User Manual

ENGLISH

AEMC® INSTRUMENTS

CHAUVIN ARNOUX GROUP

AC/DC Current Probe
Models MR417 & MR527

CURRENT PROBES

Measure Up
WITH AEMC® INSTRUMENTS

Chauvin Arnoux®, Inc. d.b.a. AEMC® Instruments
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Statement of Compliance

Chauvin Arnoux®, Inc. d.b.a. AEMC® 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 its 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. Refer to our repair and calibration section at www.aemc.com.

Serial #: _____

Catalog #: **1200.84 / 1200.85**

Model #: **MR417 / MR527**

Please fill in the appropriate date as indicated:

Date Received: _____

Date Calibration Due: _____

AEMC® INSTRUMENTS
CHAUVIN ARNOUX GROUP

Chauvin Arnoux®, Inc.
d.b.a AEMC® Instruments
www.aemc.com

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1. INTRODUCTION

Thank you for purchasing an AEMC® Instruments **Current Probe Model MR417 or MR527**. For best results from your instrument and for your safety, please read the following operating instructions carefully and comply with the precautions for use.

This instrument is compliant with the IEC 61010-2-032 safety standards for voltages of 300 V in measurement Category IV or 600 V in Category III.

Symbols

	**CAUTION - Risk of Danger!** Indicates a **WARNING**. Whenever this symbol is present, the operator must refer to the user manual before operation
	Application or withdrawal authorized on conductors carrying dangerous voltages. Type A current sensor as per IEC 61010-2-032
	Signifies that the instrument is protected by double or reinforced insulation
	Battery
	USB Socket
	Indicates important information to acknowledge.
	Direction of the current
	The product has been declared recyclable
	This product complies with the Low Voltage & Electromagnetic Compatibility European directives (73/23/CEE & 89/336/CEE)
	In the European Union, this product is subject to a separate collection system for recycling electrical and electronic components in accordance with directive WEEE 2002/96/EC

Definition of Measurement Categories (CAT)

CAT IV corresponds to measurements performed at the 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.

1.1 PRECAUTIONS FOR USE

These instructions are intended to ensure the safety of users and proper operation of the instrument. Failure to observe these safety instructions may result in electric shock, fire, explosion, and desctruction of the instrument and/or installations.

- The operator and/or the responsible authority must carefully read and clearly understand the various precautions to take before and during use.
- Do not use the instrument on networks on which the voltage or category exceeds instrument specifications.
- Never exceed the protection limits stated in the specifications.
- Observe the environmental conditions of use, including relative humidity, altitude, degree of pollution, and place of use.
- Do not use the instrument if it appears to be damaged, incomplete, or not properly closed.
- Before each use, check the condition of the insulation on the leads, housing, and accessories. Any component on which the insulation is deteriorated (even partially) must be set aside for repair or disposal.
- When handling the instrument, keep your fingers behind the physical guards.
- Use suitable means of protection.
- All troubleshooting and metrological checks must be performed by competent and accredited personnel.

1.2 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. It the equipment appears to be damaged, file a claim immediately with the carrier and notify the distributor at once, giving a detailed description of any damage. Save the damaged packing container to substantiate your claim.

1.3 ORDERING INFORMATION

AC/DC Current Probe Model MR417 ..... Cat. #1200.84
Includes 9 V battery, multi-language safety data sheet, and user manual

AC/DC Current Probe Model MR527 ..... Cat. #1200.85
Includes 9 V battery, multi-language safety data sheet, and user manual

1.3.1 Replacement Parts/Accessories

Cable - 6 ft USB Type A to Micro Type B ..... **Cat. #2138.66**

2. DESCRIPTION

The Models MR417 and MR527 are clamp-on current probes that measure DC currents up to 1400 A, AC currents up to 1000 ARMS (1400 A peak), and combined AC+DC currents without opening the circuit that the current is flowing through. They indicate the shape and amplitude of the current measured in the form of a voltage.

These instruments can be used with oscilloscopes. They can be powered by a battery or with 5 VDC via the optional micro-USB cable.

The MR417 and MR527 include the following features:

- Range overage indicator.
- Power supply indicator.
- Zero adjustment.
- Auto Standby feature.
- Two ranges (sensitivity 1 and 10 mV/A).
- Micro-USB connector to connect a power supply.

2.1 INTERFACE

2.1.1 MR417

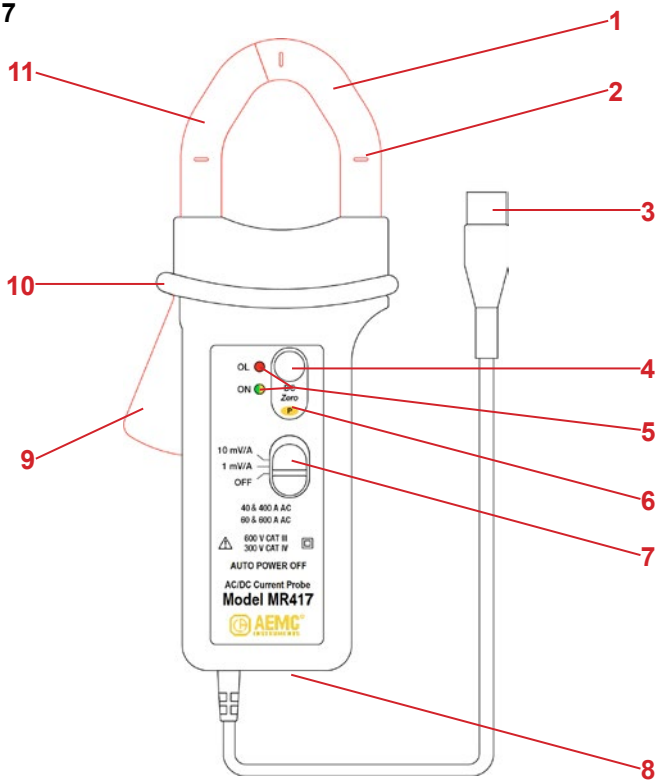


Figure 1 (MR417)

Item	Functions
1	Fixed (non-mobile) jaw
2	Arrow indicating current flow direction
3	Male BNC connector
4	**DC Zero** button
5	**OL** (overload) and **ON** indicators. **ON** is green when Auto Standby is enabled and yellow when it is disabled.
6	**P** (Permanent mode) indicator. Holding down the DC Zero button while turning ON the instrument enables Permanent mode. In this mode, Auto Standby is disabled (see § 3.4).
7	3-position slide switch
8	USB port
9	Trigger
10	Hand guard
11	Mobile jaw

2.1.2 MR527

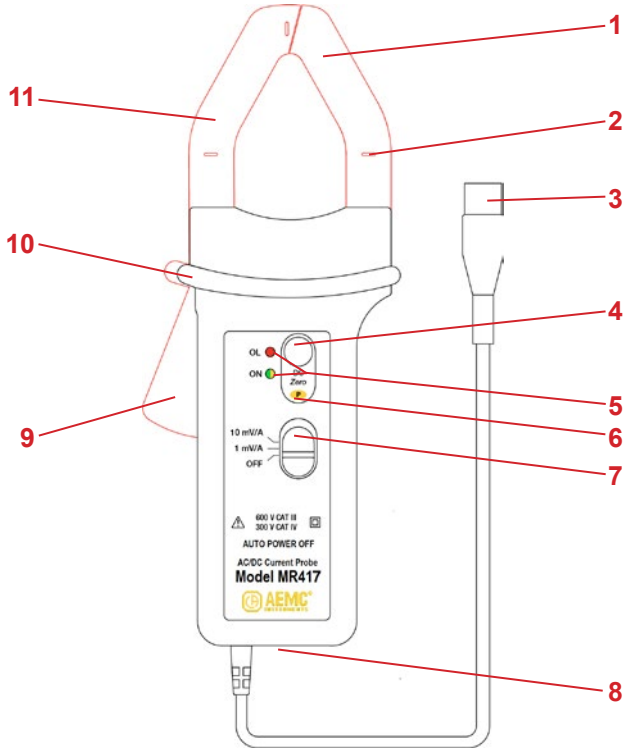


Figure 2 (MR527)

Item	Functions
1	Fixed (non-mobile) jaw
2	Arrow indicating current flow direction
3	Male BNC connector
4	**DC Zero** button
5	**OL** (overload) and **ON** indicators. **ON** is green when Auto Standby is enabled and yellow when it is disabled.
6	**P** (Permanent mode) indicator. Holding down the DC Zero button while turning ON the instrument enables Permanent mode. In this mode, Auto Standby is disabled (see § 3.4).
7	3-position slide switch
8	USB port
9	Trigger
10	Hand guard
11	Mobile jaw

3. OPERATION

3.1 BATTERY INSTALLATION

NOTE: Before changing the battery, set the switch to OFF and remove the clamp from the circuit being measured.

