

PORTABLE DIGITAL MULTIMETER

MODEL MX53^{III}

USER MANUAL

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1. GENERAL INSTRUCTIONS

You have just acquired a portable digital multimeter and we thank you for your purchase.

This instrument complies with the specification of IEC publication 1010-1, concerning safety requirements for electronic measuring apparatus. To get the best service from this instrument, read carefully this user's manual and respect the detailed safety precautions.

1.1. Precautions and safety measures

1.1.1. Before use

- This device can be used for measurements on category III installations, pollution rating 2, for voltages never exceeding 600 V (AC or DC) relative to the earth.
- Definition of overvoltage categories (cf. publication IEC 664-1) :
 - CAT I : The circuits of CAT I are protected by measures limiting transient overvoltages to appropriate low level.
Example : protected electronic circuits
 - CAT II : The circuits of CAT II are power supply circuits of appliances or portable equipment with transient overvoltages of an average level.
Example : appliances and portable equipment
 - CAT III : The circuits of CAT III are power supply circuits of power equipment with important transient overvoltages.
Example : fixed installation or industrial equipment
 - CAT IV : The circuits of CAT IV may comprise very important transient overvoltages.
Example : primary supply level
- * For your own safety, only use the measuring probes which have been delivered with the instrument : they conform to the IEC 1010-1 safety standard. Before use, check that they are in good condition.

1.1.2. During use

- * 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.
- * Never exceed the protection limit values indicated in the specifications for each type of measurement.
- * When the multimeter is connected to energized circuits, do not touch unused terminals.

- * When the scale of the value to be measured is unknown, check that the scale initially set on the multimeter is the highest possible or, wherever possible, choose the autoranging mode.
- * Before changing functions, disconnect the test leads from the circuit under test.
- * When performing current measurements, do not connect or disconnect leads without first isolating the current. If you do, there is a risk of generating surge currents which can blow the fuses or damage the instrument.
- * In TV repair work, or when carrying out measurements on power switching circuits, remember that high amplitude voltage pulses at the test points can damage the multimeter. Use of a TV filter will attenuate any such pulses.
- * Never perform resistance measurements on live circuits.

1.1.3. Symbols



Warning : Refer to the user's manual.



Danger, high voltage : Risk of electric shock



Earth terminal

1.1.4. Opening the instrument

- * Before opening the instrument, always disconnect from all sources of electric current and make sure not to be loaded with static electricity, which may destroy internal components.
- * Fuses must be replaced with fuses of the same rating and type.
- * Any adjustment, maintenance or repair work carried out on the multimeter while it is live should be carried out only by appropriately qualified personnel, after having taken into account the instructions in this present manual.
A "**qualified person**" is one who is familiar with the installation, construction and operation of the equipment and the hazards involved. He is trained and authorized to energize, de-energize circuits and equipment in accordance with established practices.
- * When the instrument is open, remember that some internal capacitors can retain a dangerous potential even after the instrument is powered down.
- * It is recommended to remove the battery from the instrument if not used.


1.2. Protection devices

ASYC II series instruments are fitted with various protection devices :

- * Varistor protection for limiting transients of over 1100 V at the V Ω terminal, particularly 6 kV pulse streams as defined in French standard NFC 41-102.

- * A PTC (Positive Temperature Coefficient) resistor protects against permanent overvoltages of up to 600 V during resistance, capacitance and diode test measurements. This protection is reset automatically after overload.
- * Two fuses provide protection during measurements of intensity type.
- * Maximum protection between mA and 10 A input terminals : 500 V.
- * An IP protection rating of 67.

1.3. Safety devices

- * The battery unit and fuses cannot be accessed without first disconnecting the measuring leads.
- * When measuring voltages above 24 V, the sign blinks  on the display.
- * If the maximum range is repeatedly exceeded, an intermittent audible signal indicates the risk of electric shock.

1.4. Warranty

This equipment is warranted against any defects of manufacture or materials according to the general conditions of sale.

During the warranty period (3 years), defective parts will be replaced, the manufacturer reserving the right to repair or replace the product. In the event of the equipment being returned to the after sale department or to a local agency, carriage to the centre shall be payable by the customer.

1.5. Maintenance and metrological verification

Return your instrument to your distributor for any work to be done within or outside the guarantee.

1.6. Unpacking - Repacking

This equipment has been fully checked out mechanically and electrically before shipping. All precautions have been taken to ensure that the instrument arrives at its destination undamaged.

