


PORTABLE DIGITAL MULTIMETER

MODEL MX54^{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, for maintenance purposes for example, remember that some internal capacitors can retain a dangerous potential even after the instrument is powered down.
- * If any faults or abnormalities are observed, take the instrument out of service and ensure that it cannot be used until it has been checked out.
- * 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 **0** 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 instrument, 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) family, designed for a high degree of user safety, maximum protection and a hitherto unrivalled performance.


2.1. Selector switch

It is a standalone, handheld professional measuring instrument, capable of measuring the following quantities (accessed by the ten-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,
- * dBm,
- * noise on the 50/60 Hz mains supply,
- * temperature.

2.2. Keypad

An ten-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)
- * select time-domain measurements: frequency, duty cycle, (Hz key)
- * select survey mode to detect minimum, maximum or average value (SURV key)
- * expand the bargraph scale (ZOOM key)
- * activate sending data to a printer (PRINT key)
- * activate back lighting of the display unit ( key)

2.3. Display

The display shows :

- * clearly legible figures (14 mm high)
 - * a 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)
- Display backlight when required in poor lighting conditions. Automatic switch off.

2.4. Power supply

It 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 § 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 , Hz , $^{\circ}\text{C}$	$V\Omega$
10 A	A
μA mA	μA 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 surveillance mode (SURV), peak measurements (Pk +/-) or a data print-out.*

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

( 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 the input impedance for measurements in the mV range :*

Switch on with the rotary switch while holding down the RANGE 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 the μA mA position. Fuse F2 is located in the common circuit. Therefore, V, Ω , C and \rightarrow 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 (refer to 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.

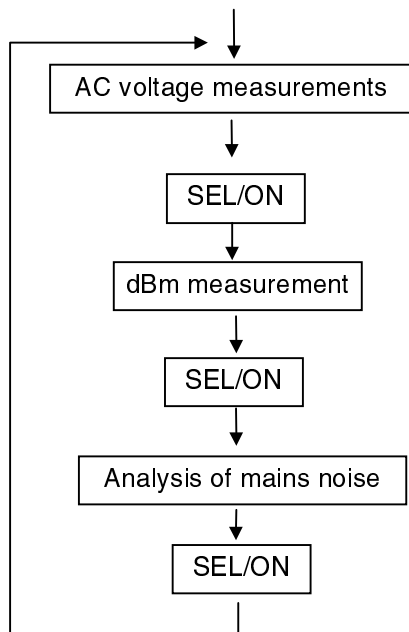
4. FUNCTIONAL DESCRIPTION

4.1. SEL/ON key

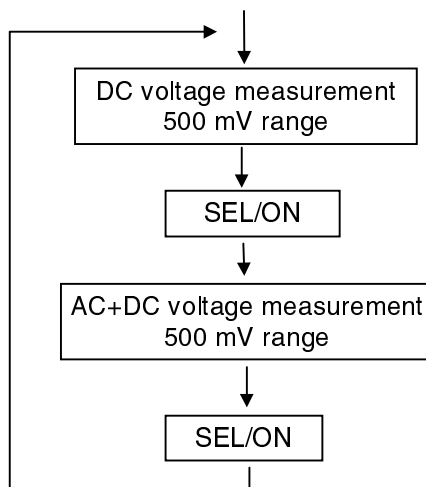
This can be used to switch on the multimeter again after an automatic shutdown. It can also be used to access secondary functions associated with the selector switch positions.

The flowcharts below define these various functions.