1. Using a screwdriver, remove the battery compartment cover (1) from the back of the housing (see Figure 3).
2. Connect the battery to the snap-on connector (2), observing polarity.
3. Place the battery into the battery compartment (3).
4. Replace the battery compartment cover and screw it onto the housing.

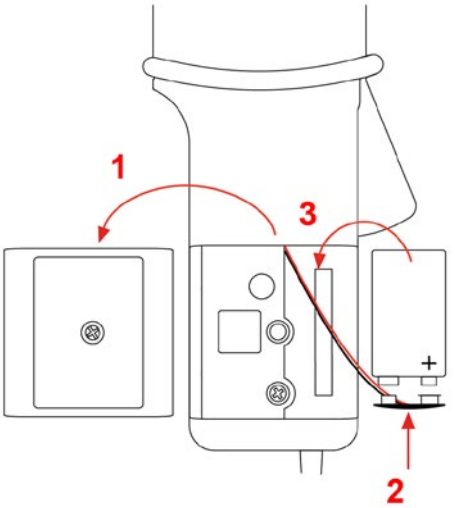


Figure 3

3.2 EXTERNAL POWER (OPTIONAL)

For long-term measurements, you can connect the clamp to external power via any micro-USB adapter that delivers 100 mA or more. If external power is disconnected, the clamp automatically switches to battery operation.

The insulation between the type B micro-USB connector and the measurement output is 600 V CAT III. This enables you to safely connect the clamp to measuring instruments with uninsulated inputs. The type B micro-USB connector must not be in contact with conductors or uninsulated parts at dangerous voltage.

When operating on external power, the Auto Standby feature is disabled. The color of the **ON** indicator shows whether the automatic standby is enabled (green) or disabled (yellow).

3.3 TURNING THE INSTRUMENT ON

To turn the clamp on, push the slide switch to the **1 mV/A** or **10 mV/A** setting:

- **MR417**
  1 mV/A corresponds to the 600 A range.
  10 mV/A corresponds to the 60 A range.
- **MR527**
  1 mV/A corresponds to the 1400 A range.
  10 mV/A corresponds to the 150 A range.

The green **ON** indicator should light up:

- If the indicator blinks, less than 4 hours of battery life remains.
- If the indicator does not light up, replace the battery (see § 5.2).

3.4 AUTO STANDBY

After 10 minutes of operation without user action (such as pressing the **DC Zero** button), the clamp automatically enters Standby mode. In this mode, the **ON** indicator will turn OFF.

To reactivate the clamp, press the **DC Zero** button or change the switch to any setting other than OFF.

To disable automatic Standby, press and hold down **DC Zero** when turning the instrument ON. The ON indicator blinks to indicate that the request has been applied. The ON indicator will show steady yellow after you release the **DC Zero** button.

3.5 DC ZERO ADJUSTMENT

NOTE: If the measurement range (or sensitivity) is changed, the **DC Zero** must be adjusted before any further measurements are made.
The **DC Zero** must be adjusted before any series of measurements and after each disconnection and reconnection.

To adjust the **DC Zero**:

- With the clamp connected to the measuring instrument, select the desired measurement range (or sensitivity) on the switch.
- Make sure that there is no conductor in the clamp and that its jaws are closed correctly.
- Press the **DC Zero** button.
- The **OL** indicator will light up for approximately three seconds to indicate that the zero adjustment is in progress.
- The **OL** indicator will turn off to indicate that the operation has succeeded.
- If the **OL** indicator stays on, the zero could not be adjusted.
- Before repeating the operation, check that the jaws closed correctly (air gaps clean, no dust, no oxidation, etc.) and that there is no conductor in the clamp.
- Press the **DC Zero** button again.
- In the event of failure, or if the clamp is switched off (selector set to OFF), it is the last adjustment of the **DC Zero** that is kept.

3.6 MEASUREMENTS

3.6.1 Making a Measurement

After adjusting the **DC Zero**:

1. Press the clamp trigger to open the jaws.
2. Clamp the jaws around the conductor to be measured. Use the centering marks on the jaws to position the clamp around the conductor. If the measurement is for a power calculation, ensure the arrow on the clamp jaws (see Figures 1 and 2) points in the right direction of the current flow:

   source ⇨ load

3. Release the trigger, ensuring the jaws are completely and correctly closed.
4. Observe the measurements displayed on the measuring instrument.
5. If the **OL** indicator lights up, the current is too high to be measured. If the sliding switch is set to the **10 mV/A** range, change the setting to **1 mV/A**.

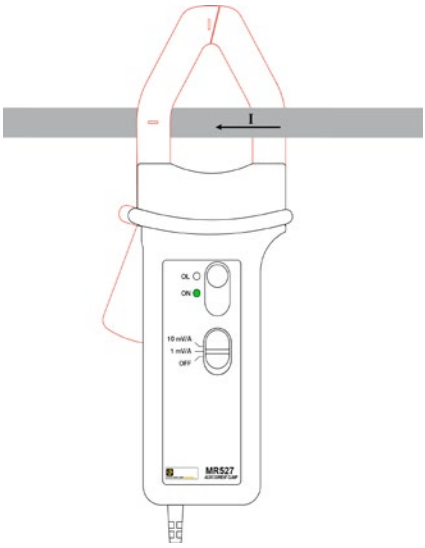


Figure 4 (MR527 shown)

3.6.2 Converting to Current

The MR417 and MR527 both provide two measurement ranges. The MR417 measures current up to 600 A with 1 mV of output corresponding to 1 A and measures current up to 60 A with 10 mV corresponding to 1 A. The MR527 measures current up to 1400 A with 1 mV corresponding to 1 A and measures current up to 150 A with 10 mV corresponding to 1 A.

To convert the clamp output to current, divide the voltage reading on the connected measuring device by the V/A coefficient. For example, in the MR527's 1400 A range, a reading of 100 mV corresponds to a current of 100 A.

4. SPECIFICATIONS

4.1 REFERENCE CONDITIONS

Quantities of Influence	Reference Conditions
Temperature	73.4 °F ± 9 °F (23 °C ± 5 °C)
Relative humidity	(20 to 75) % RH
Position of the conductor	Centered on the marks on the jaws
Measurement frequency	DC to 65 Hz sine wave
External electrical field	Zero
External DC magnetic field (Earth)	< 40 A/m
External AC magnetic field	Zero
Input impedence	≥ 1 MΩ and ≤ 100 pF

The intrinsic uncertainty is the error defined under the reference conditions. It is expressed as a percentage of the output signal (R) plus an offset in mV: ±(a % R + b)

4.2 ELECTRICAL SPECIFICATIONS

4.2.1 Electrical Specifications, 1 mV/A Sensitivity

Output impedence: 215 Ω

MR417

Specified Measurement Range	(0.5 to 100) Aac/dc	(100 to 400) Aac/dc	(400 to 500) Aac/dc	(500 to 600) Adc
Intrinsic uncertainty	≤ ± (2 % R + 1.5 mV)	≤ ± 2 % R	≤ ± 3 % R	≤ ± 4 % R

MR527

Specified Measurement Range	(0.5 to 100) Aac/dc	(100 to 800) Aac/dc	(800 to 1000) Aac/dc	(1000 to 1400) Adc
Intrinsic uncertainty	≤ ± (2% R + 1.5mV)	≤ ± 2.5 % R	≤ ± 4 % R	≤ ± 5 % R

Phase error (45 to 65Hz)