However, it is advisable to carry out a rapid check for damage sustained in shipping. If there is any evidence of damage, make this known immediately to the shipper.



Caution *Should you need to return the multimeter, preferably use the original packaging and indicate the reasons as clearly as possible on an accompanying note.*



Note *Our products are patented in FRANCE and ABROAD. The logotypes are registered. The manufacturer reserves the right to modify specifications and prices as required by technological improvements.*

2. DESCRIPTION

This multimeter is one of the ASYC II (Advanced Safety Concept, second generation) range, designed for a high degree of user safety, maximum protection and unrivalled performance.

2.1. Selector switch

It is a standalone, handheld professional measuring instrument, capable of measuring the following quantities (accessed by the eleven-position rotary selector switch) :

- * AC voltages with AC (or RMS) capacitive coupling,
- * AC voltages with AC+DC (or TRMS) direct coupling,
- * DC voltages,
- * AC currents with AC (or RMS) capacitive coupling
- * AC currents with AC+DC (or TRMS) direct coupling,
- * DC currents,
- * resistance values,
- * continuity (with beeper),
- * capacitance,
- * diode threshold voltage,
- * frequencies,
- * duty cycles

2.2. Keypad

A six-key keypad lets you :

- * select the autoranging mode (RANGE key),
- * store a value (HOLD key),
- * measure fast peaks (Pk +/- key),
- * set the measurement relative to a reference value (REL key),
- * select a function derived from the main function, or switch on the multimeter again after it has been shut down automatically (SEL/ON key),
- * activate sending data to a printer (PRINT key).

2.3. Display

The display provides :

- * clearly legible figures (14 mm high),
- * an analogue readout of the parameter being measured through a 34-segment bargraph,
- * perform 50 000-point measurements (high resolution),
- * perform 5 000-point measurements (low resolution).

2.4. Power supply

This multimeter is powered by a standard 9 V battery which provides approximately 500 hours of operation.


2.5. Input terminals

Measurements are performed using two measuring leads supplied with the instrument connected to input terminals 1, 2, 3 and 4, as indicated in section 3.1.

3. COMMISSIONING

3.1. Connecting the test leads

Connect the black lead to the COM socket (for all measurements). Depending on the position of the selector switch, connect the red lead as follows:

Rotary selector switch position	Input terminal
V_{AC} , mV_{DC} , V_{DC} , Ω , 	V_{Ω}
10 A_{DC}	A
5 mA_{DC} , 50 mA_{DC} , 500 mA_{DC}	mA

3.2. Switching on the instrument

Turn the selector switch to the required function.

All segments of the display come on for a few seconds. The instrument is then ready for measurements.

3.3. Switching off the instrument

The instrument can be switched off manually by returning the selector switch to the OFF position, or automatically after approximately half an hour if no key is pressed or the switch is not operated.



Note *Automatic shutdown of the instrument is disabled in order to avoid interrupting the peak value measurements (Pk +/-), or the data print out.*

For user safety, automatic shutdown is also disabled when a measured magnitude (voltage/current) present at the input exceeds dangerous level

( indicator displayed).

3.4. Special configurations

To adapt the configuration of the instrument to the measurement environment, the user can :

- *Choose 50 Hz or 60 Hz rejection :*

Switch on with the rotary switch while holding down the HOLD key. The selection is reversed from the last configuration, is displayed for two seconds and remains backed up in non-volatile memory.

- *Choose a low resolution mode (5 000 points) :*

Switch on with the rotary switch while holding down the REL key. The selection is displayed for two seconds.

3.5. Multimeter maintenance

3.5.1. Fuse self-test

When fuse F1 (0.63 A) or F2 (10 A) is blown, the display shows “FUSE.1” or “FUSE.2”, accordingly.

If both fuses are blown, the display shows “FUSES”.

Replace the fuse or fuses concerned.



Note *Fuse F1 cannot be tested unless the switch is set to a mA position. Fuse F2 is located in the common circuit. Therefore, V, Ω , C and \rightarrow measurements, and measurements in the 10 A range, become impossible when it is out of service.*

3.5.2. Battery self-test

When the BAT indication appears on the display, the instrument still has approximately 50 hours of operation, but specifications can no longer be guaranteed.

Replace the battery.

