

User Manual  
ENGLISH



# MiniFlex<sup>®</sup>

## Flexible AC Current Probes

High Frequency Response  
for Oscilloscopes

### MF 300-10-2-10 HF

### MF 3000-14-1-1 HF



**CURRENT MEASUREMENT PROBES**

*Measure Up*  
WITH AEMC INSTRUMENTS



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# Statement of Compliance

Chauvin Arnoux<sup>®</sup>, Inc. d.b.a. AEMC<sup>®</sup> Instruments certifies that this instrument has been calibrated using standards and instruments traceable to international standards.

We guarantee that at the time of shipping your instrument has met the instrument's published specifications.

**An NIST traceable certificate may be requested at the time of purchase, or obtained by returning the instrument to our repair and calibration facility, for a nominal charge.**

The recommended calibration interval for this instrument is 12 months and begins on the date of receipt by the customer. For recalibration, please use our calibration services.

**Serial #:**

**Catalog #:** ~~2126.84 / 2126.86~~

**Model #:** MF 300-10-2-10 HF / MF 3000-14-1-1 HF

Please fill in the appropriate date as indicated:

Date Received: \_\_\_\_\_



Date Calibration Due: \_\_\_\_\_



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

# 1. INTRODUCTION

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Thank you for purchasing an AEMC® Instruments MiniFlex® **Flexible AC Current Probe Model MF 300-10-2-10 HF or Model MF 3000-14-1-1 HF.**

For best results from your instrument and for your safety, read the enclosed operating instructions carefully and comply with the precautions for use. Only qualified and trained operators should use this product.

## 1.1 INTERNATIONAL ELECTRICAL SYMBOLS

	Signifies that the instrument is protected by double or reinforced insulation.
	<b>CAUTION - Risk of Danger!</b> Indicates a <b>WARNING</b> . Whenever this symbol is present, the operator must refer to the user manual before operation.
	Indicates a risk of electric shock. The voltage at the parts marked with this symbol may be dangerous.
	Refers to a type B current sensor. Application or withdrawal not authorized on conductors carrying dangerous voltages. Type B current sensor as per IEC 61010-2-032.
	Indicates Important information to acknowledge
	This product complies with the Low Voltage & Electromagnetic Compatibility European directives.
	Battery
	In the European Union, this product is subject to a separate collection system for recycling electrical and electronic components in accordance with directive WEEE 2012/19/EU.

## 1.2 DEFINITION OF MEASUREMENT CATEGORIES

- CAT IV:** Corresponds to measurements performed at primary electrical supply (< 1000 V).  
*Example: primary overcurrent protection devices, ripple control units, and meters.*
- CAT III:** Corresponds to measurements performed in the building installation at the distribution level.  
*Example: hardwired equipment in fixed installation and circuit breakers.*
- CAT II:** Corresponds to measurements performed on circuits directly connected to the electrical distribution system.  
*Example: measurements on household appliances and portable tools.*

## 1.3 PRECAUTIONS FOR USE

These safety warnings are provided to ensure the safety of personnel and proper operation of the instrument.

- Read this instruction manual completely and follow all the safety information before attempting to use or service this instrument.
- Safety is the responsibility of the operator. The MiniFlex® must be used only by qualified personnel using applicable safety precautions.
- Wear protective clothing and gloves as required.
- Use caution on any circuit: potentially high voltages and currents may be present and may pose a shock hazard.
- Read the safety specifications section prior to using the current probe. Never exceed the maximum voltage ratings given.
- ALWAYS de-energize the circuit before wrapping the MiniFlex® around bare conductors, bus bars, or near live parts. Do not wrap on live conductors.
- ALWAYS connect the electronic module to the display device before wrapping the MiniFlex® around the sample being tested.
- ALWAYS inspect the module, sensor, sensor cable, and output terminals prior to use. Replace any defective parts immediately. Use only factory parts.
- NEVER use the MiniFlex® on electrical conductors rated above 1000 V CAT III; 600V CAT IV.

## 1.4 RECEIVING YOUR SHIPMENT

Upon receiving your shipment, make sure that the contents are consistent with the packing list. Notify your distributor of any missing items. If the equipment appears to be damaged, file a claim immediately with the carrier and notify your distributor at once, giving a detailed description of any damage. Save the damaged packing container to substantiate your claim.