MR417

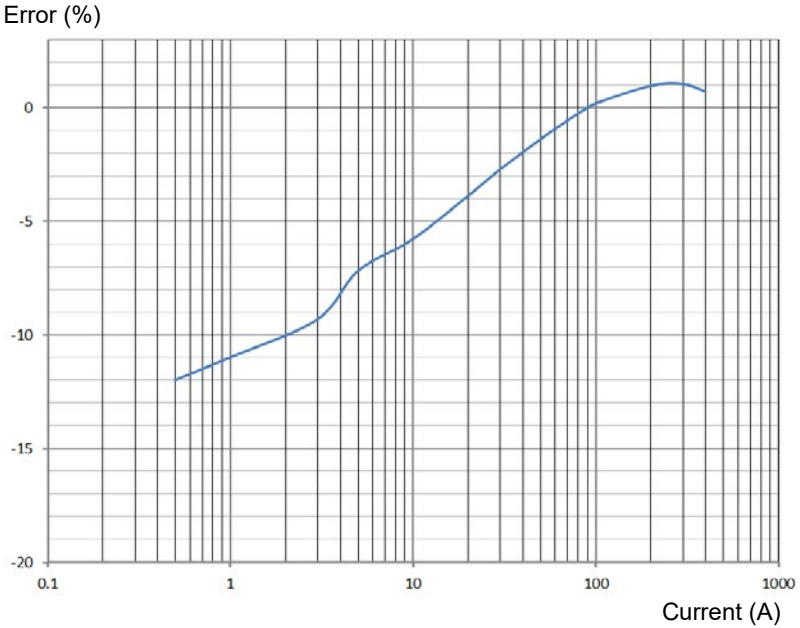
Specified Measurement Range	(3 to 300) Aac	(300 to 400) Aac
Phase shift	≤ -2.2 °	≤ -1.5 °

MR527

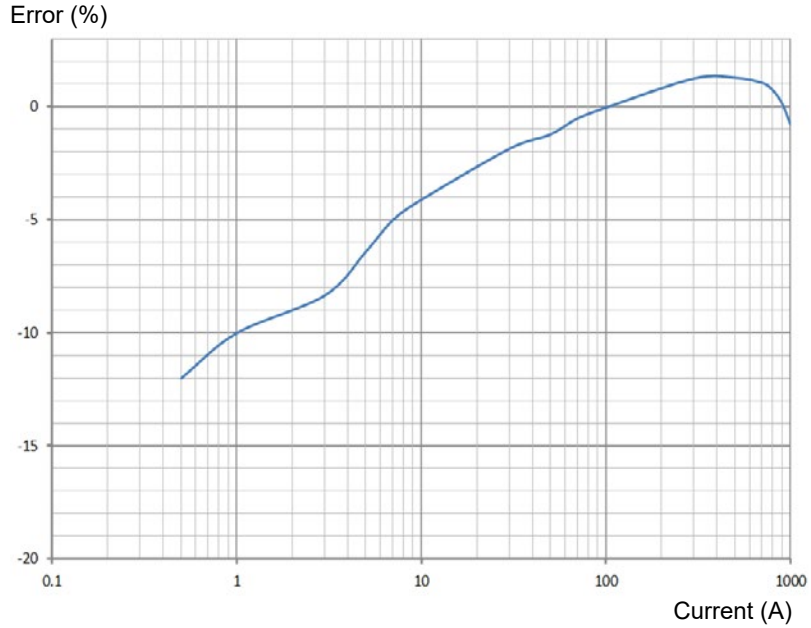
Specified Measurement Range	(3 to 200) Aac	(200 to 1000) Aac
Phase shift	≤ -2 °	≤ -1.5 °

Typical amplitude error curve at 60 Hz

MR417

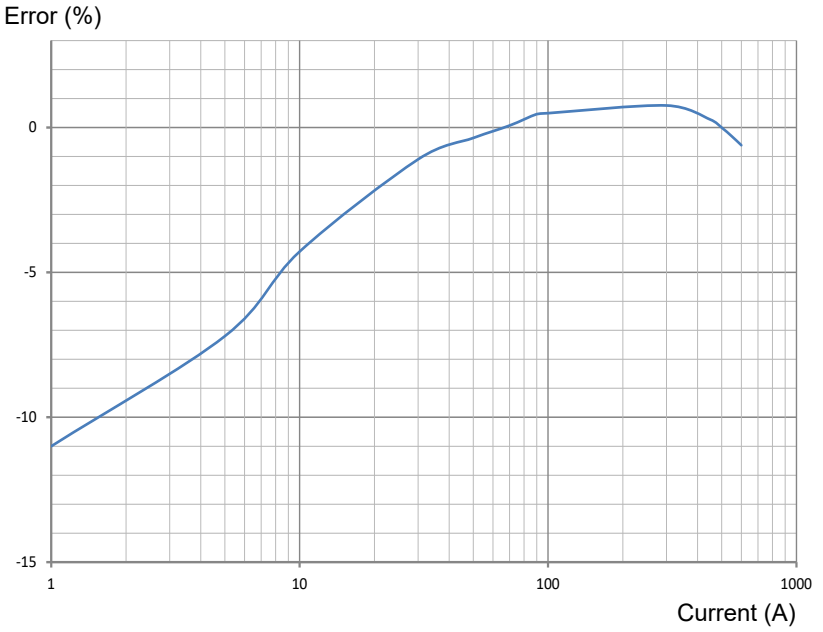


MR527



Typical amplitude error curve in DC

MR417



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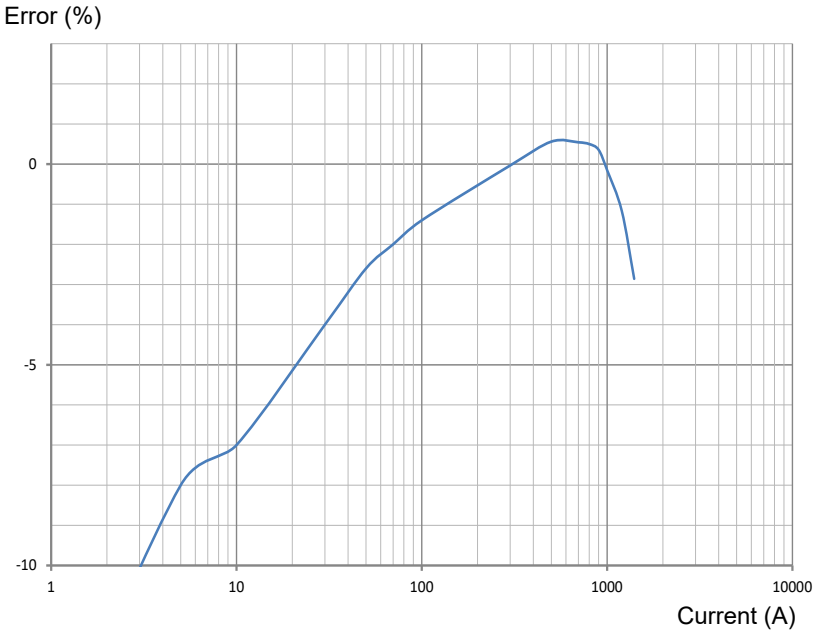
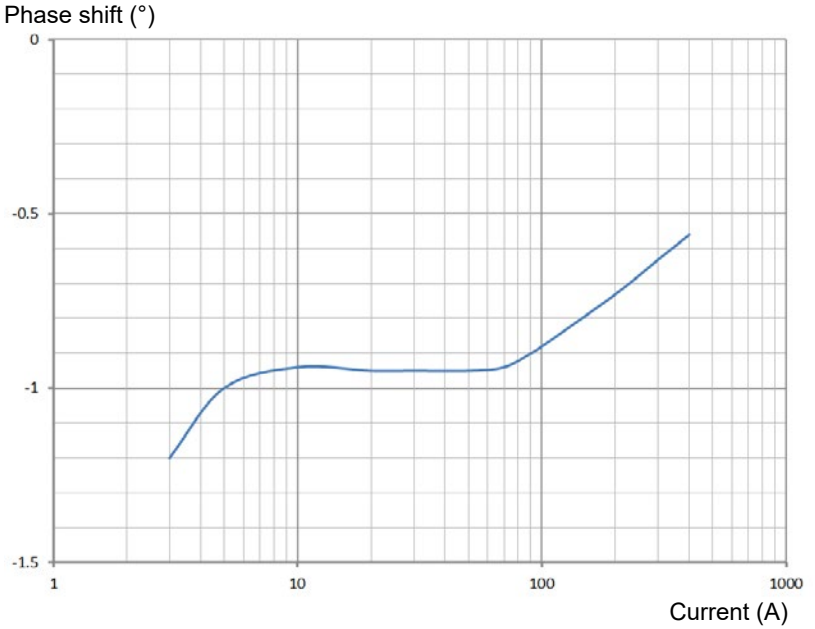


