MX 240 / MX 2040

Notice de fonctionnement
User's manual
Bedienungsanleitung
Manual de instrucciones

PINCE MULTIFONCTION
MULTIMETER CLAMP
ZANGENMULTIMETER
PINZA MULTIFUNCION

IM1137Q03

TEST EQUIPMENT RISK ASSESSMENT

Users of this equipment and or their employers are reminded that Health and Safety Legislation require them to carry out a valid risk assessment of all electrical work so as to identify potential sources of electrical danger and risk of electrical injury such as from inadvertent short circuits. Where the assessment show that the risk is significant then the use of fused test leads constructed in accordance with the HSE guidance note GS38 "Electrical Test Equipment for use by Electricians" should be used.

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Multimeter clamp

 **ENGLISH**

User's manual

CONTENTS

CONTENTS

1. General instructions

This apparatus conforms to safety standard IEC 1010, relating to electronic measuring instruments. For your own safety and that of the apparatus, you must follow the procedures described in this instruction manual.

1.1. Precautions and safety measures

1.1.1. Preliminary

- This apparatus has been designed for use in an environment of pollution degree 2.
  It can be used for measurements on installations of surge voltage category IV up to 600 volts and surge voltage category III up to 1 000 volts :
  - Overvoltage category III : fixed installation
  - Overvoltage category IV : equipment used at primary supply level
- You must comply with the usual safety regulations aimed at :
  protecting you against the dangers of electric currents,
  protecting the instrument against any incorrect operation.
- Only the leads supplied with the instrument guarantee compliance with the safety standards. They must be in good condition and they must be replaced, if necessary, with an identical model.

1.1.2. During use

Read the recommendations which follow and the instructions in this manual :

➤ Prior to connecting the test probes to the installation, check that the function selector is positioned on the required measurement.

➤ Prior to changing function, disconnect the measuring leads from the measured circuit.

➤ When the apparatus is connected to the measuring circuits, never touch an unused terminal.

➤ Never exceed the limit protection values indicated in the specifications particular to each type of measurement.

➤ Never conduct resistance measurements on a live circuit.

➤ Once the measurements are completed, turn the rotary switch to OFF.

➤ If the instrument is not to be used for a long period, remove the battery.

➤ Read carefully all the notes preceded by the symbol ⚠.

Non-compliance with the warnings and/or the instructions for use may damage the apparatus and/or its components.

1. General instructions (continued)

1.1.3. Symbols

The following symbols are used :

Caution : Refer to the instruction manual. Incorrect use may damage the apparatus or its components.

Danger high voltage : risk of electric shock.

Protective earth terminal

1.1.4. Safety instructions

Before opening the apparatus, it is imperative to disconnect it from any source of electric current.

Some internal capacitors may retain hazardous charges, even after having switched off the apparatus. Any adjustment, maintenance or repair to the instrument when live must only be carried out by qualified personnel.

In case of faults or abnormal constraints, switch off the apparatus and prevent it from being used until it has been checked.

1.2. Safety devices

- It is impossible to gain access to the battery compartment without having first of all disconnected the measuring leads.
- At the time of measuring voltages in excess of 24 V, the letter symbol ⚠ signals on the display and the AUTO OFF of the instrument is inhibited.
- At the time of exceeding a range, an intermittent audible signal indicates the risk of electric shock.

1.3. Warranty

This equipment is guaranteed against any material fault or manufacturer's defect, in accordance with the general conditions of sale. During the warranty period, faulty parts may be replaced, with the manufacturer reserving the right to decide either to repair or replace the product. In the event of returning the equipment to the after-sales service or to a regional branch, the outward transport is payable by the customer.
The warranty does not apply to the following cases :

- Repairs following unsuitable use of the equipment or by combining the latter with incompatible equipment.
- Modifications to the equipment without explicit authorisation from our technical departments.
- Repairs resulting from servicing carried out by a person not approved by the company.
- Adaptation to a particular application not provided for by the definition of the equipment or by the instruction manual.

1. General instructions (continued)

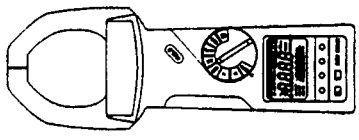
1.4. Maintenance

For any problem concerning maintenance, spare parts, warranty, etc., kindly contact your regional branch.
The latter will respond quickly to any order for spare parts or provide a rapid repair or re-calibration service on the equipment.
Maintenance: Clean the pliers using a damp cloth. Do not use abrasives or solvents.

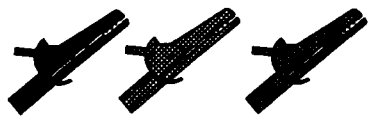
1.5. Unpacking - Repackaging

Check that the following are present :

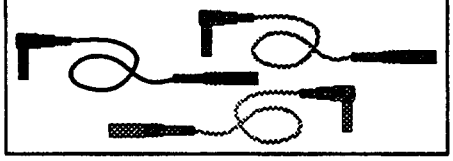
Digital multimeter clamp



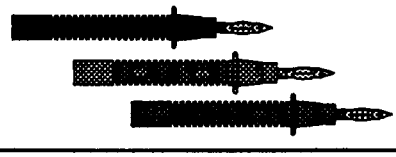
Set of crocodile clips



Set of measuring leads



Set of test probes



User's manual

All the equipment has been checked mechanically and electrically prior to shipment.
Every care has been taken to ensure that the instrument reaches you undamaged.
However, it is wise to carry out a rapid check in order to detect any possible damage which might have been caused during transport.
Should this be the case, immediately enter the usual claims with the carrier.

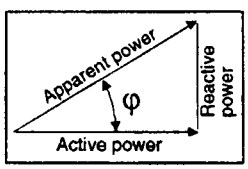
In the event of re-shipment of the equipment, it is preferable to use the original packaging and indicate, as clearly as possible, by means of a note enclosed with the equipment, the reasons for returning it.

2. General description

2.1. Measurable parameters

This apparatus is a digital multimeter clamp capable of measuring the following :

- DC values of the current (IDC) or the voltage (VDC),
- AC values without DC component of the current (IAC or IRMS) or the voltage (VAC or VRMS),
- AC values with DC component of the current (IAC+DC or ITRMS) or the voltage (VAC+DC or VTRMS),
- the peak value of the current (IPEAK) or of the voltage (VPEAK),
- the crest factor on the current or the voltage (CF) (CF = crest value / AC+DC value),



- active, apparent and reactive powers,
- energy consumption (kWh),
- the cos φ,
- electric resistance,
- frequency,
- calculating the compensation capacitance value to obtain the target cos φ of an installation,
- calculating the cos φ obtained with a selected capacitance value.

Each of these parameters can be selected by means of an 8-position rotary switch, including an OFF position, and a keyboard comprising three groups of keys.

The selected magnitude appears on a high-contrast liquid crystal display divided into two display areas.