## 1.5 ORDERING INFORMATION

MiniFlex® 30/300 A, 10 in, 100 mV/10 mV/A High Frequency  
(for use with any BNC Oscilloscope)..... **Cat. #2126.84**

MiniFlex® 3000 A, 14 in, 1 mV/A High Frequency  
(for use with any BNC Oscilloscope)..... **Cat. #2126.86**

*Both models include a 9V battery and a user manual.*

### 1.5.1 Accessories and Replacement Parts

Adapter - BNC (female) / 4 mm Banana (male) ..... **Cat. #2119.94**



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## 2. PRODUCT FEATURES

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### 2.1 DESCRIPTION

The MiniFlex® HF is a compact flexible AC current transformer composed of a flexible sensor and an electronic module. It is designed to measure from 5 Hz to 1 MHz. The flexible sensor permits measurements on conductors where standard clamp-on probes could not be used. In particular, it can be installed in confined spaces, places where access is difficult, or even wrapped around irregular shapes.

The MiniFlex® HF is lightweight. It does not use magnetic cores like standard transformers. The transformation principle is based on an air core. It presents virtually no load to the system under test, has a low phase shift and excellent frequency response from 5 Hz to 1 MHz at -3 db, and cannot be damaged by overloads. The sensor assembly is insulated for 1000 V CAT III; 600 V CAT IV. The MiniFlex® HF meets EN 61010 and is CE marked.

The MiniFlex® HF has an mV output proportional to the current measured for direct readings on oscilloscopes, DMMs, data loggers and power or harmonic meters. TRMS measurements are taken when connected to a TRMS meter. The MiniFlex® HF is insensitive to DC currents and only the AC component of the measured signal is measured.

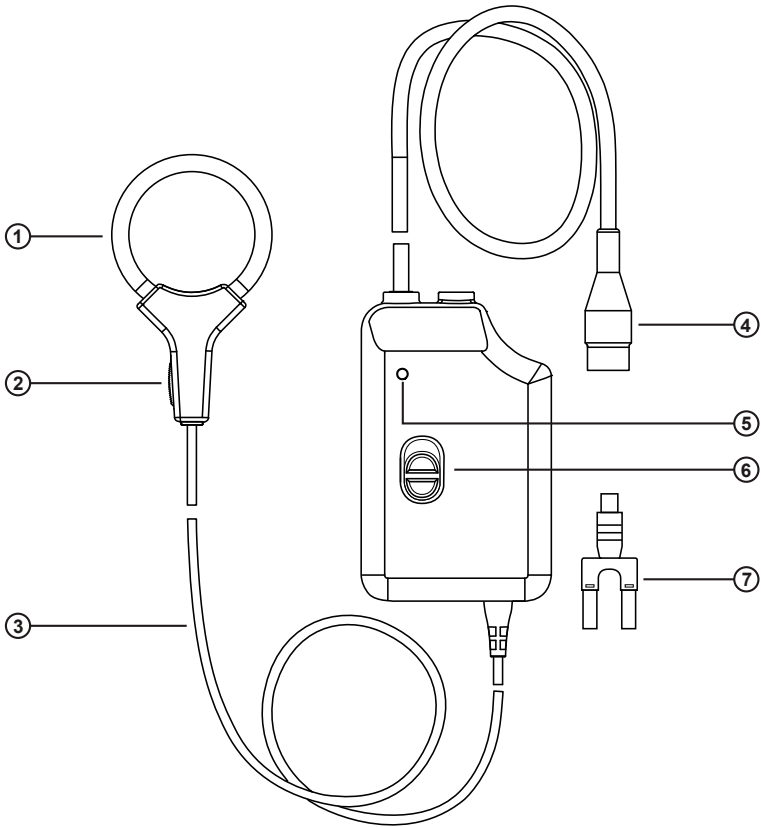
The flexible sensor is available in lengths of 6 in and 10 in.