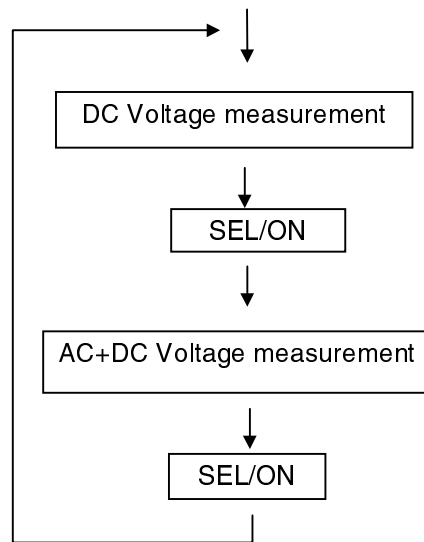
4.1.1. V_{AC} position



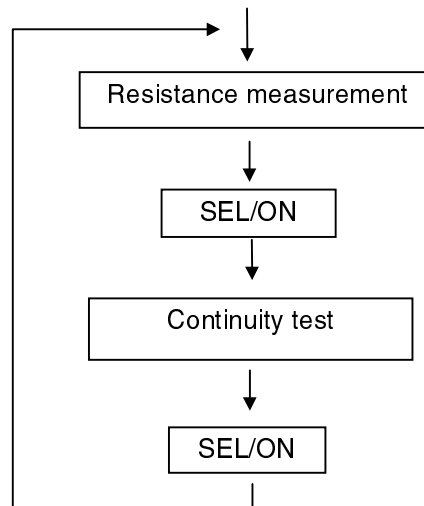
4.1.2. mV position



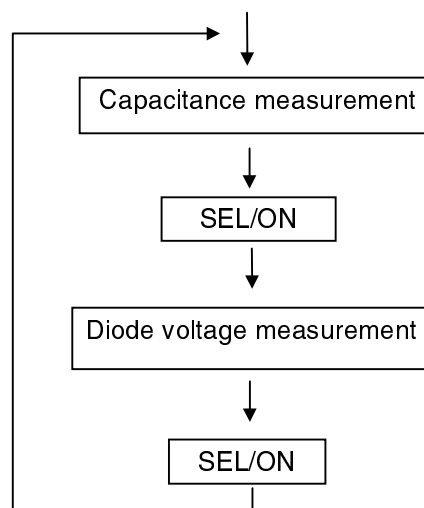
4.1.3. V_{DC} position



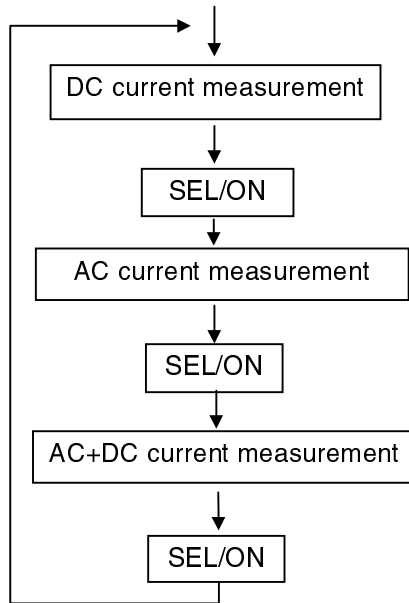
4.1.4. Ω position



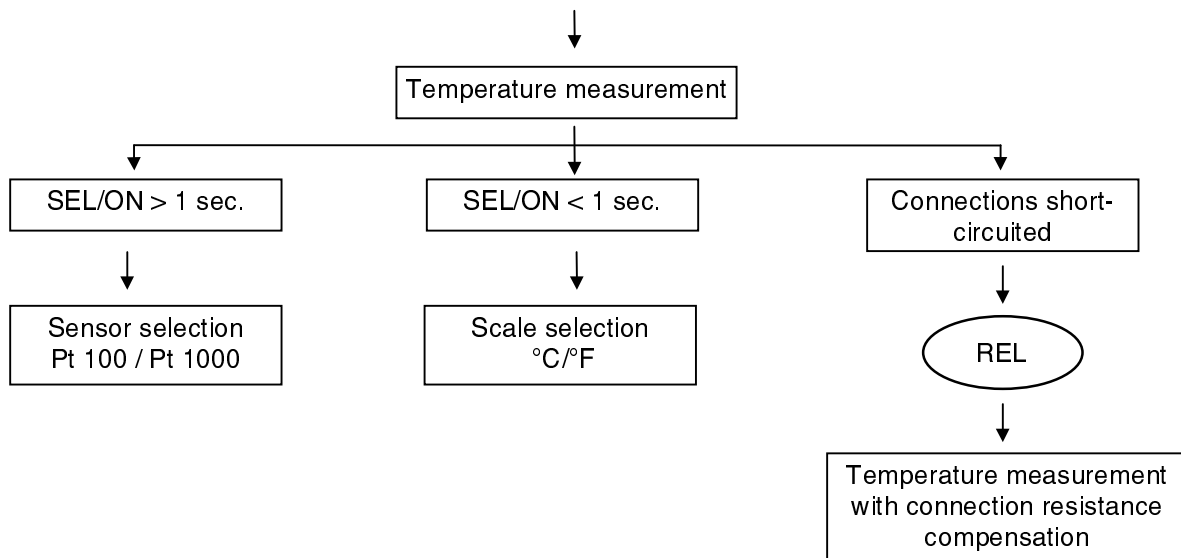
4.1.5. ||| position



4.1.6. μA mA / 10 A positions



4.1.7. °C Position



°C/°F selection and Pt 100 / Pt 1000 selection are saved in non-volatile memory.
Pt 100 selection is indicated by display of Ω symbol and Pt 1000 by display of $k\Omega$ symbol.

4.2. RANGE key

- AUTO mode to switch to MANUAL mode (short press).
- MANUAL mode, to select the next range (short press) or return to AUTO mode (long press).
Measurements concerned : voltages (except 500 mV range), capacitance, resistance, current (except 10 A range).
- When making time measurement (frequency, duty cycle) : if the range change made during previous measurements (Voltage or Current) 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 or Current) to the next range. The new range is then displayed for 2 seconds.

4.3. REL key

Short press : REL mode, the last value measured becomes the reference value derived from subsequent measurements. In temperature measurement the REL key used to compensate the connexions resistance (refer to § 4.1.7.).

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} , 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. ZOOM key

You can press this key to expand the bargraph readout five times for positive measurements and eleven times for bipolar measurements, one centred around zero (centre zero mode).

Adjusts ohm-value references in dB and audio power measurements.