2.2. Operating modes

The following modes can be actuated for each of the measurements :

- **HOLD** mode : memorisation of the measurement on the two displays
- **SURV** mode : display of the PEAK/MIN/MAX/AVG values of the parameters measured
- **AUTO/MANUAL** mode : choice between an automatic range change or a manual range change
- **DATALOG** mode : record up to 512 measurements in the internal memory of the apparatus at a programmable rate and transmit the measurements over the serial interface of the apparatus
- **TALKER** mode : sending displayed measurements over the serial interface of the apparatus at a programmable rate
- **REMOTE** mode : provides remote control and transfer of measured values over the serial interface
- **analog output** : proportional to the mesured values

3. Preparation for use

3.1. Battery power supply

Supply required : 1 x 6LF22 9 V alkaline battery
Life of the battery : 30 hours on voltage measurement
25 hours on current measurement

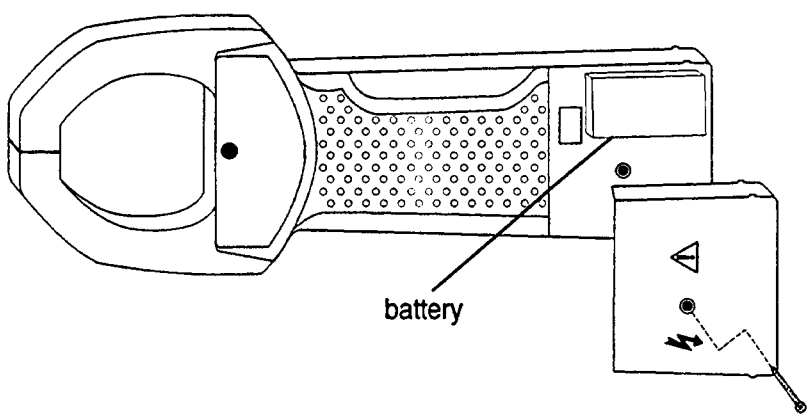
3.2. Battery replacement

Bat appears when the battery is nearly discharged.

Disconnect the test leads from the measuring circuits ; turn the rotary switch to the OFF position and remove the test leads from the apparatus.

Follow the instructions given below :

- ➤ Undo the screw situated at the bottom on the back of the apparatus.
- ➤ Disconnect the removable part on the back of the instrument.
- ➤ Remove the battery from the compartment.
- ➤ Insert the new battery into the compartment, according to the polarity indicated.
- ➤ Re-fit the removable part and screw on.



3.3. Calibration

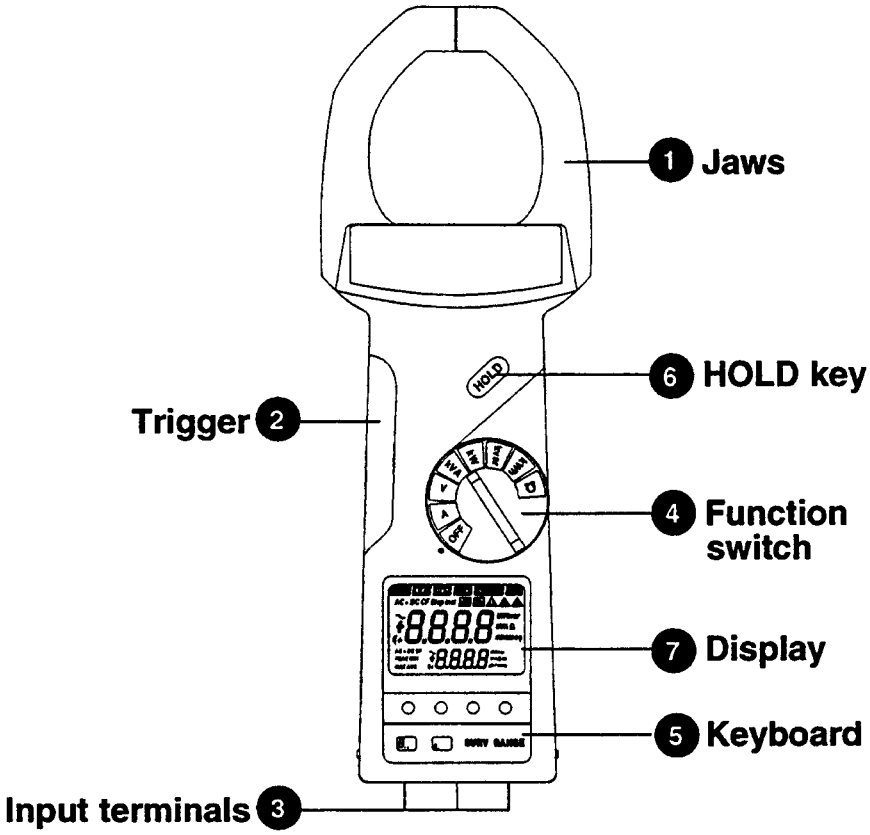
The apparatus contains a non-volatile memory containing the characteristics for adjusting all the measuring ranges. This apparatus is capable of calibration by serial interface without opening the device. The apparatus is supplied with a declaration of conformity. The performance of the specifications is guaranteed for one year.

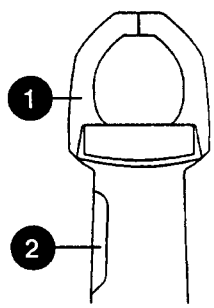
3.4. Storage

In order to guarantee the accuracy of the measurements, after a period of storage in extreme environment conditions, wait for the time necessary so that the apparatus returns to normal measuring conditions (see environment specifications).

4. Functional description

4.1. Description of the apparatus



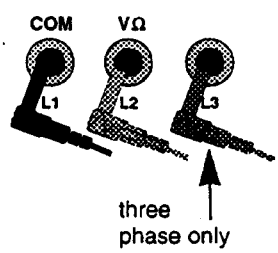


1 Jaws of the clamp

Designed to ensure magnetic coupling to the conductor in which the current to be measured is circulating.

2 Trigger

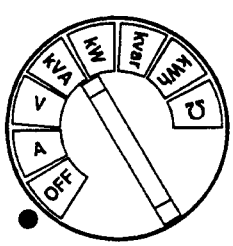
To open the jaws of the clamp, press on the upper part. On releasing the pressure, the jaws close again.



3 Input terminals

Single phase voltage and resistance measurements are connected via the black lead to the COM input terminal and the red lead to the V Ω input terminal.

Three phase voltage measurements are connected via the black lead to the L1 input terminal, the red lead to the L2 input terminal and the blue lead to the L3 input terminal.



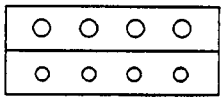
4 Rotary function switch

The rotary switch has a position for switching off the instrument (OFF), as well as seven positions for selecting the main parameter A, V, kVA, kW, kvar, kWh or Ω on the main display.

With each change of position :

- The TALKER/DATALOG Store/Analog output modes are stopped,
- The AUTO mode (automatic range change) is restored by default.