### 2.2 FEATURES

- Measures from (0.5 to 300) ARMS
- Accuracy 1 % of Reading  $\pm$  0.3 A
- TRMS measurements when connected to a TRMS instrument
- No core saturation or damage if overloaded
- 9 V battery for typical 140 h continuous operation
- 1 MHz frequency response
- Low phase shift for power measurements
- Insensitive to DC, measures only AC component on DC + AC signals
- Excellent linearity
- Lightweight
- Sensor is resistant to oils and aliphatic hydrocarbons
- EN 61010; 1000 V CAT III; 600 V CAT IV; CE Mark



## 2.3 CONTROL FEATURES



**Figure 1**

1. Flexible sensor 5 mm Ø
2. Sensor opening device
3. Shielded cord
4. BNC output connector
5. Green ON/OFF indicator
6. Range selection switch
7. Optional BNC (female) / Banana (male) connector

### 3. SPECIFICATIONS

<b>REFERENCE CONDITIONS</b>	
<b>Quantity of influence</b>	<b>Reference values</b>
Temperature	23 ± 5° C
Relative humidity	(20 to 75) % RH
Frequency of the signal measured	(40 to 400) Hz
Type of signal	Sinusoidal
External electric field	< 1 V/m
External DC magnetic field (earth field)	< 40 A/m
External AC magnetic field	None
Position of the conductor	Centered in the measurement coil
Shape of the measurement coil	Nearly circular
Input impedance of the display device connected to housing	≥ 1MΩ

<b>MODEL</b>	<b>MF 300-10-2-10 HF</b>	<b>MF 3000-14-1-1 HF</b>
<b>ELECTRICAL</b>		
<b>Range</b>	30/300 A	3000 A
<b>Signal Output</b>	100 mV/10 mV/A	1 mV/A
<b>Frequency Range</b>	5 Hz to 1 MHz @ -3db	
<b>Frequency Limitation</b>	none	
<b>Influence Of Conductor Positioning</b>	1.5 % typical, 3 % max	
<b>Influence Of Conductor Positioning In Sensor Against Handle</b>	4% typical, 6% max	
<b>External Conductor Influence</b>	35dB to 40dB on contact	
<b>Accuracy</b>	± 1% +0.3 A	
<b>Common Mode Rejection</b>	100dB typical, 80dB min	
<b>Max peak factor <sup>(1)</sup> at I nominal</b>	1.5	
<b>Residual noise at I = 0 (A<sub>RMS</sub>) <sup>(2)</sup></b>	0.3 A	
<b>Max phase shift at 1kHz (°)</b>	1.5	
<b>Max offset voltage (mV<sub>Dc</sub>)</b>	5	
<b>Max output voltage (V<sub>peak</sub>)</b>	± 4.5	
<b>Output impedance (kΩ)</b>	1	
<b>Power Source</b>	9V alkaline battery (6LF22)	
<b>Battery Life</b>	140 hrs continuous operation or 10,000 one minute measurements	
<b>Battery Indicator</b>	When Green LED starts blinking, remaining life is approx 8 hours; When LED is OFF, the battery needs to be replaced	

(1): Peak factor PF = V<sub>peak</sub>/V<sub>RMS</sub>

(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.

<b>MODEL</b>		<b>MF 300-10-2-10 HF</b>	<b>MF 3000-14-1-1 HF</b>
<b>MECHANICAL</b>			
<b>Module Output</b>	Coaxial cable terminated by an insulated female BNC connector		
<b>Module Dimensions</b>	4.0 x 2.5 x 1.1 in (103 x 64 x 28 mm)		
<b>Module Weight</b>	7 oz (200 g)		
<b>Sensor Diameter</b>	5 mm Ø		
<b>Sensor Length</b>	10 in (250 mm)	14 in (355 mm)	
<b>Max Conductor Size</b>	2.95 in (70 mm)	3.93 in (100 mm)	
<b>Connection Cable Length</b>	6.5 ft (2 m)		
<b>Flammability Rating</b>	Sensor: UL94V0 Housing: UL94V2		
<b>Drop Test</b>	Per IEC 68-2-32		
<b>Vibration</b>	Per IEC 68-2-6		
<b>Mechanical Shock</b>	Per IEC 68-2-27		
<b>Weatherproofing</b>	IP 50		
<b>ENVIRONMENTAL</b>			
<b>Operating Temperature Range</b>	(14 to 131) °F (-10 to +55) °C		
<b>Storage Temperature Range</b>	(-40 to 158) °F (-40 to +70) °C		
<b>Influence of Temperature</b>	Sensor: (-10 to 100) °C: < 0.5 % of Reading per 10 °C Module: (-10 to 55) °C: < 0.5 % of Reading per 10 °C		
<b>Relative Humidity</b>	(10 to 90) % RH: 0.1 % typical, 0.3 % max		
<b>Altitude</b>	Operating: (0 to 2000) m, working voltage derating above; Non-operating: (0 to 12,000) m		
<b>SAFETY</b>			
<b>Double Insulation</b>	Yes, per IEC 1010-2-32		
<b>CE Rated</b>	Yes		
<b>Safety Rating</b>	EN 61010, 1000V CAT III; 600V CAT IV		
<b>Pollution Level</b>	2		
<b>Immunity and Emission</b>	Industrial environment		
<b>Electromagnetic Compatibility</b>	Satisfies the EMC and LVD directives required for CE marking and product standard IEC 61326-1 (Ed. 97) + A1 (Ed. 98)		