When the current measurement is dB or audio power, you can display the resistance reference with the ZOOM key (long press). This value can then be adjusted using the SEL/ON and RANGE keys. You quit the ohm reference adjustment mode with the ZOOM key (short press).

4.7. SURV key

If you press this key (long press), you access the surveillance mode (or coming out), in which minimum (MIN), maximum (MAX) and sliding average (AVG) values of the current measurement are stored.

You can look up each of these values by repeatedly pressing the same key (short press). The symbols MIN, MAX or AVG flicker with the selected value.



Note *When entering in the SURV mode, non-coherent values may be displayed.*

4.8. Hz key

When the current positions are V_{AC} , V_{DC} , mV, mA and 10 A, the Hz key invokes, in turn :

- frequency measurement,
- positive duty cycle measurement (% +) and negative one (% -).

A long press on Hz key allows a direct selection of the voltage or current function.

4.9. PRINT key

This key operates with optional interface accessory for printer or PC.

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

Long press : adjusts 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).

4.10. key

Activates / deactivates back lighting of the display unit.

It automatically goes off after about 30 seconds.

5. TECHNICAL SPECIFICATIONS

Only those values assigned tolerances or limits are guaranteed values. Values without tolerances are given for information only (French standard NF C 42-670).

{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	0.05%R + 2D	10 MΩ/1GΩ*	± 1100 VPK **	10 μV
V _{DC}	5 V	0.05%R + 2D	11 MΩ	± 1100 VPK	100 μV
	50 V	0.05%R + 2D	10 MΩ	± 1100 VPK	1 mV
	500 V	0.05%R + 2D	10 MΩ	± 1100 VPK	10 mV
	1000 V	0.05%R + 2D	10 MΩ	± 1100 VPK	100 mV

* refer to § 3.4.