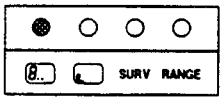
4. Functional description (continued)



❺ Keyboard

The keyboard is divided up into two groups of keys :

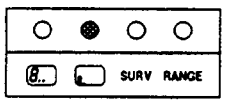
• Main keyboard :



key : by pressing successively on this key, it is possible to select the function to be displayed on the main display.

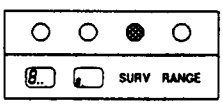
position of the rotary switch	function available
A, V	AC+DC, AC, DC, CF*
kVA, kW, kvar, kWh	none
Ω	continuity

*CF = Crest Factor



key : by pressing successively on this key, it is possible to select the function to be displayed on the secondary display (after the clamp has switched on, no function is selected initially).

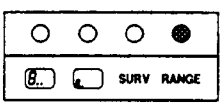
position of the rotary switch	function available
A	Hz, V_{AC+DC}, V_{AC}, V_{DC}, I_{AC+DC}
V	Hz, I_{AC+DC}, I_{AC}, I_{DC}, V_{AC+DC}
KVA, kW, kvar	I_{AC+DC}, V_{AC+DC}, cos φ, compensation capacitance
kWh	I_{AC+DC}, V_{AC+DC}
Ω	none



SURV key : by pressing on this key once, it is possible to actuate the surveillance mode. In surveillance mode, by pressing successively on this key, it is possible to select the following functions :

position of the rotary switch	function available
A, V	PEAK, MIN, MAX, AVG
kVA, kW, kvar, Ω	MIN, MAX, AVG
kWh	none

A long press exits the SURV mode.

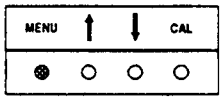


RANGE key : this key is used to select the mode for selecting the AUTO or MANUAL ranges.

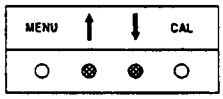
- on AUTO mode : selecting the MANUAL mode (short press)
- on MANUAL mode : selecting the next range (short press) or return to AUTO mode (long press)

4. Functional description (continued)

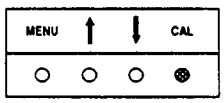
• Secondary keyboard protected by a cover :



MENU key : by pressing once on this key, it is possible to enter the MENU mode in the last option configured and to scan the different options (leave the MENU mode by one long press).



↑ and ↓ keys : by pressing once on these keys, it is possible to modify the option of the selected menu.

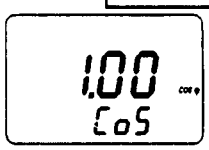


CAL key : by pressing once on this key, it is possible to carry out an auto zero of the electric current measurements.

• Running the Menu :

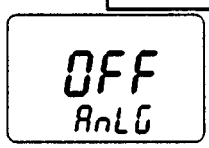
By successive presses on the MENU key, choose between the following options :

Always accessible



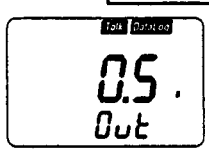
cos φ setting — adjustment of the value of cos φ (from 0.70 to 1.00) the modifications made to this value are saved in the non-volatile memory. Used to calculate the compensation capacitance value

Accessible with adaptors "1" and "2"



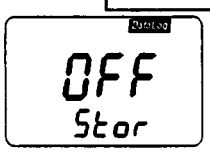
analog output — actuation or de-actuation (OFF) of the analog output (Display (d ISP) or Instantaneous (InSt))

Always accessible

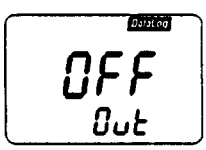


TALKER and DATALOG modes time interval — selection of the transmit or recording interval, depending on the mode (0.5 s except Ω ; 1 s ; 2 s ; 5 s ; 10 s ; 20 s ; 30 s ; 40 s ; 50 s ; 1 min. ; 2 min.; 3 min. ; 4 min. ; 5 min.), the modifications made to this value are saved in the non-volatile memory

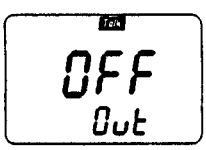
Accessible with adaptor "3"



DATALOG Store mode — actuation (On) or de-actuation (OFF) of the recording of the values in the memory



DATALOG Output mode — actuation (On) or de-actuation (OFF) of the output of the data recorded in the DATALOG Store mode



TALKER mode — actuation (On) or de-actuation (OFF) of the sending of the displayed measurements on the serial interface

❻ HOLD key

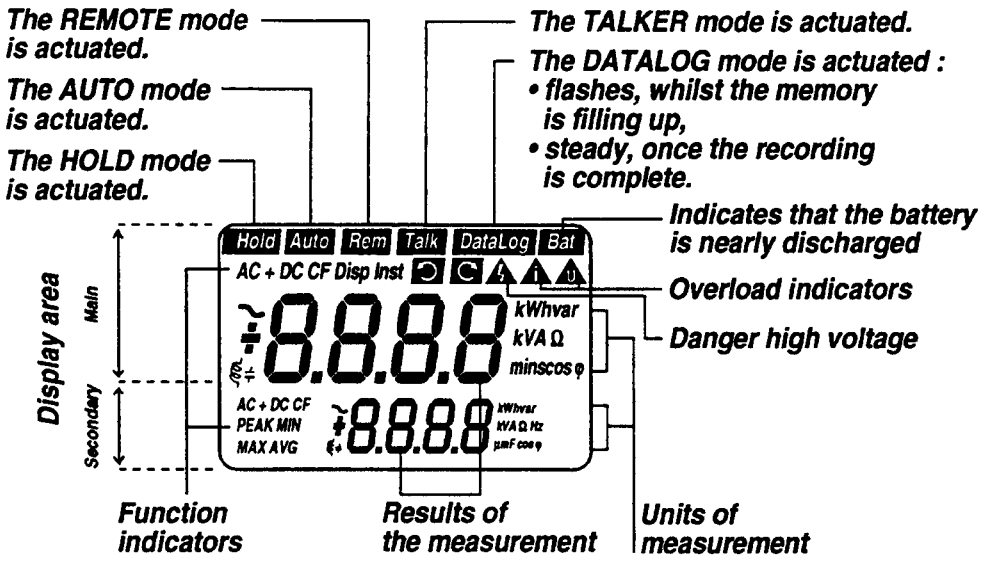
Easy to access, this makes it possible to freeze the display on the last value measured.

