

EN - User's manual

MH 60



Clamp for oscilloscope

 **海洋儀器**

致力于电子测试、维护领域！

Measure up



ENGLISH

Thank you for purchasing this **oscilloscope clamp MH 60**.

For best results from your instrument:

- **read** these operating instructions carefully,
- **comply** with the precautions for use.



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



Equipment protected by double insulation.



Chauvin Arnoux has adopted an Eco-Design approach in designing this appliance. Analysis of the complete lifecycle has enabled us to control and optimize the effects of the product on the environment. In particular, this appliance exceeds regulation requirements with respect to recycling and reuse.



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



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 2012/19/EU. This equipment must not be treated as household waste.



Earth terminal.




Application or withdrawal authorized on bare conductors carrying dangerous voltages. Type A current sensor as per IEC 61010-2-032.







Device for DC and AC.

PRECAUTIONS FOR USE

- Do not expose the clamp to running water or spattering.
 - Do not use the clamp on uninsulated conductors at a potential exceeding 600 V with respect to earth.
 - Do not use the clamp on conductors of which the temperature > 90°C.
 - For DC measurements, make sure of the zero of the output. Adjust it if necessary.
 - During the measurement, make sure that the conductor is correctly aligned with the marks on the jaws and the clamp is correctly closed.
-  If the conductors are not insulated, it may be necessary to wear PPE (Personal Protective Equipment).
- The MH 60 oscilloscope clamp includes a NiMH storage battery that must be recharged before any prolonged storage.

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1. INTRODUCTION

1.1. PRESENTATION

The clamp is an oscilloscope current probe using a Hall effect cell, allowing the measurement of direct or alternating currents up to 100 Arms without intervention on the electrical installation (cutting off of the current to be measured). It is a transducer delivering a voltage output.

This ammeter clamp, with a round core and air gap, allows rapid measurements of current in conductors; the measurement output is completely insulated from the conductor. Its user-friendly shape and small size are especially well suited to this type of measurement. Its measurement sensitivity, its metrological performance, and its very good frequency response qualify it as an oscilloscope accessory. The connection is made by a BNC coaxial cable. The clamp is powered by an internal storage battery and by a standard type B 5 V μ USB connector.

1.2. SAFETY



Never make measurements on uninsulated conductors at potentials exceeding 600 V with respect to earth.

This clamp is protected by double insulation or reinforced insulation. It does not need to be connected to a protective earth to ensure electrical safety. The USB power connector is isolated from the measurement output, preventing any hazardous potential from the BNC connector.

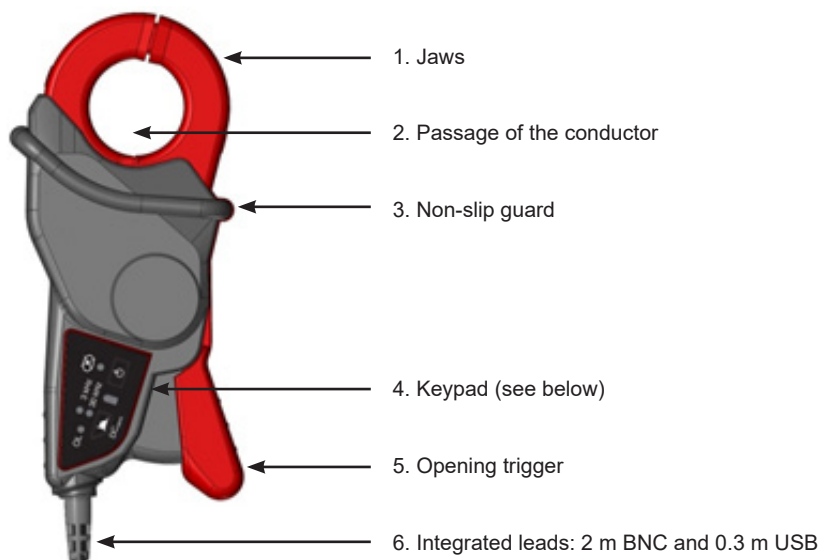
It is designed for indoor use, altitude ≤ 2000 m, in an environment of degree of pollution 2.