Typical phase error curve at 60 Hz

MR417



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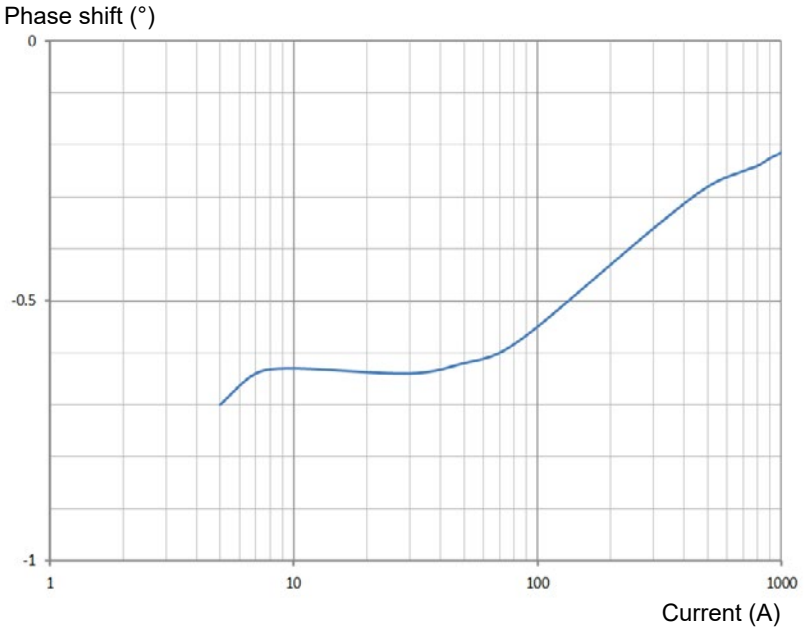


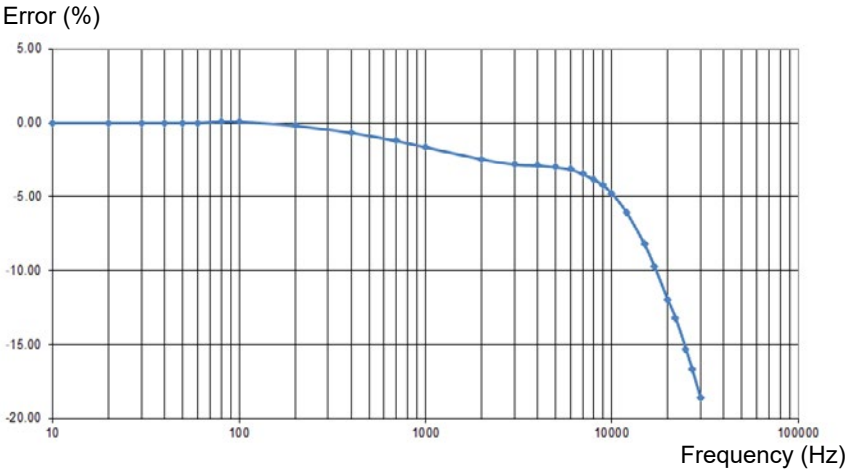
4.2.2 Frequency Specifications, 1 mV/A Sensitivity

Bandwidth -3 db: DC to 30 kHz

Frequency	50 Hz	400 Hz	1 kHz	10 kHz
Insertion impedance	<0.01 mΩ	MR417: 0.01 mΩ MR527: 0.05 mΩ	MR417: 0.12 mΩ MR527: 0.14 mΩ	MR417: 2.8 mΩ MR527: 3.4 mΩ

Typical amplitude error versus frequency curve at 60 A

MR417



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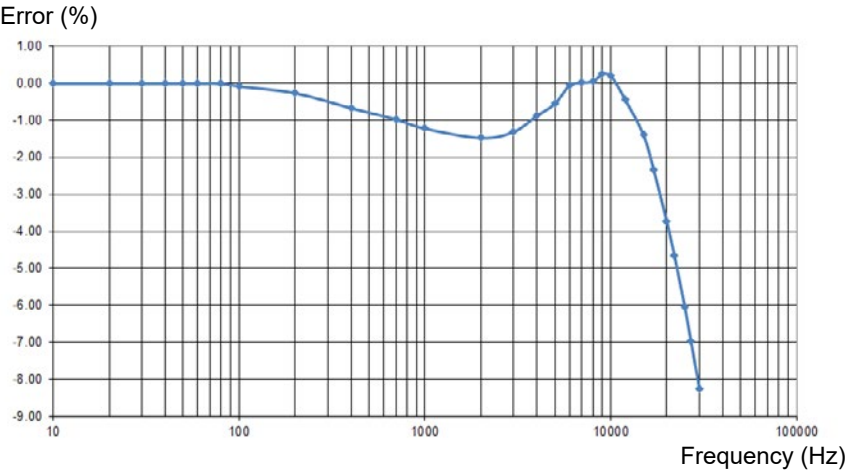
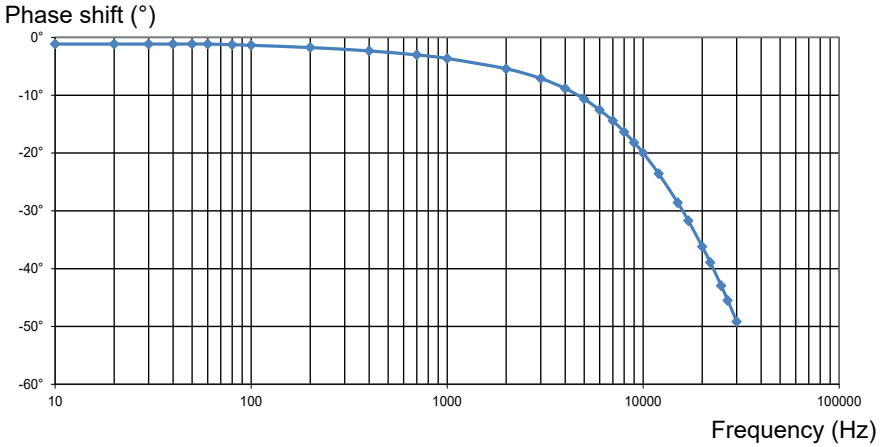


Typical phase versus frequency error curve at 60 A

MR417



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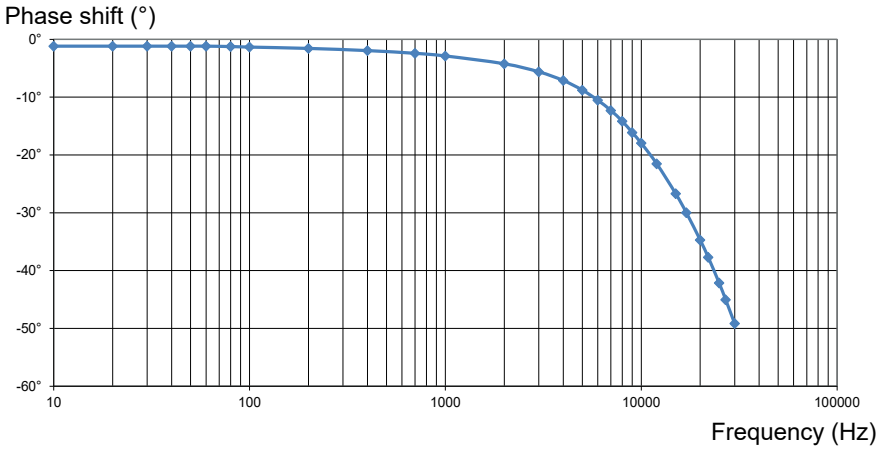
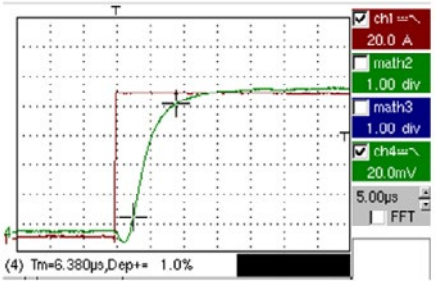
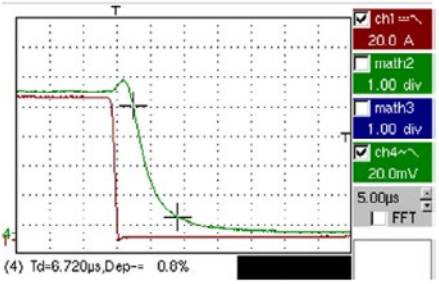