4. Functional description (continued)

❼ Display

The high-contrast liquid crystal display is divided into two display areas :

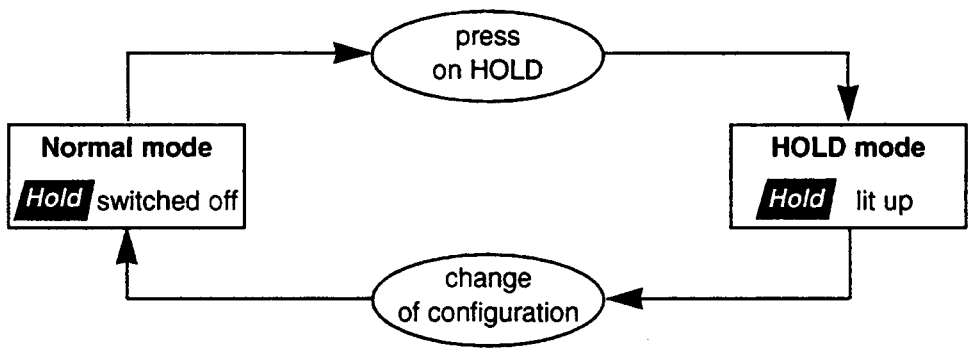
- a main display area, of 4 figures 11.5 mm high, in which there appears the function selected by the rotary switch,
- a secondary display area, of 4 figures 7 mm high, in which there appears the secondary function.



4.2. Description of the operating modes

4.2.1. HOLD mode

The **HOLD** mode freezes the main display and the secondary display.



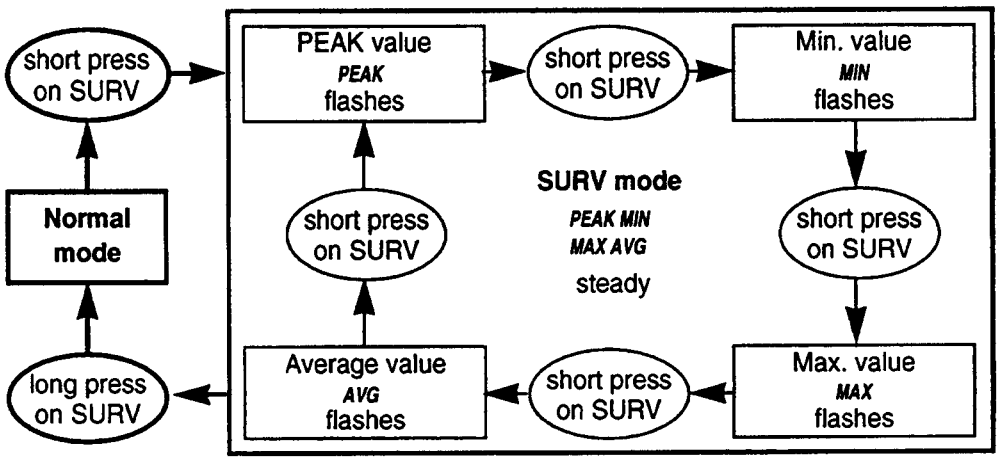
The HOLD mode is available on all measurements.
To leave the HOLD mode :

- press once on , , RANGE or HOLD key,
- operate the rotary switch,
- enter the SURV mode.

The HOLD mode has the effect of interrupting all measurements and interrupting the SURV mode. This mode makes it possible to retain in memory the PEAK/MIN/MAX/AVG values, whilst the instrument is no longer connected to the measuring point. After consulting the recorded values, leaving the HOLD mode makes it possible to continue surveillance, once the clamp is again connected to the measuring point, by leaving the PEAK/MIN/MAX/AVG values measured prior to entering the HOLD mode.

4.2.2. SURV mode

The **SURV** mode makes it possible to display, on the secondary display, the PEAK, MIN, MAX and AVG values of the parameter measured on the main display.
The AVG mode makes it possible to smooth the data displayed, by means of a sliding averaging on the 16 values.

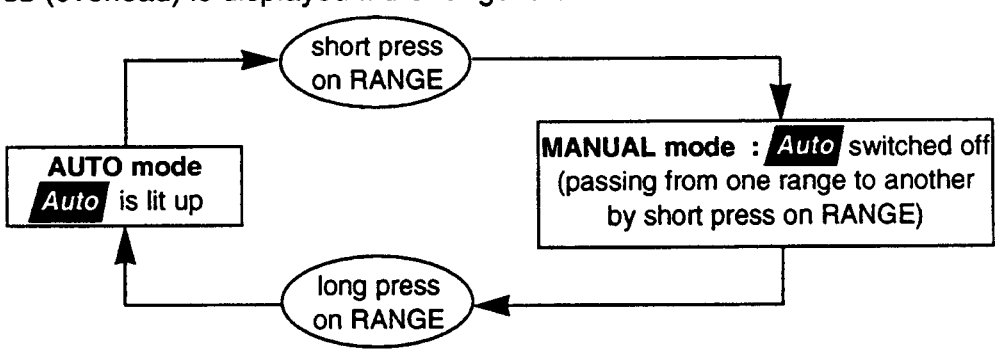


On entering the SURV mode :
- if in AUTO range mode, highest range is selected. And the range change becomes manual.
- if in MANUAL range mode, surveillance is carried out on the range in progress.

A change of range by the RANGE key re-initialises the PEAK/MIN/MAX/AVG data.

4.2.3. AUTO/MANUAL mode

The **AUTO** mode is available on all the measurements except Cos φ (which only has one range).
OL (overload) is displayed if the range is exceeded.



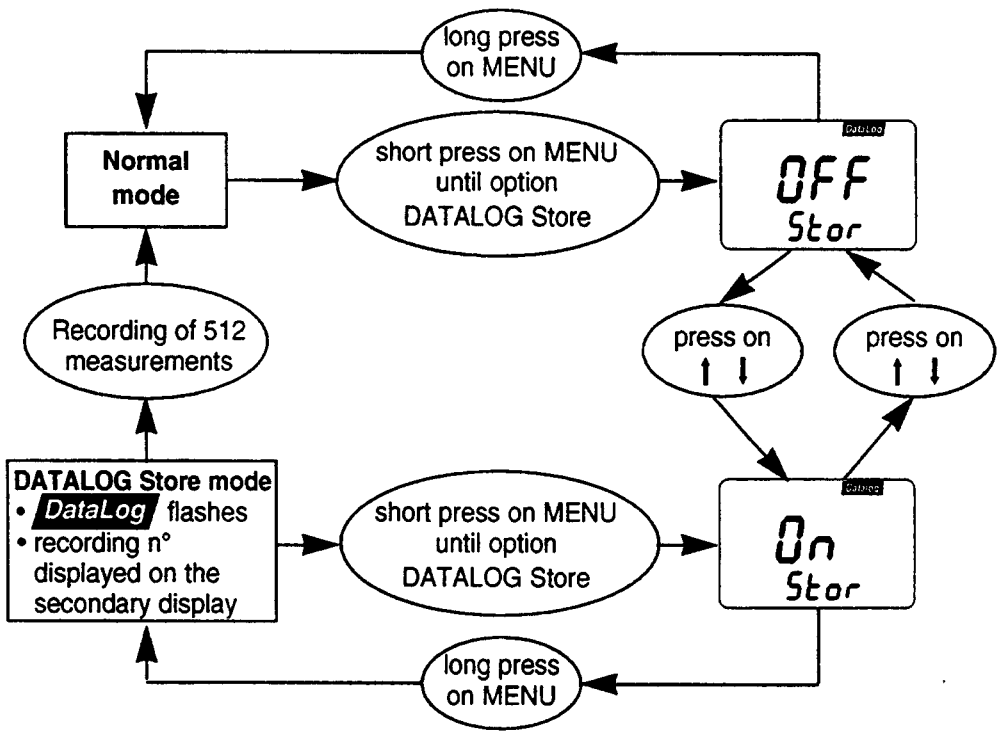
The appearance of symbols ⚠U and ⚠I indicate that the voltage or current signals have peak values which exceed the range in progress. On automatic range change mode, this indication brings about a passage to a higher voltage or current range, when one exists.
If this indication appears in manual range change mode, or in the largest voltage or current range, the relevant range flashes, indicating that its value can be crossed.