3.5.3. Replacing the battery or fuses

Open the multimeter casing as follows (see last page of the manual) :

- 1 - Remove the stand from the back of the instrument. Figures 2 and 3
- 2 - Remove the SECUR'X cover using the stand. Figure 4
- 3 - Remove the front cover using the stand as a lever. Figure 5
- 4 - Remove the gasket.
- 5 - Replace the battery or fuse.

Before use, make sure that the gasket, then the front cover are carefully set back on the instrument.

3.5.4. Cleaning

Clean the multimeter using a damp cloth. Do not use abrasives or solvents.

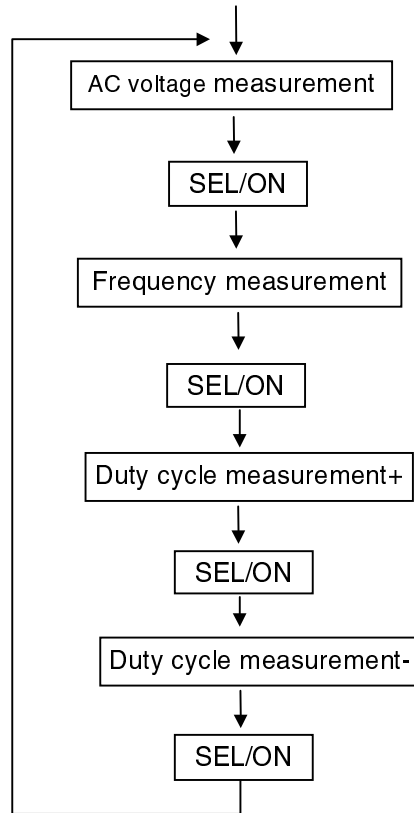
4. FUNCTIONAL DESCRIPTION

4.1. SEL/ON key

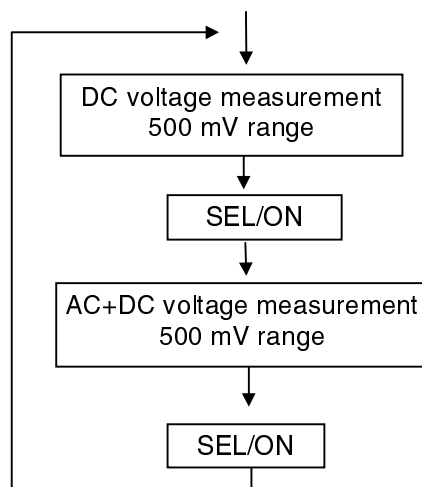
This can be used to switch on the multimeter again after an automatic shutdown. It can also be used to access secondary functions associated with the selector switch positions.

The flowcharts below define these various functions.