** 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 ± 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	4 kHz to 10 kHz	10 kHz to 30 kHz	30 kHz to 50 kHz			
		from 5% to 100% of range			from 10% to 100% of range					
mV + SEL/ON	500 mV*	0.3% R + 30 D	1% R + 30 D	7 % R + 30 D	//////////		10 MΩ/1GΩ ** // 100 pF	±1100V _{PK} ***	10 μV	
V _{AC} or	5 V			2 % R + 30 D	3 % R + 30 D	11 MΩ // 100 pF	± 1100 V _{PK}	100 μV		
	50 V					10 MΩ // 100 pF	± 1100 V _{PK}	1 mV		
V _{DC} +	500 V			10 MΩ // 100 pF	± 1100 V _{PK}	10 mV				
SEL/ON	750 V	//////////	//////////	//////////	//////////	10 MΩ // 100 pF	± 1100 V _{PK}	100 mV		

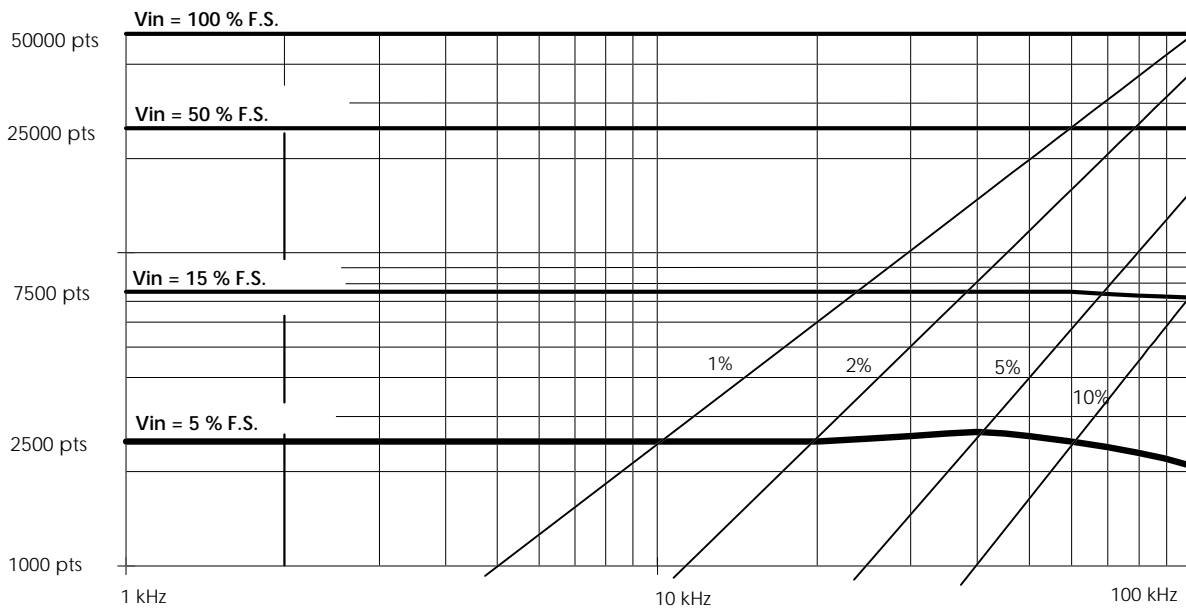
* AC+DC only.

** refer to § 3.4.

*** 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, 750 V ranges
 Common mode rejection : at 50 and 60 Hz, better than 80 dB
 Additional error according to crest factor :
 0.2 % for a crest factor of 2 to 3
 0.5 % for a crest factor of 3 to 6
 (Specification given full scale for a squarewave signal pulse 200 μs wide)

Curve showing typical measurement error (5 V, 50 V, 500 V ranges)



5.3. DC current

Selector switch position	Ranges	Accuracy	Max voltage drop	Protection	Fuses*	Resolution
μA mA	500 μA	0.2%R + 5 D	700 mV	600 VRMS	F1 + F2	10 nA
	5 mA	0.2%R + 2 D	700 mV	600 VRMS	F1 + F2	100 nA
	50 mA	0.05%R + 2 D	700 mV	600 VRMS	F1 + F2	1 μA
	500 mA	0.2%R + 2 D	1.5 V	600 VRMS	F1 + F2	10 μA
10 A	10 A	0.5%R + 5 D	500 mV	600 VRMS	F2	1 mA

* refer to fuse specifications, § 6.1.1.