Pulse Response (MR417 and MR527)
Rise time from (10 to 90) %: ≤ 11 µs
Fall time from (90 to 10) %: ≤ 11 µs
AC noise on output: ≤ 1 mV or 1 $A_{peak\text{-}to\text{-}peak}$
Delay time at 10 %: ≤ 10 µs





4.2.3 Electrical Specifications, 10 mV/A Sensitivity

Output impedance: 215 Ω

MR417

Specified measurement range	(0.5 to 30) AAC/DC	(30 to 40) AAC/DC	(40 to 60) ADC
Intrinsic uncertainty	≤ ± (3 % R + 8 mV)	≤± 1.5 % R	≤± 1.5 % R

MR527

Specified measurement range	(0.5 to 40) AAC/DC	(40 to 100) AAC/DC	(100 to 140) ADC
Intrinsic uncertainty	≤ ± (3 % R + 8 mV)	≤± 1.5 % R	≤± 1.5 % R

Phase error (45 to 65) Hz

MR417

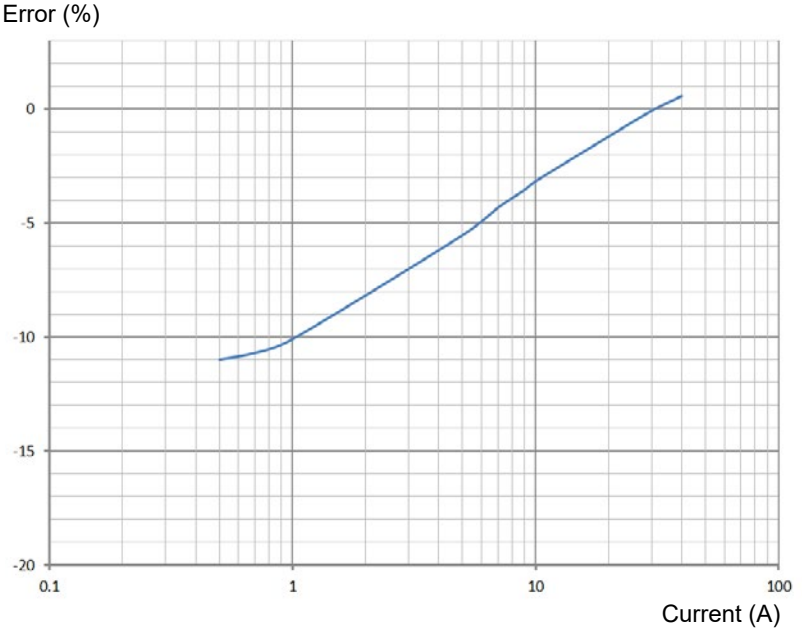
Specified measurement range	(1 to 20) AAC	(20 to 40) AAC
Phase shift	≤ -3 °	≤ -2.2 °

MR527

Specified measurement range	(1 to 100) AAC
Phase shift	≤ -2 °

Typical amplitude error vs current curve at 60 Hz

MR417



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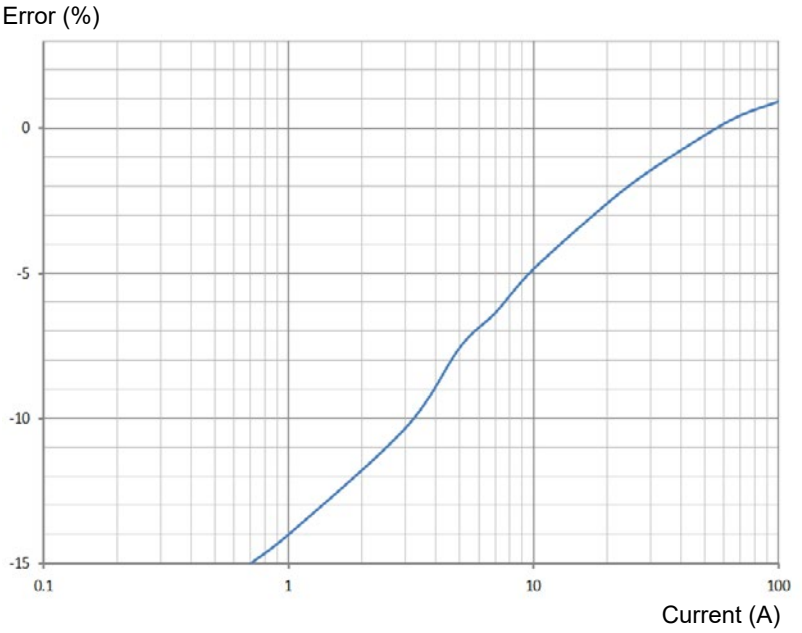
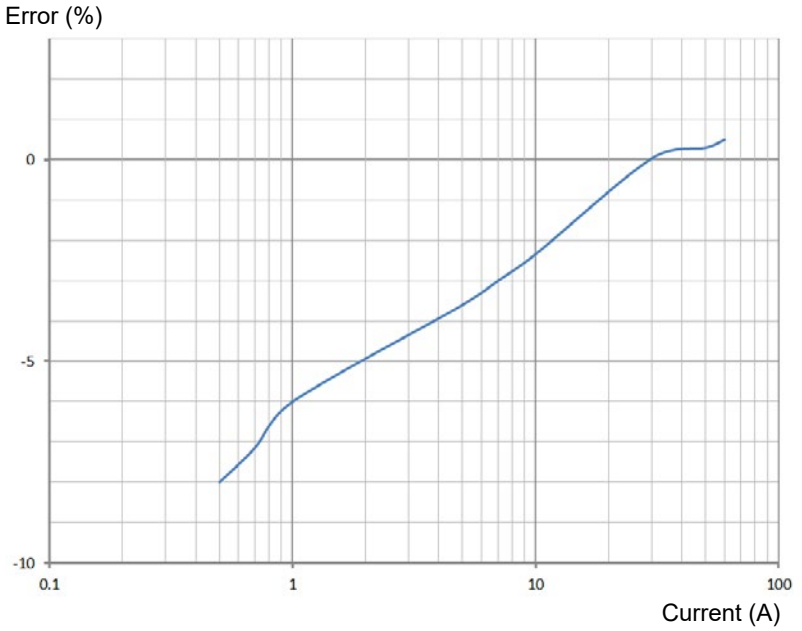