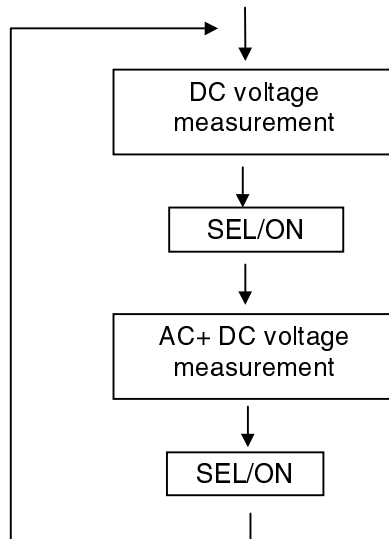
4.1.1. V_{AC} position



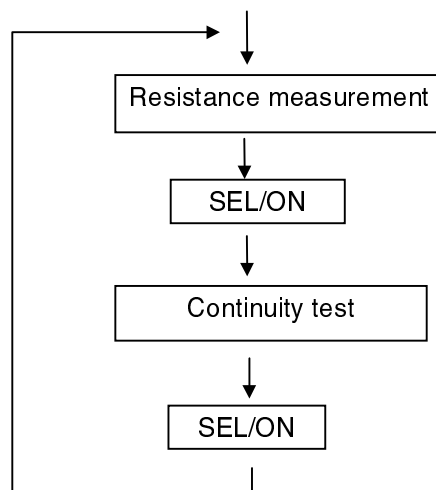
4.1.2. mV position



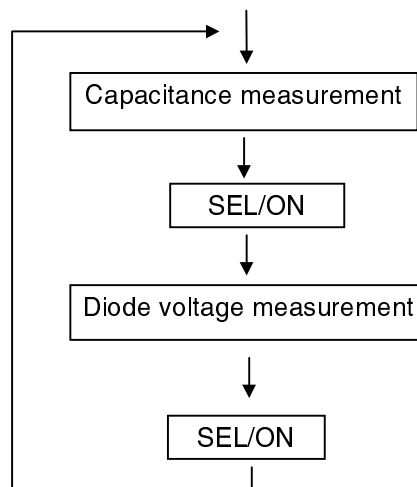
4.1.3. V_{DC} position



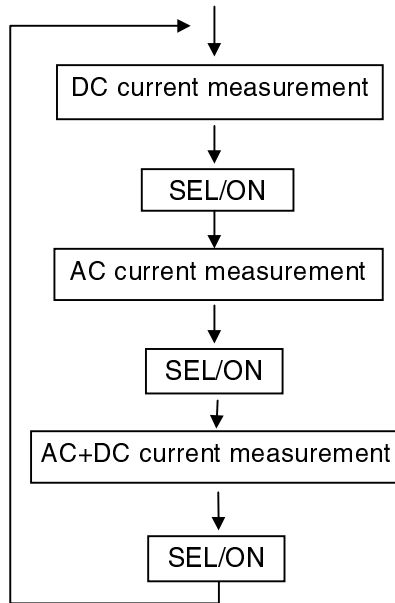
4.1.4. Ω position



4.1.5. ||| position



4.1.6. 5 mA / 50 mA / 500 mA / 10 A positions



4.2. RANGE key

- In AUTO mode to switch to MANUAL mode (short press).
- In MANUAL mode, to select the next range (short press) or return to AUTO mode (long press).
Measurements concerned : AC or DC voltages, capacitance, resistance.
- When making time measurement : if the range change made during previous measurements (voltage) was in manual mode, it may be necessary to adapt this measurement range to the signal level injected at the input. This is why the RANGE key is used to change from one range (voltage) to the next range. The new range is then displayed for 2 seconds.

4.3. REL key

Short press : Mode REL, the last value measured becomes the reference value derived from subsequent measurements.

Long press : When in REL mode, a long press displays the reference being used. This value may be adjusted using the SEL/ON key (selection of digits and a sign) and the RANGE key (increment the selected digit).

4.4. Pk +/- key

The fast positive or negative peak measurement functions (≥ 1 msec.) can be accessed by repeatedly pressing this key in the V_{DC} , mV_{DC} , $5 mA_{DC}$, $50 mA_{DC}$, $500 mA_{DC}$, and $10 A_{DC}$ functions.

4.5. HOLD key

Short press : Fixes the display on the current value.

Long press : Accesses or quits the “autostore” mode. Can be accessed in the V_{DC} , mV, V_{AC} positions.

Autostore

Set the probes on the point to be measured. An audio signal indicates if the measurement is stable. When you remove the probes, a second audible signal indicates that this stable value displayed has been stored.

4.6. PRINT key

This key operates with the optional serial interface for printer or PC :

Short press : Activate / deactivate « send measures to printer » mode at the rate defined by the user.

Long press : Adjust the rate varying from 00000 sec (a single transmission) up to 9h 59 min. 59 sec, using the SEL/ON key (selection of digits) and the RANGE key (increment the selected digit).

5. TECHNICAL SPECIFICATIONS

Only those values assigned tolerances or limits are guaranteed values. Values without tolerances are given for information only (French standard NFC 42670).

{Accuracy : "n%R + nD" means "n% of the reading + n digits" as per IEC 485}

5.1. DC voltages

Selector switch position	Ranges	Accuracy	Input impedance	Protection	Resolution
mV	500 mV	0.1 % R + 2D	10 M Ω	± 1100 VPK*	10 μ V
V _{DC}	5 V	0.1% R + 2D	11 M Ω	± 1100 VPK	100 μ V
	50 V	0.1% R + 2D	10 M Ω	± 1100 VPK	1 mV
	500 V	0.2% R + 2D	10 M Ω	± 1100 VPK	10 mV
	1000 V	0.3% R + 2D	10 M Ω	± 1100 VPK	100 mV

* 1 mn max

Number of points : 50 000 (or 5 000 - refer to § 3.4.)
 Range selection : automatic or manual for the 5 V, 50 V, 500 V, 1000 V ranges
 Common mode rejection : at 50 and 60 Hz, better than 120 dB
 Serial mode rejection : at 50 and 60 Hz, better than 60 dB
 Additional error in Pk +/- mode for a pulse of ≥ 1 ms: 1% R \pm 50 D

