing of alternating currents, to determine transition and propagation times in electrotechnical equipment.

Each sensor takes the form of a flexible coil, 17, 25 or 35 cm long, 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.

The housing can be connected to any oscilloscope having an AC voltage input and an input impedance of at least $1M\Omega$.

1.2. OF THE INSTRUMENT



2. CURRENT MEASUREMENT

2.1. MEASUREMENT PRINCIPLE

The sensor provides an image of the derivative of the current analysed.
The electronic housing provides an image of the integral of the sensor output.
The resultant of these two operations on the output of the housing is the image of the current analysed.

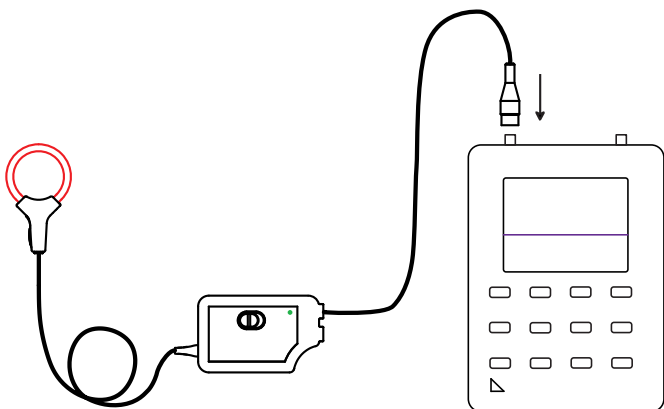
The sensor used provides:

- very good linearity with no saturation effect (and so no heating);
- insensitivity to direct current (it is possible to measure the AC component of any AC + DC signal);
- light weight (no magnetic circuit).

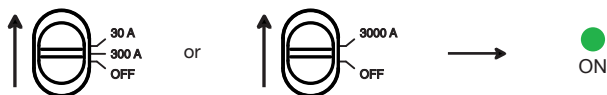
2.2. USE

2.2.1. CONNECTION

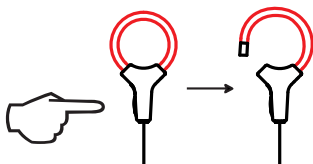
Connect the cord to the input of an oscilloscope having an input impedance of at least $1\text{M}\Omega$, in AC mode.



Switch the electronic housing on by sliding the switch to a position. The green indicator lights.



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.

Set the switch on the housing to the range that provides the best sensitivity.

Read the measurement on the oscilloscope, applying the reading coefficient indicated on the label of the housing corresponding to the setting of the switch.

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

2.2.2. DISCONNECTION

Remove the flexible coil from the conductor, then disconnect the housing of the multimeter or oscilloscope.

3. CHARACTERISTICS

3.1. REFERENCE CONDITIONS

Quantity of influence	Reference values
Temperature	23 ± 5°C
Relative humidity	20 to 75% RH
Frequency of the signal measured	40 to 400Hz
Type of signal	sinusoidal
External electric field	<1V/m
External DC magnetic field (earth field)	<40A/m
External AC magnetic field	none
Position of the conductor	centred in the measurement coil
Shape of the measurement coil	nearly circular
Input impedance of the oscilloscope	≥1MΩ

3.2. ELECTRICAL CHARACTERISTICS

Range - I nominal (Arms)	30	300	3000
Wrapping diameter (mm)	45 ou 70		100
Output/input ratio (mV~/A~)	100	10	1
Range of use (A)	0.5-30	0.5-300	0.5-3000
Specified measurement range (A)	5-30	5-300	5-3000
Maximum peak factor ⁽¹⁾ at I nominal	1.5		
Uncertainty	± (1 % + 0,3 A)		
Residual noise at I = 0 (Arms) ⁽²⁾	0.25 typical, 5 max.		
Max. phase shift at 1 kHz (°)	1.5		
Max. output voltage (Vpeak)	± 4.5		
Output impedance (kΩ)	1		

(1): Peak factor: $PF = V_{peak}/V_{rms}$.

(2): The residual noise affects the measurement uncertainty according to the formula:

$$\text{global uncertainty} = \frac{\sqrt{(I \text{ measured} \times 0.01)^2 + (\text{residual noise})^2}}{I \text{ measured}} \quad (I \text{ measured} \neq 0)$$

If the current measured is zero, the uncertainty is equal to the residual noise.