*Specifications are subject to change without notice*

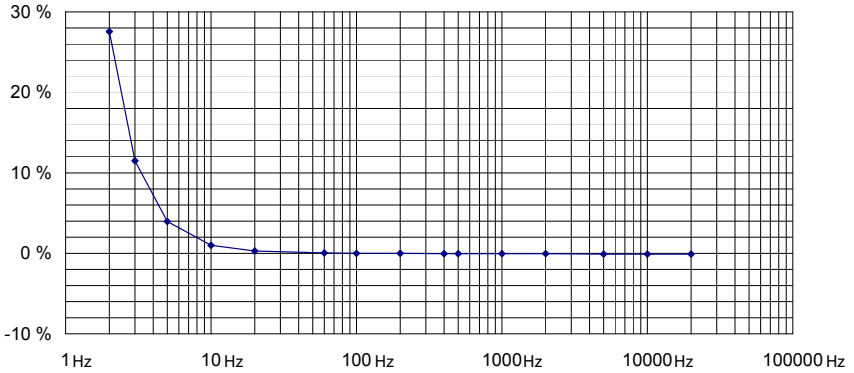
### 3.1 TYPICAL RESPONSE CURVES

#### 3.1.1 Frequency Error

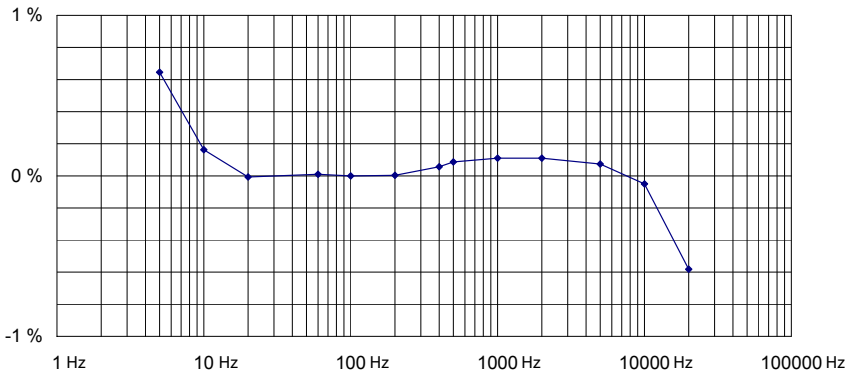
Model MF 300-10-2-10 HF Diameter 70 mm

Model MF 3000-14-1-1 HF Diameter 100 mm

#### 300 A Range:



#### 3000 A Range:



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## 4. OPERATION

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### 4.1 COMPATIBILITY

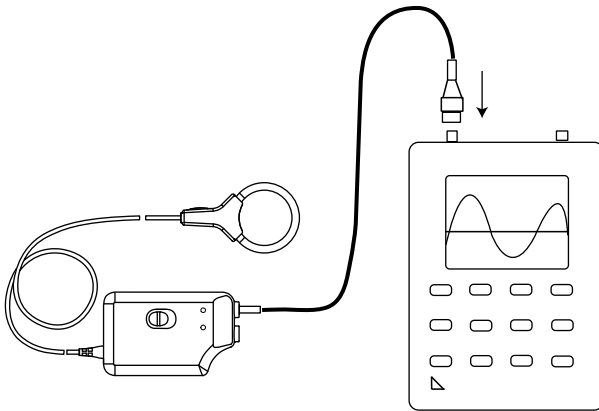
The MiniFlex<sup>®</sup> is compatible with any Oscilloscope, AC voltmeter, or other voltage measuring instrument with an input impedance greater than 1 M $\Omega$ . To achieve the best overall accuracy, use the MiniFlex<sup>®</sup> with an Oscilloscope set to AC mode with an accuracy of 0.75 % or better.