It can be used for measurements on CAT II installations up to 600 V and CAT III installations up to 300 V and complies with international standards IEC 61010-1 and IEC 61010-2-032.

Do not use it on conductors carrying currents at high frequency, greater than 4 Arms @ 1 MHz \rightarrow risk of burns and of deformation of the jaws of the clamp.

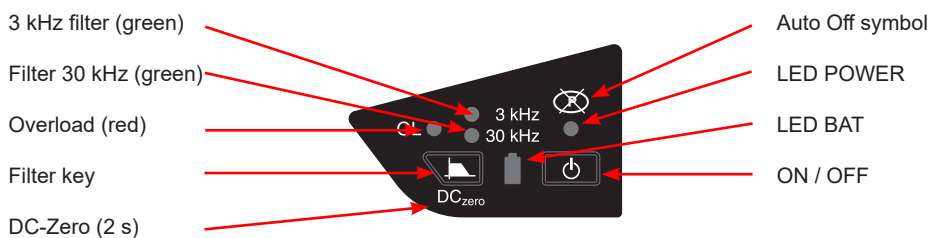
The protection provided by this clamp may be impaired if it is used other than as specified.

2. DESCRIPTION






3. FUNCTIONS OF THE KEYS AND OF THE LEDS

This keypad is item 4 in the figure above:





3.1. FUNCTIONS OF THE KEY


3.1.1. SWITCHING ON

Long-press the  key. The clamp **MH 60** acknowledges with the LED  LED. Then release . The «ON» state of the MH 60 clamp is indicated by the sequential lighting of the «BAT» LED.

3.1.2. SWITCHING OFF



Long-press the  key (2 s). The **MH 60** clamp acknowledges the long press by the rapid blinking of the  LED, then all of the LEDs. When the key is released, the **MH 60** clamp switches off.

3.1.3. DEACTIVATE / ACTIVATE AUTO OFF

Reminder: Each time the device is switched on (by pressing ), AUTO OFF is active.

If operation is interrupted because the storage battery charge is too low, the current state of the AUTO OFF function is stored, then restored when the power supply is restored.



Start from the following state: the **MH 60** clamp is «ON».

Hold the  key down and press .

Keep it pressed (approx. 2 s) until acknowledged, then rapid blinking of the  LED.

Release the  and  keys.

The  LED stop blinking → The AUTO OFF function is deactivated.


To reactivate , proceed in the same way or switch On/Off using .

Remarks: The «AUTO OFF» timer is reset whenever one of the keys is pressed.

The Auto Power Off hold-off time is approximately 10 mn.

3.2. FUNCTIONS OF THE FILTER KEY


3.2.1. CHANGE THE FILTER



A short press on the  key changes the filter. Depending on the filter chosen, it is the 3 kHz LED or the 30 kHz LED that lights (green LED). If both LEDs are off, it means that there is no filter.

 **The state of the filter is stored. It is restored at each power up.**

3.2.2. ADJUST DC-ZERO

The clamp must not be on a conductor, the jaws must be closed.

Long-press the  key (approx. 2 s). The DC-Zero function is then activated.

During the process, the  LED is lit. At the end of the process, if there is no ERR, the  LED goes off. Otherwise, it remains lit.

 **The ERR status is generally caused by the flow of a current in a conductor in a clamp.**

The **MH 60** clamp includes a magnetometer that reduces the influence of external fields, notably the Earth's field.

Example: I adjust the zero with the plane of the horizontal: to "clamp", I turn my clamp to the vertical. Thanks to the magnetometer, my zero is preserved.


3.3. INDICATION OF THE LED

3.3.1. OVER LIMIT

The  LED is lit when the measurement current exceeds $110 \text{ Arms} \pm 3 \%$.