3.3. FREQUENCY CHARACTERISTICS

Range (Arms)	30	300	3000
Pass band to ± 3 dB (Hz) ⁽³⁾	2-1,000,000	2-1,000,000	2-1,000,000
Tr and Tf from 10 to 90% (μ s)	0.30	0.24	0.3
Td to 10% (μ s)	0.4	0.3	0.4
Insertion impedance at 10kHz (m Ω)	<0.05		

Tr: Rise Time

Tf: Fall Time

Td: Delay Time

(3): This is the equivalent pass band calculated by the formula:

$$BP = 0.35/Tt$$

with Tt = transition time (Tr or Tf)

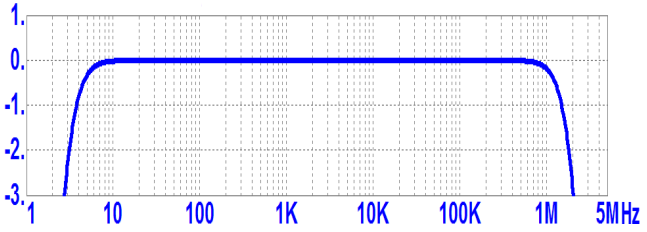
3.4. VARIATIONS IN RANGE OF USE

Quantity of influence	Range of influence	Error in % of reading	
		Typical	Maximum
Battery voltage	7 to 9V	0.02%	0.1%
Temperature	Adapter: - 10°C to + 55°C Coil only: - 10°C to +90°C	0,05 % / 10 °C 30 / 300 A model 0,15 % / 10 °C 3000 A model	0,2 % / 10 °C 30 / 300 A model 0,6 % / 10 °C 3000 A model
Relative humidity	10 to 90% RH	0.2%	0.5%
Frequency response	5Hz to 1 MHz	See §3.5	
Position of the conductor in the undeformed sensor	Any position	$\pm (1 \% + 0,3 A)$	2.5% (6% near snap device)
Adjacent conductor carrying alternating current	Conductor 1cm from the sensor	1% or 40 db	1.5% or 36.5 db (3% or 30.5 db near snap device)
Deformation of the sensor	Oblong shape	0.2%	1%
Common mode rejection	600V between the jacket and the secondary	83 db	75 db
Common mode rejection	600V between the flexible sensor and the secondary	100 db	80 db
Impedance of the measuring instrument Z	Depends on measuring instrument	0.1%/Z in M Ω	

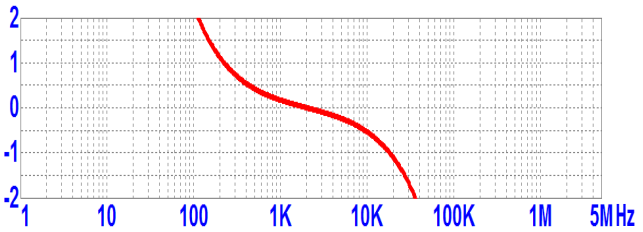
3.5. TYPICAL FREQUENCY RESPONSE CURVES

3.5.1. 30 / 300 A MODEL, DIAMETER 45 MM

Amplitude error in dB

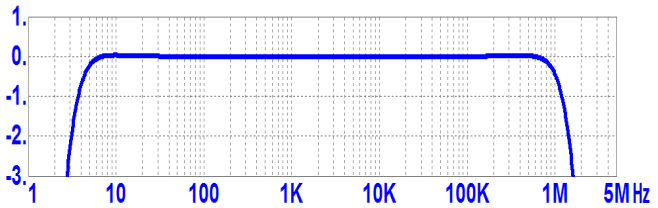


Phase error in degrees

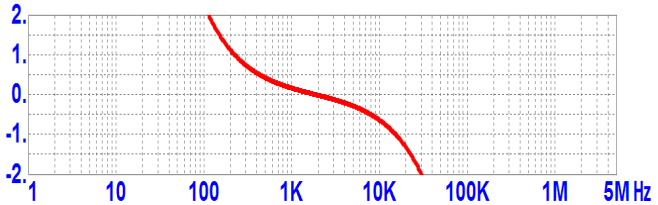


3.5.2. 30 / 300 A MODEL, DIAMETER 70 MM

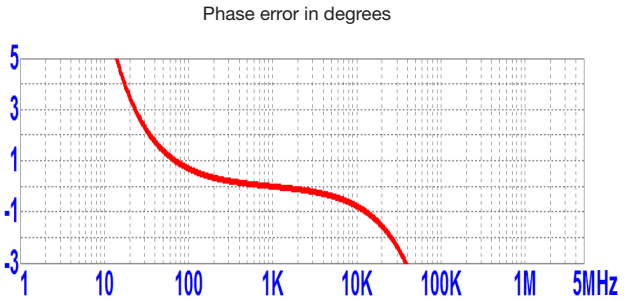
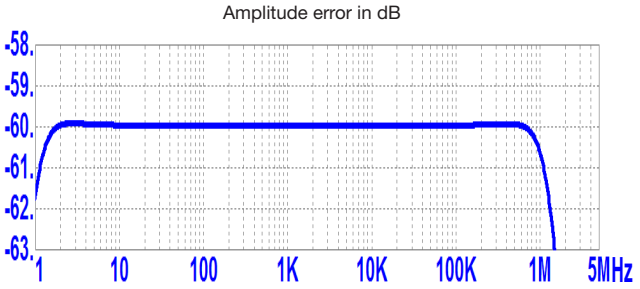
Amplitude error in dB