Typical amplitude error vs current curve in DC

MR417



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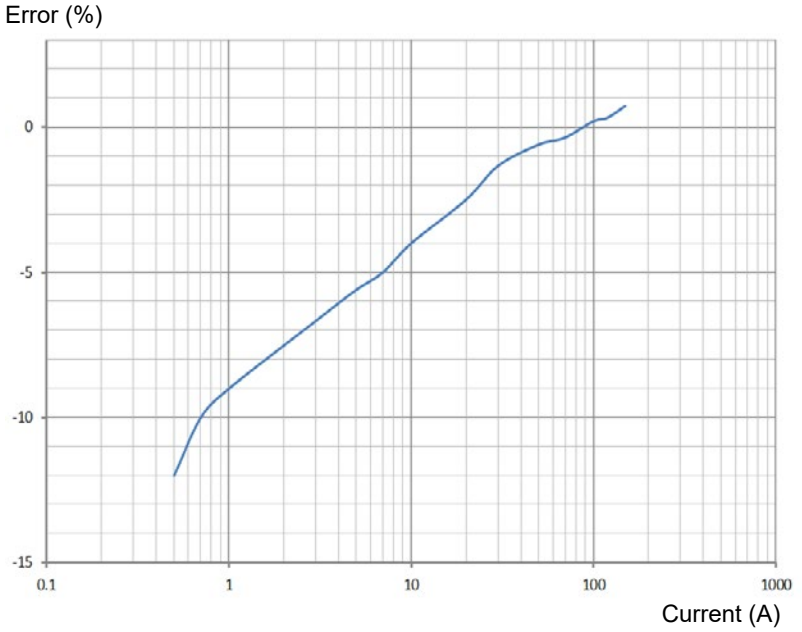
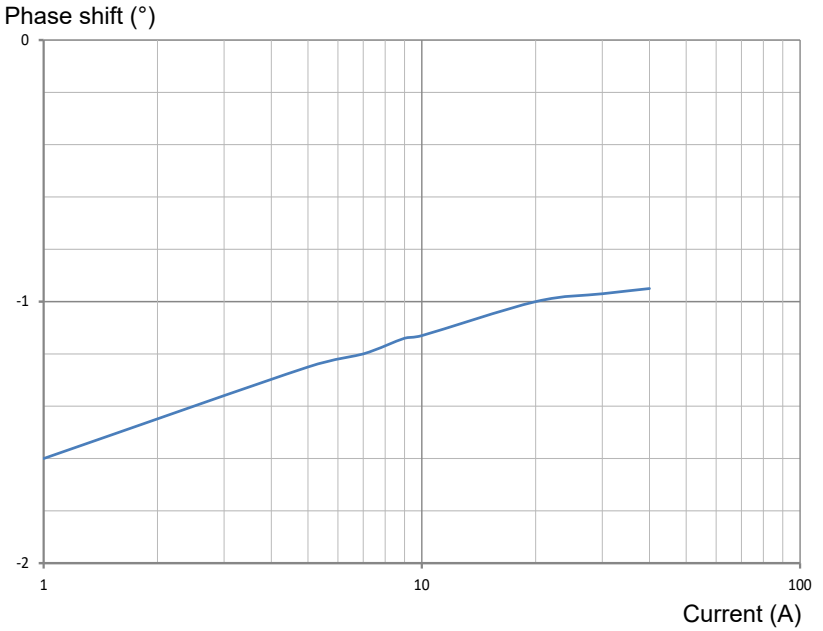


Typical phase vs current error curve at 60 Hz

MR417



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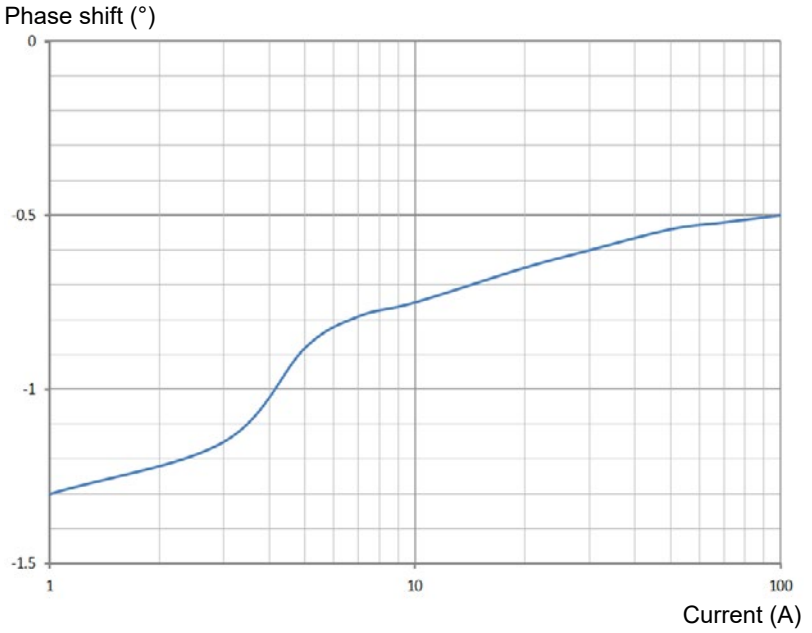


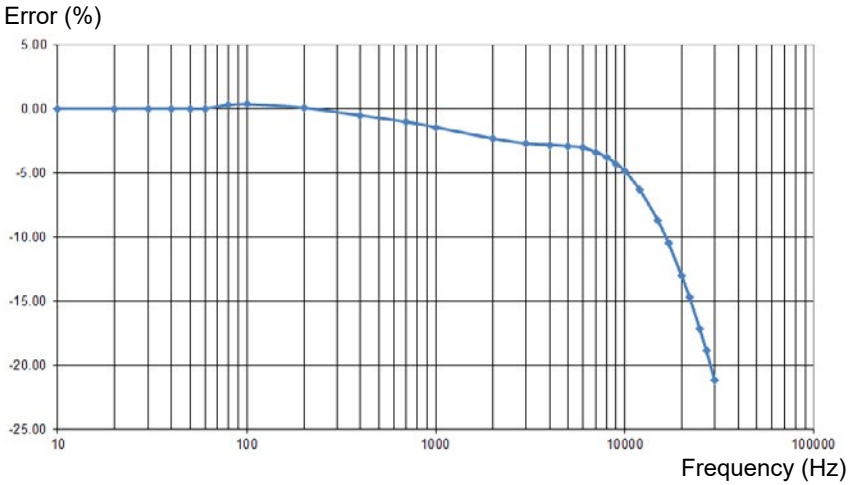
4.2.4 Frequency Specifications, 10 mV/A Sensitivity

Bandwidth -3 dB: DC to 30 kHz

Frequency	50 Hz	400 Hz	1 kHz	10 kHz
Insertion impedence	<0.01 mΩ	MR417: 0.01 mΩ MR527: 0.05 mΩ	MR417: 0.12 mΩ MR527: 0.14 mΩ	MR417: 2.8 mΩ MR527: 3.4 mΩ