 **This function does not take the frequency derating into account.**

3.3.2. FAILURE OF THE DC ZERO

The  LED remains lit following failure of the DC zero adjustment.

3.4. INDICATIONS OF THE BAT LED


3.4.1. CHARGE STATE, NUMBER OF BLINKS OF THE LED

When the clamp is in operation, the LED of the power supply flashes sequentially according to the charge level of the storage battery:

If the remaining life is 2 h, the LED blinks once every 3 s.


For 2 additional hours, it flashes one more time.


E.g.: If the LED flashes 5 times every 3 s, the remaining life of the storage battery is 7 to 8 h.

At the end of discharging, when the last 2 hours have been consumed, the  LED scintillates permanently, until a complete shutdown occurs automatically.

3.4.2. OPERATION WITH THE USB SUPPLY

- The clamp is «OFF». Connect the USB.

The storage battery charges → blinking every second; at the end of charging, this  LED remains lit.

- The clamp is «ON». Connect the USB, the storage battery is in permanent trickle charging → the  LED is lit permanently.

4. POWER SUPPLY

The clamp is powered either from the internal storage battery or from an external 5 VDC supply connected to the Type B μ USB connector.

- Power supply: from the internal storage battery
- Life between charges: from 7 to 8 hours of non-stop operation
- Type: 1 1.2 V NiMH AAA cell with soldered lug, connected by connector
- Life: 2 years minimum
- Nr. or recharging cycles: ≥ 300

This type of storage battery can be procured from CHAUVIN ARNOUX

- Power supply: from the type B μ USB connector
- Max. consumption (with storage battery charging): < 170 mA

4.1. RECHARGING OF THE INTERNAL STORAGE BATTERY

- The internal storage battery can be recharged in the presence of an external power source, with the clamp off. A complete charging cycle lasts approximately 10 hours
- If the clamp is in operation, only a trickle charge is applied, so the storage battery keeps its charge, but it is not recharged in this case.

4.2. CABLES

- Output: BNC coaxial cable 2 m long
- Power supply: the power supply cable, 30 cm long, has a female Type B μ USB connector.

5. OPERATING

5.1. PRECAUTIONS

- Do not exceed the voltage of 300 V (CAT III) or 600 V (CAT II) with respect to earth with an uninsulated conductor.
- Use the clamp on conductors in which the current is less than or equal to the maximum continuous value allowed, namely 100 Arms or 140 A peak.
- Do not expose the clamp to running water or spattering.
- Keep your hand and fingers behind the guard.
- If the housing of the product is cracked or broken, and/or the front panel with the buttons separates, there is a risk of electrocution; make sure that the product is not used in that condition, and replace it or have it repaired.

5.2. USE

- Adjust the DC-Zero.
- Press the trigger to open the jaws of the clamp, then place the clamp on the conductor with the current in the right direction (source P1 towards the back of the arrow, receiver P2 towards the tip of the arrow).
- Close the clamp. Make sure that it is correctly closed and centred on the conductor, in order to obtain optimum measurement accuracy.
- The pass band can be modified on demand:
1 MHz, 30 MHz, 3 kHz.

5.3. MAINTENANCE

Before any maintenance work is done, the clamp must not enclose a conductor; it must also be disconnected from the external instrument to which it is connected.

- **Maintenance of the magnetic circuit**
Keep the air gaps of the clamp perfectly clean.
Wipe them, if necessary, with a soft cloth.
- **Maintenance of the housing**
Clean the clamp with a cloth moistened with soapy water and rinse with a cloth moistened with clear water. Never run water on the clamp.
Dry using a dry cloth or forced air (max. temperature + 70°C).
- **Check of the calibration**
Annual verification of the measurement characteristics by an approved organization.