4. Functional description (continued)

4.2.4. DATALOG Store mode

Accessible with adaptor "3"

The **DATALOG** Store mode makes it possible to memorise a maximum of 512 measurements from the main display (recording interval can be set in the MENU mode).



The DATALOG Store mode stops (the letter symbol *DataLog* remains steady without flashing) :

- on a de-actuation of the DATALOG Store option (*OFF* is displayed on the main display),
- on the 512th recording (an audible tone is emitted),
- on a change of measurement by the rotary switch or by key ⊡ ,
- on entering the MENU mode.

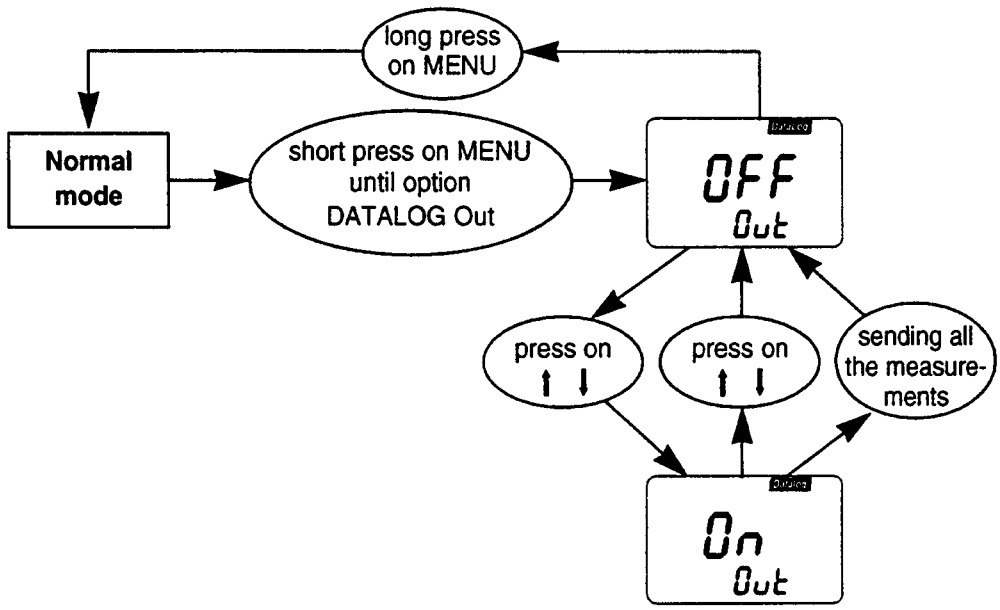
On leaving the MENU mode, if DATALOG is actuated, a further recording starts.

4. Functional description (continued)

4.2.5. DATALOG Out mode

Accessible with adaptor "3"

The **DATALOG** Out mode makes it possible to send, over the serial interface, the measurements recorded in the DATALOG Store mode.



The recording number is sent prior to each measurement.

Example of output :

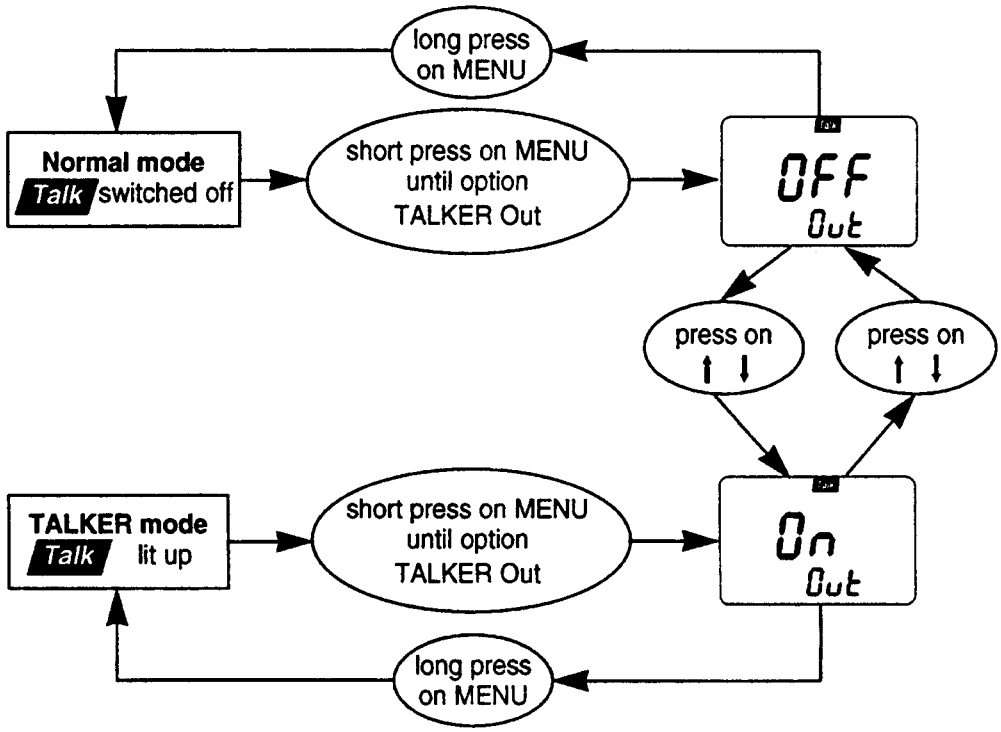
```
                -
                -
                -
018 :      007.9 V      AC+DC
019 :      007.8 V      AC+DC
020 :      008.0 V      AC+DC
021 :      007.9 V      AC+DC
                -
                -
                -
```

4. Functional description (continued)

4.2.6. TALKER mode

Accessible with adaptor "3"

The **TALKER** mode makes it possible to send, over the serial interface, the measurements from the main display (transmit interval can be set in the MENU mode).



The time elapsed since the TALKER mode was started is sent prior to each measurement (maximum relative time : 99 h 59 min 59 s).

Example of output (programmed interval : 5 s) :

```
                    –
                    –
                    –
01h23min45s :   120.2 A     AC+DC
01h23min50s :   120.3 A     AC+DC
01h23min55s :   120.2 A     AC+DC
01h24min00s :   120.1 A     AC+DC
                    –
                    –
                    –
```

The TALKER mode stops :

- on a de-actuation of the TALKER option (*OFF* is displayed on the main display),
- on a change of measurement by the rotary switch or by key ⊡ ,
- on entering the MENU mode.