5.2. AC voltages (AC and AC+DC)

Selector switch position	Ranges	Accuracy						Input impedance	Protection	Resolution
		DC*	40 Hz to 1 kHz	1 kHz to 4 kHz	4kHz to 10 kHz	10 kHz to 20 kHz	20 kHz to 30 kHz			
		5 % to 100 % full scale			10 % to 100 % full scale					
mV	500 mV *		4%R+3D	//////////	//////////	//////////	10 M Ω	± 1100 VPK**	100 μ V	
V _{AC} or V _{DC}	5 V	1% R + 3 D	2 % R + 3 D		3%R+3 D	11M Ω	± 1100 VPK	1 mV		
	50 V		10 M Ω	± 1100 VPK	10 mV					
500 V	10 M Ω		± 1100 VPK	100 mV						
V _{DC} + SEL/ON	750 V	//////////	//////////	//////////	//////////	10 M Ω	± 1100 VPK	1 V		

* AC + DC only

** 1 mn max

Number of points : 5 000
 Range selection : automatic or manual for the 5 V, 50 V, 500 V, 750 V ranges
 Common mode rejection : at 50 and 60 Hz, better than 80 dB
 Additional error according to crest factor :
 0 % for a crest factor < 1.5
 1 % for a crest factor of 1.5 to 2
 4 % for a crest factor of 2 to 3

5.3. DC current

Selector switch position	Accuracy	Max voltage drop	Protection	Fuses *	Resolution
5 mA	0.2 %R + 2 D	700 mV	600 VRMS	F1 + F2	100 nA
50 mA	0.2 %R + 2 D	700 mV	600 VRMS	F1 + F2	1 μ A
500 mA	0.2 %R + 2 D	1.5 V	600 VRMS	F1 + F2	10 μ A
10 A	0.5 %R + 5 D	500 mV	600 VRMS	F2	1 mA

* refer to fuse specifications section 6.1.1.

Number of points : 50 000 (or 5 000 - refer to § 3.4.)
 Additional error in Pk +/- mode for a pulse width of ≥ 1 ms : 1% R \pm 50 D

5.4. AC currents (AC and AC+DC)


Selector switch position	Accuracy		Max voltage drop	Protection	Fuses *	Resolution
	DC**	40 Hz to 5 kHz				
5 mA	1 % R + 3 D	700 mV	600 VRMS	F1 + F2	1 μ A	
50 mA		700 mV	600 VRMS	F1 + F2	10 μ A	
500 mA		1.5 V	600 VRMS	F1 + F2	100 μ A	
10 A	1.5 % R + 3 D up to 2 kHz		500 mV	600 VRMS	F2	10 mA

* refer to fuse specifications section 6.1.1.

** AC+DC only

Specification : from 5 % to 100 % of the range
 Number of points : 5 000
 Additional error according to crest factor :
 0 % for a crest factor < 1.5
 1 % for a crest factor of 1.5 to 2
 4 % for a crest factor of 2 to 3

5.5. Resistance / Continuity

Ranges	Accuracy	Measurement current	Protection*	Resolution
500 Ω / ϵ 	0.1% R + 5 D	1 mA	600 VRMS	10 m Ω
5 k Ω	0.1% R + 3 D	100 μ A	600 VRMS	100 m Ω
50 k Ω	0.1% R + 3 D	10 μ A	600 VRMS	1 Ω
500 k Ω	0.1% R + 3 D	1 μ A	600 VRMS	10 Ω
5 M Ω **	0.3% R + 3 D	100 nA	600 VRMS	100 Ω
50 M Ω **	1% R + 3 D	10 nA	600 VRMS	1 k Ω

* Overload protection can be reset automatically.

**It is highly recommended to use very short test leads for measurements in this range.

Number of points : 50 000 (or 5 000 - refer to § 3.4.)
 Range selection : automatic or manual (fixed in continuity mode)
 Maximum open circuit voltage : 7 V
 Detection threshold in continuity mode : 10 Ω to 20 Ω
 Response time in continuity mode : 1 ms

5.6. Capacitance



Note *Discharge all capacitors before taking measurements.*

Ranges	Accuracy	Measurement current	Max measurement time	Protection*	Resolution
50 nF**	1% R + 2 D	100 nA	0.5 s	600 VRMS	10 pF
500 nF	1% R + 2 D	1 μ A	0.5 s	600 VRMS	100 pF
5 μ F	1% R + 2 D	10 μ A	0.5 s	600 VRMS	1 nF
50 μ F	1% R + 2 D	100 μ A	0.5 s	600 VRMS	10 nF
500 μ F	1% R + 2 D	1 mA	1.5 s	600 VRMS	100 nF
5 000 μ F	2% R + 2 D	1 mA	3 s/mF	600 VRMS	1 μ F
50 mF	2% R + 2 D	1 mA	3 s/mF	600 VRMS	10 μ F

* Overload protection can be reset automatically.