6. TECHNICAL CHARACTERISTICS

6.1. REFERENCE CONDITIONS

Quantity of influence	Reference conditions
Starting up before measurement	1 mn
Ambient temperature	23°C ± 5 K
Humidity	20 % to 75 % RH
Frequency	from DC to 400 Hz
Position of the conductor	centred in the jaws
External AC magnetic field	no field
External DC magnetic field	< 40 A/m (Earth's field)
Impedance of the measuring instrument	1 MΩ and C < 100 pF

6.2. CHARACTERISTICS

Parameter	Value		
Nominal range	100 ADC (or 100 AAC)		
Output/input ratio	10 mV/A		
Resolution	10 mA		
Error in % measurement	0.5 to 64 Arms ± 1.5 % ± 0.1 mV ¹	64 to 90 Arms ± 4 %	90 to 100 Arms ± 5 %
Phase error at 50 Hz and without filtering	± 1°		

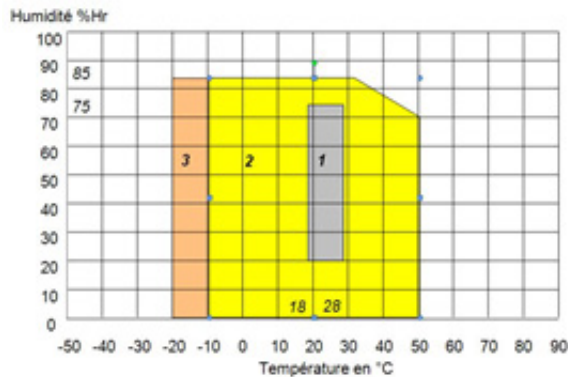
(1) concerning the residual offset

Pass band according to filter chosen	1 MHz @ - 3 dB	30 kHz @ - 3 dB	3 kHz @ - 3 dB
Noise at output, mArms	15	5	4
Rise time from 10 to 90 %	350 ns	11.7 μs	117 μs
di/dt	5 A/μs at 2 A peak/peak	150 A/ms	15 A/ms

Output voltage for $I_p = 0$ after compensation of the zero	≤ ± 0.5 mVDC or ≤ ± 50 mADC
Range of zero or counter-current compensation	± 6 ADC approximately
Insertion impedance	0.25 mΩ (at 400 Hz) or in RF: 0.1 μH for a primary transition

6.3. NOMINAL RANGE OF USE

6.3.1. ENVIRONMENTAL CONDITIONS

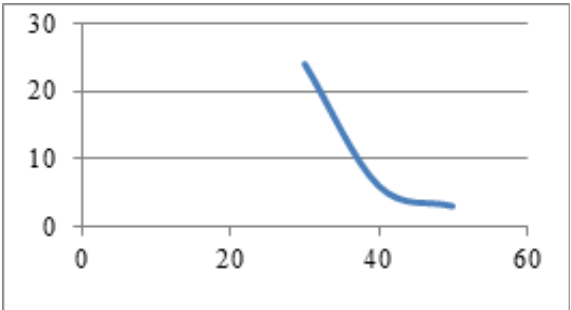


- 1 = Reference range
2 = Operating range
3 = Storage range

⚠ The storage range is reduced by the presence of a storage battery. At high temperatures, the self-discharge current is higher. It is a deep discharge that causes deterioration of the storage battery. It is therefore necessary to completely pre-charge the storage battery prior to prolonged exposure to high temperatures. Recharge if the exposure to 50°C lasts more than 3 months (6 months at 40°C, 24 months at 30°C.

Below, foreseeable storage durations, storage battery fully charged:

Life versus storage temperature, storage battery fully charged.



40°C to 50°C	3 months
30°C to 40°C	6 months
-20°C to 30°C	24 months

- | | |
|--------------------------------|--|
| - Tightness with clamp closed: | IP 40 with clamp jaws closed, per EN 60529 |
| - Transport altitude: | ≤ 1200 m |
| - Use: | indoor |
| - Temp. on BNC output cable: | 90°C max. |
| - Temp. on housing and jaws: | 90°C max. |

6.3.2. ELECTROMAGNETIC COMPATIBILITY AND SUSCEPTIBILITY

Compliant with IEC 61326-1 for emissions and immunity in industrial use.