4. Functional description (continued)

4.2.7. REMOTE mode

Accessible with adaptor "3"

The **REMOTE** mode makes it possible to :
- operate the clamp under remote control,
- receive the measurement results,
- calibrate the clamp.

The REMOTE mode can be actuated at any time by a PC linked up to the clamp via the adaptor "3".

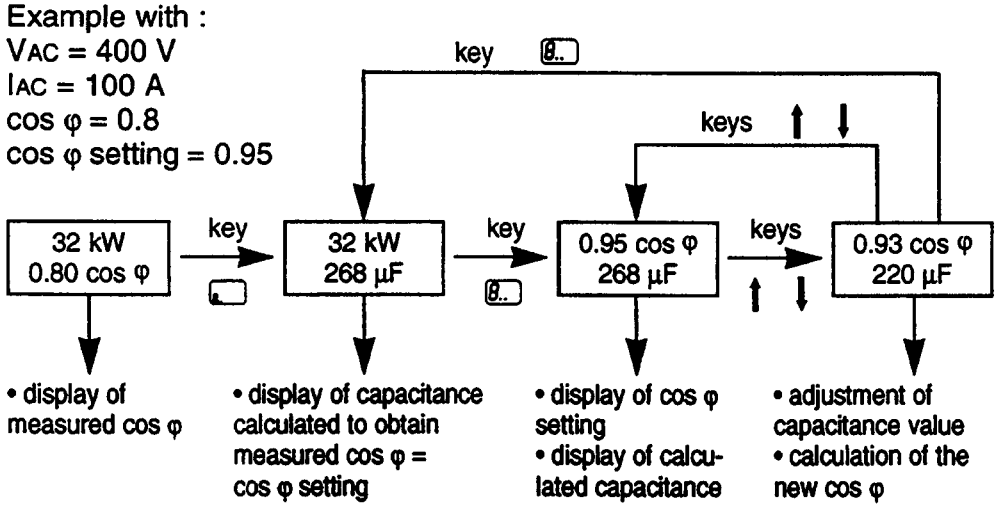
4.2.8. AUTO OFF mode

standby mode

The **AUTO OFF** mode makes it possible for the clamp, firstly, to switch to standby mode (minimum consumption) after 3 minutes, if there has been no action on the switch or on the keys.
Secondly, the clamp stops automatically after 15 minutes, if there has been no action on the switch or on the keys. You can go out of standby mode by pressing any key. The AUTO OFF mode is disactivated either when REMOTE, TALKER or SURV mode is activated, or when the input sockets detect a voltage above 24 V.
If the DATALOG memory is not empty, the automatic stop is de-actuated and the clamp remains on standby mode.
In order to bring the clamp back into service after an AUTO OFF, it is necessary to turn the rotary switch to OFF and then return to the required position.

4.2.9. Mode for calculating the compensation capacitance

Calculating the compensation capacitance value is based on the cos φ setting value defined in the MENU mode (refer to section § 4.1. MENU key). The compensation capacitance can be displayed on the secondary display for the kVA/kvar/kW positions of the rotary switch.
Management of the displays (access to keys ↑ and ↓ is independent of the MENU mode) :
Example with :
V_{AC} = 400 V
I_{AC} = 100 A
cos φ = 0.8
cos φ setting = 0.95



When the clamp detect the triphase mode, the capacity value indicated on the display corresponds to 3 capacity in triangular wiring. If the wiring of the capacity is to be in star form, the capacity value displayed must be multiplied by three.

4. Functional description (continued)

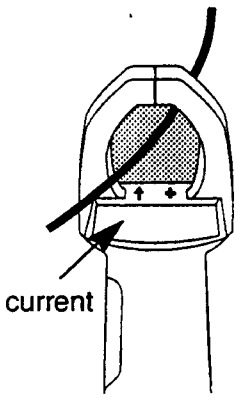
4.3. Description of the measurements

4.3.1. Current measurement

➤ Turn the rotary switch to "A".

➤ Select the function IAC+DC, IAC, IDC or crest factor of the current (CF) by short successive presses on key .

The measurement can also be displayed on the secondary display for the positions of the rotary switch V, kVA, kW, kvar, kWh (see section 4, ❺ keyboard, key).

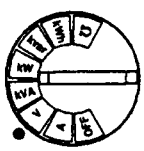


➤ On DC or AC+DC measurement, press the CAL key in order to re-set the clamp at zero (compensation for the residual magnetisation) prior to effecting the measurement (the clamp must not enclose the conductor).

On DC measurement, the value displayed is positive when the current crosses the clamp as indicated in the figure.

➤ Enclose the conductor lead ; check that the clamp is properly closed. The clamp must be positioned around a single conductor of a circuit ; if not, the reading would be false.

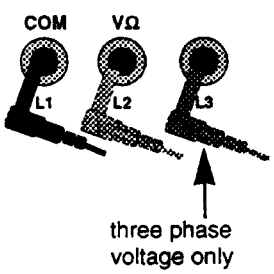
4.3.2. Voltage measurement



➤ Turn the rotary switch to "V".

➤ Select the function VAC+DC, VAC, VDC or crest factor of the voltage (CF), by short successive presses on key .

The measurement can also be displayed on the secondary display for the positions of the rotary switch A, kVA, kW, kvar, kWh (see section 4, ❺ keyboard, key).



➤ For a single phase voltage, connect the black measuring lead to the "COM" terminal and the red measuring lead to the "V Ω" terminal.

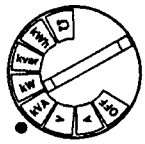
➤ For a three phase voltage, connect the black measuring lead to the "L1" terminal, the red measuring lead to the "L2" terminal and the blue measuring lead to the "L3" terminal. The value displayed is the average value of the voltages between phases.

You can then bring the test probes into contact with the measuring points.

4. Functional description (continued)

4.3.3. Measurement of power and energy consumption

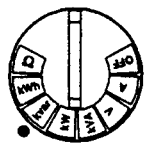
Display of the measurement on the main display.



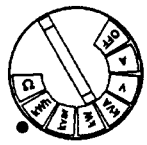
➤ Turn the rotary switch to :

- "kVA", in order to measure the apparent power.

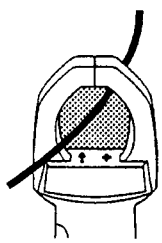
- "kW", in order to measure the active power.



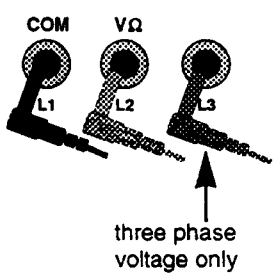
- "kvar", in order to measure the reactive power.



- "kWh", in order to measure the energy consumption.