Typical amplitude error versus frequency curve at 30 A

MR417



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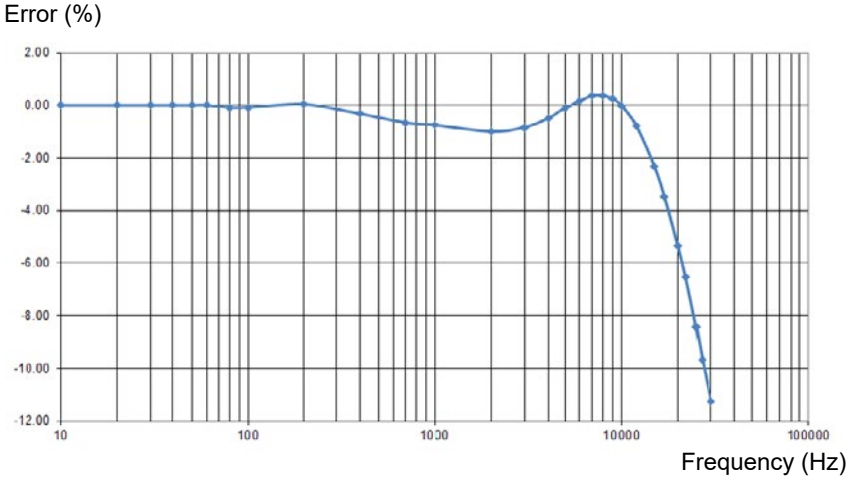
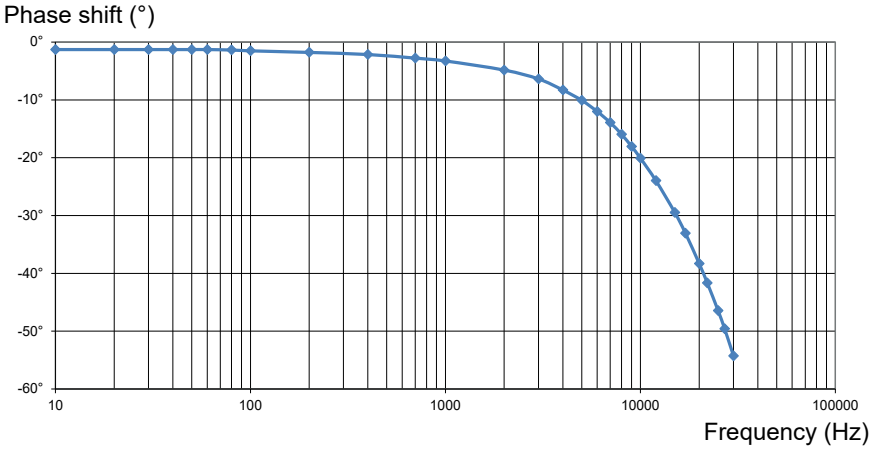
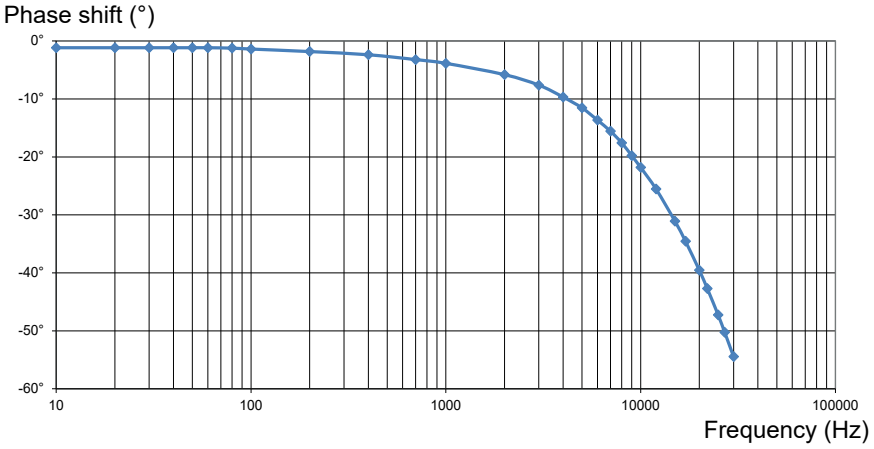


Typical phase versus frequency error curve at 100 A

MR417

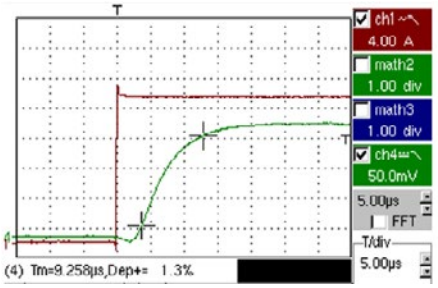


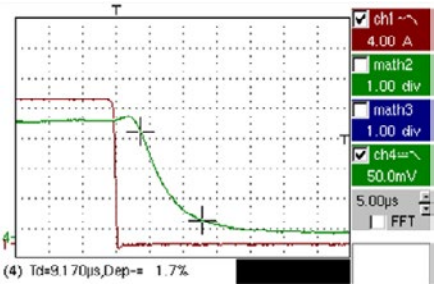
MR527



Pulse Response (MR417 and MR527)
Rise time from (10 to 90) %: ≤ 11 µs
Fall time (from 90 to 10) %: ≤ 11 µs
AC noise on output: ≤ 3 mV or 0.3 A
Delay time at 10 %: ≤ 10 µs

Square wave response curves

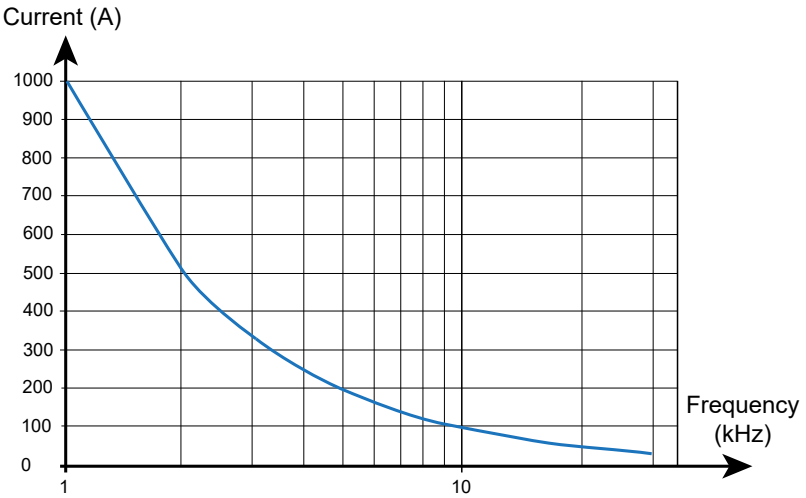




4.3 OPERATING LIMITS (MR417 AND MR527)

- In DC: 3000 A permanent
- In AC: 1000 A permanent up to 1 kHz
- from 1 kHz, IMAX = 1000/f (kHz)
- Conductor temperature: ≤ 194 °F (90 °C), 230 °F (110 °C) peak
- Temperature of the jaws: ≤ 176 °F (80 °C)

Curve of derating vs frequency



4.4 VARIATIONS IN THE RANGE OF USE

Quantity of influence	Range of influence	Error in % of reading	
		Typical	Maximum
Temperature	(14 to 131) °F (-10 to +55) °C		Drift of the zero ± 100 mA/°C Drift of the gain 3 %
Relative humidity	(10 to 85) % RH		0.5 %
Frequency	(10 to 400) Hz 400 Hz to 7 kHz (7 to 30) kHz		1 % 3.5 % see curves
Position of the conductor 0.79 in (20 mm) in diameter			0.5 %
Adjacent conductor carrying a 50 Hz AC current	Conductor 0.91 in (23 mm) from the clamp		10 mA/A
External 400 A/m field at 50 Hz	Cable centered		1.3 A
Common mode rejection	600 V between jacket and secondary		90 dB A/V at 50 Hz
Remanence		**MR417:** 50 ADC: 1.2 A 100 ADC: 2.3 A 200 ADC: 3.4 A 400 ADC: 4.8 A 600 ADC: 5.5 A 800 ADC: 5.8 A **MR527:** 100 ADC: 2.8 A 200 ADC: 3.5 A 400 ADC: 5 A 800 ADC: 5.3 A 1200 ADC: 5.7 A 1400 ADC: 5.8 A	

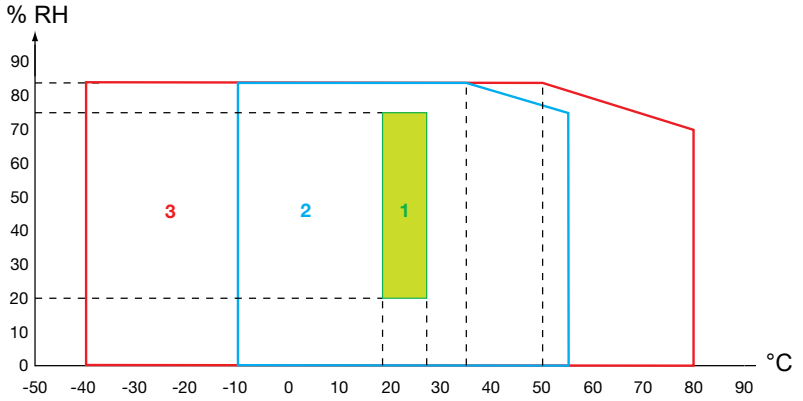
4.5 POWER SUPPLY

The instrument is powered by a 9 V battery (type 6LR61, 6LF22, or NEDA 1604). The average battery life is 50 hours with an alkaline battery.

The instrument can also be powered by an external supply (5 VDC, 100 mA) via the type B micro-USB connector.

4.6 ENVIRONMENTAL CONDITIONS

The instrument must be used in the following environmental conditions.