6.3.3. PROTECTION FROM ELECTRIC SHOCKS

Type A clamp with double insulation or reinforced insulation in the grip part in normal use, and double insulation or reinforced insulation between the primary and the secondary output and the terminations part of the USB power supply and the BNC output.

Maximum service voltage per EN 61010-2-032

- 300 V in installations of category III and degree of pollution 2.

- 600 V in installations of category II and degree of pollution 2.

6.3.4. VARIATIONS IN THE NOMINAL OF THE USE

Quauntity of influence	Influence	Typical	Maximum
USB supply voltage	5 VDC \pm 5 % or storage battery voltage between 20 % and 100 % charge	0	none
Relative humidity	10 % at 90 % RH		0.1 % of Is
Temperature on measurement	-10 °C at +45°C	\pm 0.12 %/°C	
	45°C at +50°C	\pm 0.22 %/°C	
Setting time	upon start of operation	10 s	
Pass band (without filter)	DC to 1 kHz		1 %
	to 100 kHz	-0.2 dB	-0.5 dB
	to 500 kHz	-0.5 dB	- 1 dB
	to 1 MHz	-1.5 dB	-3 dB
Position of the cable	DC to 100 Hz		\pm 1.5 %
Repeatability of the measurement	10 open./clos.	mean Δ : 0.3 %	
Common mode rejection	50 Hz		> 90 dB or 0.003 %
	400 Hz		> 80 dN or 0.01 %
Rejection of an external current at 50 Hz ¹	near air gap	30 dB	
	jaws	34 dB	
	grip	40 dB	
External magnetic field (spatial position) ²	DC (Earth's)	\pm 0.3 mV or \pm 30 mA	\pm 1 mV or \pm 100 mA
High-frequency electromagnetic field, 10 V/m between 650 MHz and 750 MHz	value of the current	1.2 A	1.5 A max.

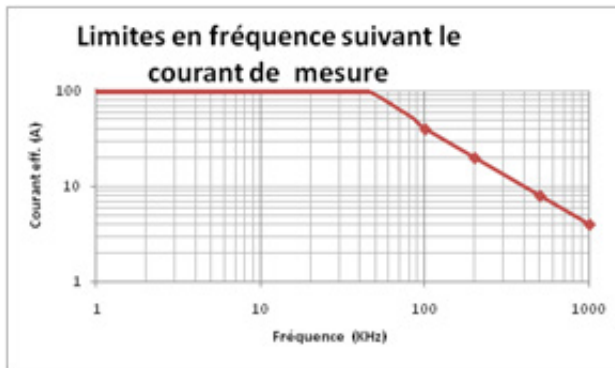
(1) Conductor outside the jaws and parallel to the position of a conductor in the jaws.

(2) Measurement made after demagnetization of the clamp. For this purpose, set to AC, I = 0, gradually increase the value to I = 40 A. Gradually reduce the value to I = 0.

6.4. EXTREME CONDITIONS

- Overload: 1500 ADC for 1 mn.

6.5. FREQUENCY LIMITS DEPENDING ON THE MEASUREMENT CURRENT



In normal use, 100 Arms permanent up to the frequency of 45 kHz.

Derating at frequency above 100 A, 45 kHz.