### 4.2 TIPS FOR MAKING PRECISE MEASUREMENTS

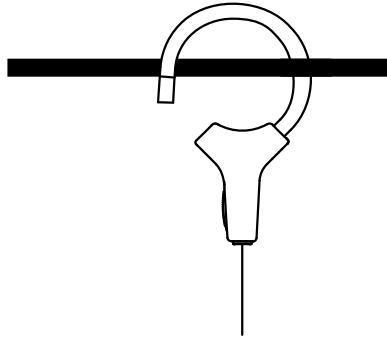
- When using the MiniFlex<sup>®</sup> with an Oscilloscope, it is important to select the range that provides the best resolution. Failure to do this may result in measurement errors.
- For best results, select the highest MiniFlex<sup>®</sup> output signal possible and the most sensitive meter range for this output.
- Make sure the Oscilloscope or measuring instrument can accurately measure mVAC.
- For best accuracy, center the MiniFlex<sup>®</sup> around the conductor to be measured.
- The overall measurement accuracy is the sum of the MiniFlex<sup>®</sup> accuracy and the displaying instrument accuracy.

### 4.3 MAKING MEASUREMENTS

- Connect the electronic module to the AC Volt range of a Oscilloscope input or measuring instrument. Select the highest range on the MiniFlex<sup>®</sup>.



- Press the sensor's yellow opening device to open the flexible coil.
- Wrap the coil around the conductor to be tested. If possible, within range, select the lowest range to obtain the best resolution.



- Do not exceed specified current range for the output.
- Read the displayed value on the Oscilloscope and divide it by the range selected (i.e. if reading = 2.59 V with the 10 mV/A output range, the current flowing through the probe is  $2590 \text{ mV} \div 10 = 259 \text{ A}$ ).
- For best accuracy, carefully center the conductor inside the flexible core, and if possible, avoid being in the proximity of other conductors which may create noise and interference (particularly near the latch).

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## 5. MAINTENANCE

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### 5.1 WARNING

- For maintenance use only specified replacement parts.
- To avoid electrical shock, do not attempt to perform any servicing unless you are qualified to do so.
- To avoid electrical shock and/or damage to the instrument, do not get water or other foreign agents into the case.
- Turn the instrument OFF and disconnect the unit from all the circuits before opening the case.

### 5.2 BATTERY REPLACEMENT

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 screws on the housing.
- Replace the old battery with a new one (9V alkaline or lithium battery of type 6LF22).
- Close the housing, making sure that it is completely and correctly closed, then screw both screws back in.

### 5.3 CLEANING

- It is important to keep the sensor latch mating surfaces clean to prevent foreign matter from entering the closing.
- The sensor may be gently cleaned with a soft cloth, soap and water. Dry immediately after cleaning. Avoid water penetration into the electronic module.
- Make sure the sensor, electronic module, and all leads are completely dry before any further use.

## **5.4 REPAIR AND CALIBRATION**

To ensure that your instrument meets factory specifications, we recommend that it be sent back to our factory Service Center at one-year intervals for recalibration or as required by other standards or internal procedures.

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## **5.5 TECHNICAL ASSISTANCE**

If you are experiencing any technical problems or require any assistance with the proper operation or application of your instrument, please call, e-mail or fax our technical support team/



## 5.6 LIMITED WARRANTY

The instrument is warranted to the owner for a period of two years from the date of original purchase against defects in manufacture. This limited warranty is given by AEMC® Instruments, not by the distributor from whom it was purchased. This warranty is void if the unit has been tampered with, abused, or if the defect is related to service not performed by AEMC® Instruments.



**NOTES:**

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