Phase error in degrees

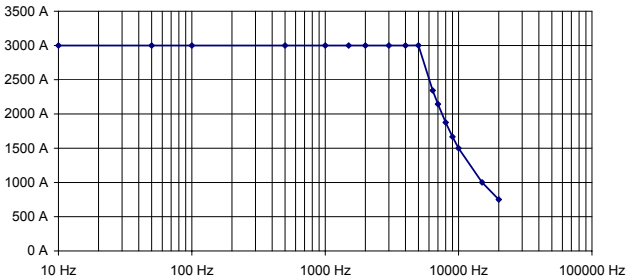


3.5.3. 3000 A MODEL, DIAMETER 100 MM



3.6. FREQUENCY LIMITATION VERSUS AMPLITUDE

3000A range



3.7. POWER SUPPLY

The instrument is powered by a 9 V alkaline battery (type 6LF22).
The nominal operating voltage is between 7 and 10 V.

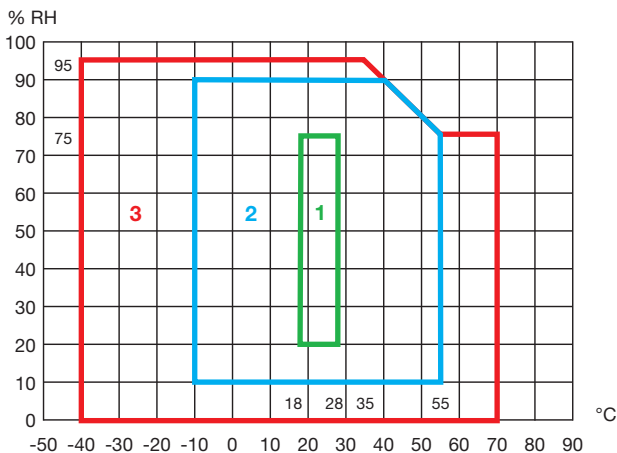
The battery life is 100 hours in continuous operation.

When the green (ON) indicator starts flashing, the remaining battery life is approximately 8 hours.

When the indicator no longer lights, the battery must be replaced (see §4.2).

3.8. ENVIRONMENTAL CONDITIONS

The instrument must be used in the following conditions:



- 1: Reference range
- 2: Operating range
- 3: Storage range (without battery)

If the instrument is to be stored or left unused for an extended period, remove the battery from the housing.

The sensor itself can withstand a maximum temperature of 90°C (by contact).

For indoor use.

Level of pollution: 2.

Altitude: <2000 m.

3.9. CHARACTERISTICS OF CONSTRUCTION

Coil

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

Cord between sensor and housing: 2 m long

Housing:

- Overall dimensions: 103 x 64 x 28 mm

- Output: a coaxial cable 40 cm long terminated by an insulated female BNC connector.

Mass of the instrument: approximately 200 g.

Index of protection: IP 50 as per IEC 60529
IK 04 as per IEC 50102

Flammability rating:

- Flexible sensor: V0 (as per UL 94)
- Housing: V2 (as per UL 94)

The flexible coil is resistant to oils and aliphatic hydrocarbons.

3.10. COMPLIANCE WITH INTERNATIONAL STANDARDS

Electrical safety as per IEC 61010-2-032 for type B sensors.

Housing	Sensor
Double insulation	Double insulation
Measurement category: III	Measurement category: IV
Rated voltage: 600 V ⁽¹⁾	Rated voltage: 600 V ⁽²⁾


(1): or 300 V in category IV.

(2): or 1000 V in category III.

3.11. ELECTROMAGNETIC COMPATIBILITY

Emissions and immunity in an industrial setting compliant with EN 61326-1.

4. MAINTENANCE

 **Except for the battery, the instrument contains no parts that can be replaced by personnel who have not been specially trained and accredited. 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 set the switch to 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 BATTERY

The battery must be replaced when the green indicator flashes or remains off when the instrument is switched on.

- Disconnect everything connected to the instrument and set the switch to OFF.
- Use a screwdriver to unscrew the two closing screws of the housing.
- Replace the old battery with a new battery (9V alkaline battery of type 6LF22).
- Place the battery in its compartment.
- Close the housing; make sure that it is completely and correctly closed.
- Screw both screws back in.

4.3. METROLOGICAL CHECK

 **Like all measuring or testing devices, regular instrument verification is necessary.**

This instrument should be checked at least once a year. For checks and calibrations, contact one of our accredited metrology laboratories (information and contact details available on request), at our Chauvin Arnoux subsidiary or the branch in your country.

4.4. REPAIR

For all repairs before or after expiry of warranty, please return the device to your distributor.