➤ Enclose the conductor. The clamp must be positioned around a single conductor of a circuit; if not, the reading would be false.



➤ For a single phase voltage, connect the black measuring lead to the "COM" terminal and the red measuring lead to the "V Ω" terminal. When the symbol "Cos φ" on the display is flashing, it is necessary to reverse the current in the jaws by turning the clamp upside down.

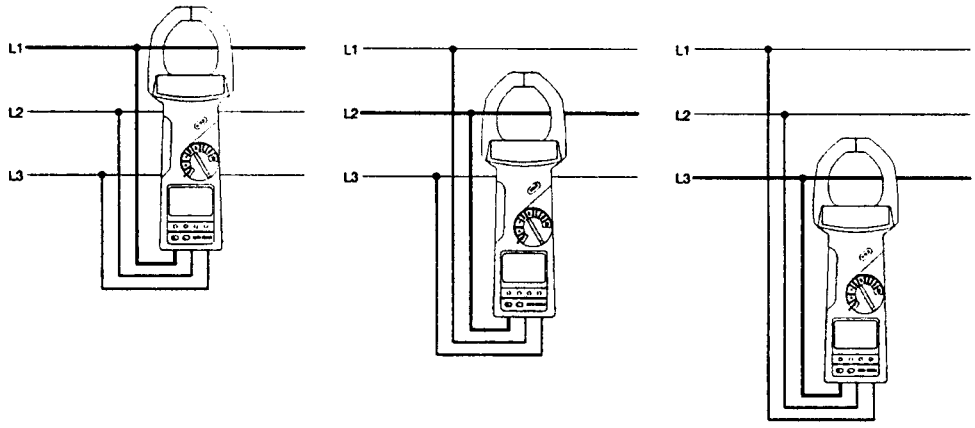
➤ For a three phase voltage, connect the black measuring lead to the "L1" terminal, the red measuring lead to the "L2" terminal and the blue measuring lead to the "L3" terminal.

You can then bring the test probes into contact with the measuring points.

Measuring the power in three phase environment without neutral :

In the case of consumption balanced over the 3 phases, the measurement is conducted by taking as the voltage reference (COM input), the phase on which the current measurement is obtained. Detection of the three phases is automatic and no correction of the result need be made.

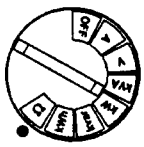
In the case of unbalanced consumption over the 3 phases, the power is obtained by measuring, in turn, the three phase power on each phase and by calculating the average of each of the results.



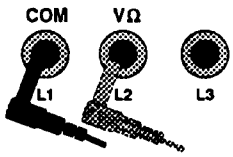
Measuring the power in three phase environment with neutral :

This measurement is obtained by adding together the 3 measurements conducted on single phase between each of the phases and neutral.

4.3.4. Resistance measurement and continuity check



➤ Turn the rotary switch to "Ω".



➤ Connect the black measuring lead to the "COM" terminal and the red measuring lead to the "V Ω" terminal.

➤ Check that the circuit to be tested is not live. Connect the measuring leads to the measuring points.

The measurement of continuity can be actuated by pressing once on key . The ranging is then set in the 200 Ω range and the internal buzzer emits an audible signal if the resistance on the circuit being tested is less than approximately 30 Ω.

On measuring continuity, display of the measurement on the main display and bEEP on the secondary display.

To return to the measurement of the resistance, press once on key .

4.3.5. Compensation of zero for current measurement

In order to take into account the residual magnetic field in the jaws of the clamp at the time of measuring current, power and energy, it is necessary to recalibrate it at regular intervals. To this end, remove the conductor from the jaws of the clamp and press the CAL key.
Duration of this calibration : from 2 to 7 s.

5. Technical specifications

5.1. General

Only the values assigned tolerance or limit are guaranteed values. Values without tolerance are given for information only (Standard NFC 42670).

5.2. Characteristics

The accuracy is to [% of the reading (R) + number of digits (D)] at 23°C ± 1°C (73.4°F ± 33.8°F) and less than 75 % relative humidity.

5.2.1. Current measurement (DC, AC, AC+DC, peak)

Clamp	DC range	AC, AC+DC range	Measurable peak	Resolution	Accuracy 10 Hz to 400 Hz	Measurable min. value
200 A	30 A	20 A	30 A PEAK	0.01 A	1 % R + 8 D	0.10 A
	300 A	200 A	300 A PEAK	0.1 A	1 % R + 8 D	1 A
2000 A	300 A	200 A	300 A PEAK	0.1 A	1 % R + 8 D	1 A
	2000 A	2000 A	3000 A PEAK	1 A	1 % R + 8 D (I < 1400 A) 5 % R + 8 D (I > 1400 A)	

Selection of ranges :
- automatic or manual on the main display
- automatic on the secondary display (except on SURV mode)

Measurement bandwidth : DC and from 10 Hz to 3 kHz
Additional error, depending on the frequency : 3 % x f (kHz) from 400 Hz
Additional error on PEAK measurement :
- sinusoidal arc 1 ms : 1 % + 3 % of the full scale
- rectangular pulse 1 ms : 14 % + 3 % of the full scale

Additional off-centering error of the conductor : 5 %
Crest factor : (clamp 200 A : I > 3 A ; clamp 2000 A : I > 30 A)
- indication of saturation ⚠ on the display makes it possible to adapt the selected range to the signal peaks and thereby to optimise measurement of the crest factor
- this crest factor is given for information only in the following case, for the 200 A range, sine 60 A 50 Hz on which a pulse of 1 ms is superposed : CF = 5

Characteristics of the magnetic circuit :
- residual magnetism : 0.2 % max. of the entered current peak
- limitation due to iron losses : I x f < 1 (I in kA, f in kHz)
- re-calibration of the zero by instruction at the keyboard

5.2.2. Voltage measurement (DC, AC, AC+DC, peak)

DC range	AC, AC+DC range	Measurable peak	Resolution	Accuracy 10 Hz to 400 Hz	Protection
600 V	400 V	600 V PEAK	0.1 V	0.5 % R + 15 D	1100 V PEAK
1000 V	750 V	1000 V PEAK	1 V	0.5 % R + 8 D	

Selection of ranges :
- automatic or manual on the main display
- automatic on the secondary display

Input impedance : 970 kΩ
Measurement bandwidth : DC and from 10 Hz to 3 kHz
Additional error, depending on the frequency of the signal :

- 1 % from 400 Hz to 1 kHz
- 3.5 % from 1 kHz to 3 kHz

Additional error on PEAK measurement :

- sinusoidal arc 1 ms : 1 % + 3 % of the full scale
- rectangular pulse 1 ms : 14 % + 3 % of the full scale

Crest factor : (U > 60 V)

- indication of saturation ⚠U on the display makes it possible to adapt the selected range to the signal peaks and thereby to optimise measurement of the crest factor.
- this crest factor is given for information only in the following case, for the 750 V range, sine 230 V 50 Hz on which a pulse of 1 ms is superposed : CF = 5

5.2.3. Measurement of Cos φ

Cos φ is calculated from the phase difference existing between the voltage and the current. The measurement is obtained in the automatic range change mode.
Display of a symbol ± or ∓ will indicate whether φ is positive or negative.
Absolute error on Cos φ : 0.01
Additional error of the angle : 2° at 50 Hz and 60 Hz
4° at 400 Hz (2000 A clamp)
8° at 400 Hz (200 A clamp)
Conditions : for the 200 A clamp, U > 60 V and I > 3 A
for the 2 000 A clamp, U > 60 V and I > 30 A

5.2.4. Measurement of active (kW), reactive (kvar) and apparent power (kVA) and energy consumption (kWh)

The power and energy consumption measurements are calculated from the data on voltage and current in the automatic range change mode.
Display of a symbol ± or ∓ will indicate whether φ is positive or negative.