Per the formula: $100A \times \frac{1}{F / 45}$ (F in kHz)

7. MECHANICAL CHARACTERISTICS

Type	Part concerned	Characteristics	Note
Clamp	dimensions	138 x 49 x 28 mm	overall
	mass	200 g approx.	with cable and storage battery
Self-extinguishing	housing	V1 (UL94)	BNC and USB
	jaws	V0 (UL94)	
	cables	V0 (UL94)	
Jaws and trigger	maximum opening	27 mm	colour red
	clamping of cable	1 cable Ø 26 mm max. temperature: 90°C	
Cables	type	1 ready-made BNC coaxial	
BNC cable	length diameter	2 m Ø 4 mm approx.	
	tensile strength	100 N	
	Flexions	30000	at the housing
	connection of the connector	5000	connections/ disconnections
USB cable	type	female µUSB cable	
	length diameter	30 cm Ø 4 mm approx.	
Power supply connector	type	female µUSB 5 VDC	
Measurement connector	type	Insulated male BNC	
Height of fall	clamp	1 m	NF EN 60068-2-32
Protection against impacts	Housing and jaws	IK 04 0.5 J	EN 50102

7.1. REPLACING THE STORAGE BATTERY

- Procure the replacement storage battery (ref. P01296049).
- Disconnect the USB charger and remove the clamp from any circuit.
- Withdraw the two screws closing the housing.
- Identify the two-point storage battery connector and disconnect it.



- Lift the storage battery clear and unclip it.



- Refitting: proceed in the reverse order.

7.2. GAIN ADJUSTMENT PROCEDURE FOR THE MH 60



Make sure you are technically qualified to perform this operation.

Warning: Make this adjustment only if the gain coefficient is manifestly outside tolerances. Check first that nothing interferes with the movements of the jaws and that the air gap is clean. Make sure that the clamp is adequately charged. Disconnect the USB charger.

■ **Check of the gain:**

Equipment necessary: AC current calibrator accurate to 0.1 % capable of delivering least 3 A at 50/60 Hz, 10-turn coil, RMS AC multimeter accurate to better than 0.1 %, female BNC/male banana adapter, leads.

Step	Action
1	Switch the clamp on and clamp it centred on the coil. Connect the clamp to the multimeter using the adapter.
2	Optional: Demagnetize the clamp (0 ... 3 A ... 0 / 50 or 60 Hz) ² .
3	Adjust the DC-Zero with no current and do not subsequently move the clamp. The measurement must be < 0.1 mV DC.
4	Establish a current of 3 A ¹ 60 Hz in the coil.
5	Measure the output voltage with the multimeter set to AC rms and note this value.

- If $295.1 \text{ mV} \leq \text{Reading} \leq 304.9 \text{ mV} \rightarrow$ Do not adjust.
- Otherwise: adjust the gain.

■ **Adjusting the gain:**

Step	Action
1	Switch the clamp on and clamp it centred on the coil.
2	Optional: Demagnetize the clamp (0 ... 3 A ... 0 / 50 or 60 Hz) ² .
3	Adjust the DC-Zero with no current and do not subsequently move the clamp.
4	Press the DC-Zero key and the ON/OFF key for approx. 30 s, until all of indicators blink. At this point, there is no turning back: the procedure must be completed.
5	Release the keys. The BAT and ON/OFF LEDs blink.
6	Establish a current of ¹ 3 A 60 Hz in the coil.
7	Adjust the output by successive presses ³ on the DC-Zero key until you reach 300 mV $\pm 1.5 \text{ mV}$. Wait for the display to stabilize between presses.
8	Press the ON/OFF key 2 s (the ON/OFF LED blinks) to store the gain.
9	Gradually reduce the current from 3 A to zero.
10	Check the gain as before.

- (1) Gradually increase the current starting from zero.
(2) Gradually increase the current, starting from zero, up to 3 A, then gradually reduce it to zero.
(3) The increment is approximately 0.5 mV.

8. WARRANTY

Except as otherwise stated, our warranty is valid for **twelve months** starting from the date on which the equipment was sold. Extract from our General Conditions of Sale provided on request.

The warranty does not apply in the following cases:

- Inappropriate use of the 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 device by a person not approved by the manufacturer;
- Adaptation to a particular application not anticipated in the definition of the equipment or not indicated in the user's manual;
- Damage caused by shocks, falls, or floods.



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