Number of points : 50 000 (or 5 000, refer to § 3.4)

Range selection : automatic or manual for the 500 μA , 5 mA, 50 mA, 500 mA ranges

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)


Ranges	Accuracy		Protection	Fuses*	Resolution
	DC **	40 Hz to 5 kHz			
		5% to 100% of range			
500 μA		0.75 % R + 30 D	600 VRMS	F1 + F2	10 nA
5 mA		0.6 % R + 30 D	600 VRMS	F1 + F2	100 nA
50 mA			600 VRMS	F1 + F2	1 μA
500 mA		0.7 % R + 30 D	600 VRMS	F1 + F2	10 μA
10 A		1% R + 30 D up to 2 kHz	600 VRMS	F2	1 mA

* refer to fuse specifications, § 6.1.1.

** AC + DC only

Number of points : 50 000 (or 5 000, refer to § 3.4.)
 Range selection : automatic or manual for the 500 μ A, 5 mA, 50 mA, 500 mA ranges
 Additional error according to crest factor :
 0.2 % for a crest factor of 2 to 3
 0.5 % for a crest factor of 3 to 6
 (Specification given full scale for a squarewave signal pulse 200 μ s wide)

5.5. Resistance / Continuity

Ranges	Accuracy	Measurement current	Protection*	Resolution
500 Ω / 	0.07% R + 5 D	1 mA	600 VRMS	10 m Ω
5 k Ω	0.07% R + 2 D	100 μ A	600 VRMS	100 m Ω
50 k Ω	0.07% R + 2 D	10 μ A	600 VRMS	1 Ω
500 k Ω	0.07% R + 2 D	1 μ A	600 VRMS	10 Ω
5 M Ω **	0.3% R + 2 D	100 nA	600 VRMS	100 Ω
50 M Ω **	1% R + 2 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
5000 μ F	1% R + 2 D	1 mA	3 s/mF	600 VRMS	1 μ F
50 mF	1% 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

5.10. Temperature function

- temperature range : -200°C to + 800°C
- resolution : 0.1°C
- accuracy : $\pm 0.5^\circ\text{C}$ from - 125°C to 75°C
 $\pm 1^\circ\text{C}$ from - 150°C to 700°C
- temperature sensors * : platinum probes Pt 100 or Pt 1000
- unity * : °C or °F
- connection* resistance compensation with REL key

* refer to § 4.1.7. for Pt 100 / Pt 1000 selection, °C/°F selection and connection resistance compensation procedure.



5.11. dB function

Displays measured values in dBm relative to a resistance reference which can be adjusted from 1 to 9999 ohms and backed up in non-volatile memory (factory-set to 600 ohms , refer to dressing procedure in § 4.6).

Resolution :	0.01 dB
Absolute error in dB :	$0.09 \times V_{AC}$ relative error as a percent
Additional computation error :	± 0.01 dB
Measurement range :	10 mV _{AC} to 750 V _{AC}
Protection :	± 1100 VPK

5.12. Analysis of noise on the 50/60 Hz mains

This function simultaneously shows :

- Presence of spikes > 80 V, in the 1 kHz - 100 kHz band, by a 3 bar III display next to the  symbol.
- Presence of noise level > 25 V in the 1 kHz - 100 kHz band, by a 3 bar III display next to the  symbol.
- The rms value of the mains voltage (50 or 60 Hz) in the 500 V_{AC} range, accurate to 1 %.

6. GENERAL SPECIFICATIONS

Adjustment

The 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-point 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