Clamp	Range	Resolution	Accuracy (kVA)	Accuracy (kW)	Accuracy (kvar)
200 A	2 k	0.001 k	Accuracy in I + Accuracy in U	Accuracy in kVA + figure 1	2 x accuracy in kVA + Accuracy in kW (for cos φ < 0.7)
	20 k	0.01 κ			
	200 k	0.1 k			
2000 A	20 k	0.01 k		Accuracy in kVA + figure 2	
	200 k	0.1 k			
	2000 k	1 k			

figure 1 : 200 A clamp

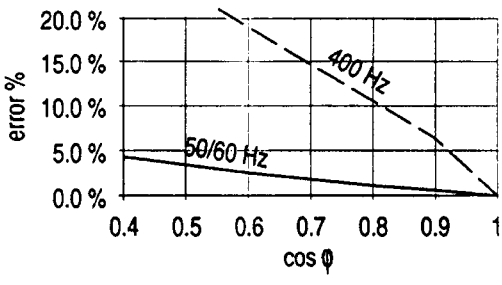
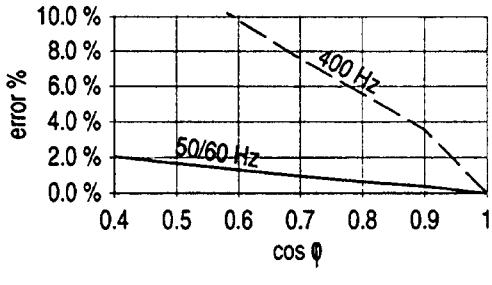


figure 2 : 2000 A clamp



Measurement of energy consumption :

- the apparatus accumulates the energy measurements from when the function was started, and converts the measured value to kW hours.
- the indication on the display also corresponds to the average power from when the function was started

5.2.5. Phase rotation indication

Once the presence of three phases is detected, the display indicates the direction of rotation of the phases :

- if the direction of rotation is L1 → L2 → L3, the display indicates a clockwise direction : C is lit up.
- if the direction of rotation is L3 → L2 → L1, the display indicates an anti-clockwise direction : C signals.

When the clamp detects an anomaly in the connection of the 3 phases, the display indicates : C and C signal.
Minimum voltage on the inputs : 30 V

5.2.6. Resistance measurement

Range	Resolution	Protection	Accuracy
200 Ω	0.1 Ω	600 Veff	1 % R ± 5 D
2000 Ω	1 Ω		

Continuity threshold : < 30 Ω approximately
Response time in continuity mode : 100 ms
Measuring current : 0.50 mA approximately
Maximum voltage at no load : 80 VDC

5.2.7. Frequency measurement

The frequency measurements are obtained from the voltage or current signals.
Measuring range : 4 Hz to 2 000 Hz

Range	Resolution	Accuracy
20 Hz	0.01 Hz	0.3 % R + 5 D
200 Hz	0.1 Hz	0.3 % R + 3 D
2000 Hz	1 Hz	

Conditions : for the 200 A clamp, U > 60 V and I > 3 A
for the 2 000 A clamp, U > 60 V and I > 30 A

5.2.8. Safety

IEC 1010-1 (1990) + amend. 1 (1992) (EN 61010) (NFC 42020 - 1993)
UL 3111 ANSI/ISA - SP2.01.94
CSA 22.2 n°1010-1.92
Insulation : class 2
Pollution degree : 2
Indoor use, altitude < 2 000 m
Surge voltage category of the inputs :
CAT III, 1 000 V max. to earth
CAT IV, 600 V max. to earth

5. Technical specifications (continued)

5.2.9. General information

Mechanical characteristics

	200 A clamp	2 000 A clamp
Dimensions (W x L x H) :	270 x 90 x 50 mm	285 x 100 x 50 mm
Weight (incl. battery) :	approx. 0.550 kg	approx. 0.610 kg
Jaw opening :	Ø 40 mm	Ø 64 mm
	bars : 7 x 52 mm	bars : 22 x 64 mm

Power supply

Power supply required : 1 x 6LF22 9 V alkaline battery

Battery power low indicator : Bat is displayed when the voltage supplied by the battery is too low

Life of the battery : 25 hours on current measurement

Display

Main display : LCD, 4 figures 11.5 mm high

Secondary display : LCD, 4 figures 7 mm high

Display rate : 2 measurements per second

5.3. Environment

5.3.1. Temperatures

Reference temperature : 23°C ± 1°C (73.4°F ± 33.8°F)

Temperature of use : 0°C to 45°C (32°F to 113°F)

Operating temperature : - 10°C to 55°C (- 50°F to 131°F)

Storage temperature : - 20°C to 75°C (-68°F to 167°F)

Temperature coefficient : 0.1 x (specified accuracy) / °K

Relative humidity : 80 % at 40°C (104°F)

5.3.2. EMC

This apparatus was designed in accordance with the EMC standards in force and its compatibility has been tested in accordance with the following standards :

- Emissions radiated : IEC 1326-1, class A
- Immunity : IEC 1326-2-30
  - Electrostatic discharges : IEC 1000-4-2
  - R.F. field : IEC 1000-4-3
  - Rapid transients : IEC 1000-4-4 (with adaptor "3")

CE

This product conforms to the prescriptions of the European directive on low voltage 73/23/EEC and to EMC directive 89/336/EEC, amended by 93/68/EEC.

6. Accessories

6.1. Supplied with the apparatus

1 set of test leads (one black, one red and one blue)		AG0511
3 test probes :	1 black	AA2830
	1 red	AA2832
	1 blue	AA2831
3 crocodile clips :	1 black	AA2809
	1 red	AA2810
	1 blue	AA2829
1 instruction manual		IM1137
1 x 9 V alkaline battery 6LF22		AL0042

6.2. Supplied as an option

adaptor "1" : analogue output for current measurements
adaptor "2" : analogue output for all measurements
adaptor "3" : RS 232 insulated input-output
Mains power supply for adaptors "1", "2" and "3"
Turnkey operating software
Transport suitcase HA1339
Padded carrying case AE0224

INDEX