**It is highly recommended to use very short test leads for measurements in this range.

Number of points : 5 000
 Range selection : automatic or manual
 Maximum open circuit voltage : 7 V

5.7. Diode threshold voltage measurement

Measurable voltages : 0 to 2 V
 Measurement current : 1 mA \pm 20 %
 Resolution : 1 mV
 Protection : 600 VRMS, can be reset automatically

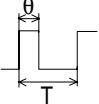
5.8. Frequencies

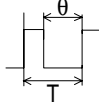
Selector switch setting : V_{AC} + SEL/ON
 Measurement range : 0.62 Hz to 500 kHz
 Accuracy : 0.03 %
 Protection : 1100 VPK
 Display : 50 000 points

RANGE	SENSITIVITY	
		5 V to 500 V
0.62 Hz to 5 kHz *	2 % of range	100 V
5 kHz to 50 kHz	5 % of range	250 V
50 kHz to 500 kHz	10 % of range	//////////

* Rectangular signals

5.9. Duty cycle %+, %-

$$\% + = \frac{\theta}{T} \times 100$$


$$\% - = \frac{\theta}{T} \times 100$$


Resolution : 0.01 %

Minimum duration for θ or $T - \theta$: 2 μ s

Maximum duration for T : 0.8 s

Minimum duration for T : 100 μ s

Absolute error as a % : $\frac{3.10^{-4}}{T}$

Sensitivity : see sensitivity in frequency measurement mode

Absolute additional error on θ , due to the zero crossing slope : $0.1 \times \frac{C}{P}$

with C : V range (C = 5000 V for 1000V_{DC} ou 750 V_{AC} ranges)

with P : slope in V/s

6. GENERAL SPECIFICATIONS

Adjustment

This multimeter incorporates a non-volatile memory containing the adjustment characteristics for all measurement ranges. This enables the instrument to be re-adjusted via a serial link without opening the instrument. It is supplied with a certificate of verification.

Safety

According to IEC 1010-1

Environment

Indoor use

Altitude < 2000 m

Reference temperature 18°C to 28°C

Rated range of use 0°C to 50°C

Limit range of operation -10°C to 60°C

Storage temperature range -40°C to 70°C

Temperature coefficient max 0.1 x accuracy /°K

Relative humidity 0 to 80 % from 0 to 40°C (70 % max for 5 MΩ/50 MΩ)

0 to 70 % from 40°C to 50°C

60 % above 50°C

Casing and circuit self-extinguishing materials

Operating quality IEC 359

Electromagnetic compatibility NF EN 61326-1

Power supply

9 V alkaline battery (6LF22) typical life of 500 hours in V_{DC} mode

Mechanical

Dimensions 189 x 82 x 40 mm Weight 400 g

Packaging

Dimensions 230 x 155 x 65 mm Weight 500 g

Display

Liquid crystal display comprising:

- a 50 000-points display + sign (digits 14 mm high),
- a 34-bar analogue bargraph display,
- appropriate units for each type of measurement,
- triggered mode indicators (relative, ranging),
- battery discharged indicator.

Measurement rate

Digital display 2 measurements/s

Bargraph 20 measurements/s

6.1. Accessories

AC current clamp Model MN251 (200A AC)	Cat# 2115.77
AC current clamp Model MD303 (500A AC)	Cat# 1201.21
AC current clamp Model SR652 (1000A AC)	Cat# 2113.46
DC/AC MicroProbe Model K110 (from 100 μ AC/DC to 300mA AC/450mA DC)	Cat# 2111.73
AC/DC current clamp Model MR410 (400A AC/600A DC)	Cat# 1200.70
Flexible current probe Model 1000-24-1-1 (1000A AC).....	Cat# 2112.39
Replacement leads	Cat# 2118.66
Soft carrying case.....	Cat# 2118.65
Grey holster with handle	Cat# 2118.67
Application software	Cat# 2118.61
Fuse set of 10, 10A, 600V	Cat# 2118.62
Fuse set of 10, 0.63A	Cat# 2118.64