1 = Range of reference

2 = Operating range

3 = Storage range

Indoor use

Degree of pollution: 2

Altitude: < 6500 ft (2000 m)

Transport altitude: ≤ 40,000 ft (12,000 m)

4.7 MECHANICAL SPECIFICATIONS

MR417

Dimensions (L x W x H): (8.8 x 3.8 x 1.7) in (224 x 97 x 44) mm

Weight: approximately 15.5 oz (440 g)

Cable: 6.6 ft (2 m)

Maximum Conductor Size:

Cables: One 1.18 in (30 mm) or two 0.94 in (24 mm)

Bus Bar: One 1.97 x 0.39 in (50 x 10 mm) or two 1.23 x 0.39 in (31.5 x 10 mm) or three 0.98 x 0.31 in (25 x 8 mm)

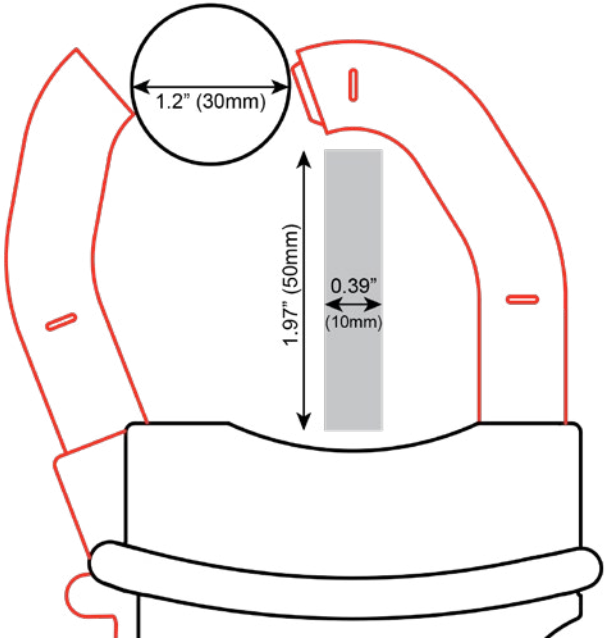


Figure 5

MR527

Dimensions (L x W x H): (9.3 x 3.8 x 1.7) in (237 x 97 x 44) mm

Weight: approximately 18.3 oz (520 g)

Cable: 6.6 ft (2 m)

Maximum Conductor Size:

Cables: One 1.5 in (39 mm) or two 1 in (25.4 mm)

Bus Bar: One 1.97 x 0.49 in (50 x 12.5 mm) or two 0.98 x 0.2 in (25 x 5 mm); 1.24 x 0.30 in (31.5 x 10 mm) or three 0.98 x 0.31 in (25 x 8 mm)

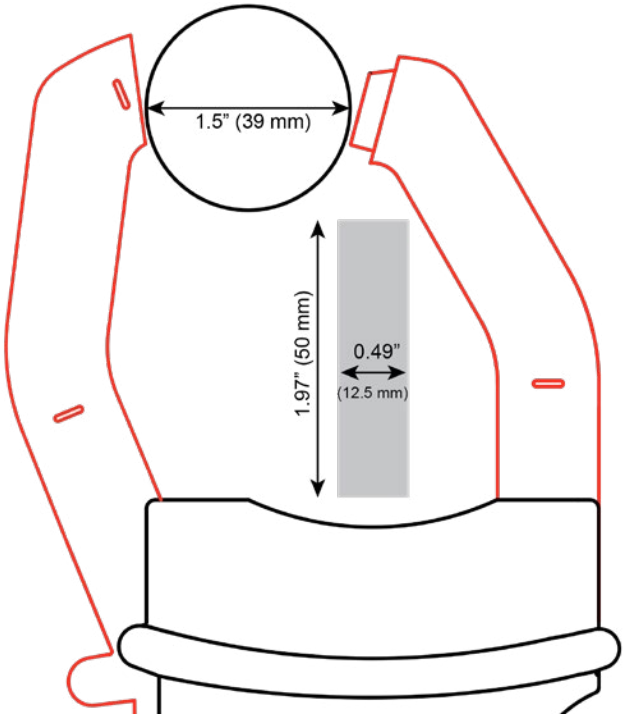


Figure 6

4.7.1 Housing Protection

Protection index:

- IP 40 per IEC 60529
- IK 06 per IEC 62262

Drop test per IEC/EN 61010-2-032 or BS EN 61010-2-032.

4.8 SAFETY SPECIFICATIONS

Electrical Conformity to International Standards:

This instrument is compliant with IEC/EN 61010-2-032 or BS EN 61010-2-032, 300 V Category IV and 600 V Category III.

Double or reinforced insulation  .

Type of current sensor per IEC/EN 61010-2-032 or BS EN 61010-2-032: type A  .

Electromagnetic Compatibility:

The device is in conformity with standard IEC/EN 61326-1 or BS EN 61326-1.

5. MAINTENANCE

WARNING: 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.

5.1 CLEANING

- Disconnect the instrument completely.
- 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.
- Keep the clamp jaws as clean as possible.

5.2 BATTERY REPLACEMENT

The battery must be replaced if the **ON** indicator remains unlit when the instrument is turned **ON**.

1. Disconnect the instrument completely and set the switch to **OFF**.
2. Remove the battery compartment cover from the instrument casing (see § 3.1).
3. Remove the old battery.
4. Insert the replacement battery into the snap-in battery connector and place it into the battery compartment.
5. Replace the battery compartment cover.

NOTE: Depleted batteries must not be treated as ordinary household waste. Take them to the appropriate collection point for recycling.

5.3 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.

For instrument repair and calibration:

You must contact our Service Center for a Customer Service Authorization Number (CSA#). Send an email to repair@aemc.com requesting a CSA#, you will be provided a CSA Form and other required paperwork along with the next steps to complete the request. Then return the instrument along with the signed CSA Form. This will ensure that when your instrument arrives, it will be tracked and processed promptly. Please write the CSA# on the outside of the shipping container. If the instrument is returned for calibration, we need to know if you want a standard calibration or a calibration traceable to N.I.S.T. (includes calibration certificate plus recorded calibration data).

Ship To: Chauvin Arnoux®, Inc. d.b.a. AEMC® Instruments
15 Faraday Drive ▪ Dover, NH 03820 USA
Phone: (800) 945-2362 (Ext. 360) / (603) 749-6434 (Ext. 360)
Fax: (603) 742-2346
E-mail: repair@aemc.com

(Or contact your authorized distributor.)

Contact us for the costs for repair, standard calibration, and calibration traceable to N.I.S.T.

NOTE: You must obtain a CSA# before returning any instrument.

5.4 TECHNICAL AND SALES 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:

Chauvin Arnoux®, Inc. d.b.a. AEMC® Instruments
Phone: (800) 343-1391 (Ext. 351)
Fax: (603) 742-2346
E-mail: techsupport@aemc.com
www.aemc.com

5.5 LIMITED WARRANTY

The instrument is warrantied to the owner for a period of two years from the date of original purchase against defects in manufacture. 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.

Full warranty coverage and product registration is available on our website at www.aemc.com/warranty.html

Please print the online Warranty Coverage Information for your records.

What AEMC® Instruments will do:

If a malfunction occurs within the warranty period, you may return the instrument to us for repair, provided we have your warranty registration information on file or a proof of purchase. AEMC® Instruments will repair or replace the faulty material at our discretion.

REGISTER ONLINE AT: www.aemc.com/warranty.html

5.5.1 Warranty Repairs

What you must do to return an Instrument for Warranty Repair:

First, send an email to repair@aemc.com requesting a Customer Service Authorization Number (CSA#) from our Service Department. You will be provided a CSA Form and other required paperwork along with the next steps to complete the request. Then return the instrument along with the signed CSA Form. Please write the CSA# on the outside of the shipping container. Return the instrument, postage or shipment pre-paid to:

Chauvin Arnoux®, Inc. d.b.a. AEMC® Instruments
15 Faraday Drive, Dover, NH 03820 USA
Phone: (800) 945-2362 (Ext. 360) / (603) 749-6434 (Ext. 360)
Fax: (603) 742-2346
E-mail: repair@aemc.com

Caution: To protect yourself against in-transit loss, we recommend that you insure your returned material.

NOTE: You must obtain a CSA# before returning any instrument.

NOTES:

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