369-3247.

MX 573

Multimètre analogique/numérique
Analogue/digital Multimeter
Analog/Digital Multimeter

2000 points - counts - Digits

Notice de fonctionnement
User's manual
Bedienungsanleitung

metrix

IEC 364

NF-C 15 100 / NF-C 18510 / NF-C 18530

WARNING

Hazardous voltages are present in this electrical equipment during operation.
Non observance of the safety instructions can result in severe personal injury or property damage.
Only qualified personnel should work on or around this equipment after becoming thoroughly familiar with all warnings, safety notices, and maintenance procedures contained herein.
The successful and safe operation of this equipment is dependant on proper handling, installation, operation and maintenance.

Qualified person :

A "qualified person" is one who is familiar with the installation, construction and operation of the equipment and the hazards involved.

In addition, he has the following qualifications :
- He is trained and authorized to energize, de-energize, clear, ground and tag circuits and equipment in accordance with established practices.
- He is trained in the proper care and use of protective equipment in accordance with established safety practices.
- He is trained in rendering first aid.

CONTENTS

MX 573

ELECTRONIC MULTIMETER

ANALOG POINTING AND DIGITAL DISPLAY

INSTRUCTION BOOK

PLEASE NOTE

This multimeter is built according to the CEI 414 safety specifications.

The user has complete protection if he respects the instructions contained in this booklet.

However protection will be impaired if these instructions are ignored.

1 – GENERAL

1.1. DESCRIPTION

This combined multimeter is perfectly suited to the needs of electronic engineers (incorporating voltage, current, resistance, decibel, and other functions using accessories).

The measured value is displayed in two ways

- analog : indicated by pointer
- digital : shown on a LCD (segment digit 12.7 mm high and readings up to 1999 counts).

The analog display allows the operator to visualize any change in a measured value.

The tautband movement provides infinite resolution, thus permitting detection and adjustment of minima and maxima with ease.

The digital display is ideal for reading accurate measurements of a constant parameter.

An up-to-date circuitry allows RMS measurement of AC voltage and current.

A high input impedance with a perfect protection added to an automatic polarity reversion will improve the multimeter features.

A single switch is provided to change both range and function, the decimal point position is set on the digital display according to the range.

If the negative sign appears on the digital display this means the polarity is at the VΩ, mA, or 10 A sockets w.r.t. the COM socket.

A continuity check is simply displayed on the 200 Ω range by the pointer reading zero.

This fast check ideal for bad contact and short-circuit detection can be completed with an audible alarm.

The buzzer is operated with the selector switch set to 

A diode test is available which checks the semi-conductor function voltage (reads directly in volts).

The overflow on the digital display when the range is less than the measured value is indicated by blanking of all digits except the 1 at the left hand of the digital display.

If the pointer overshoots the FSD (FSD being 25 % more than the 2000 counts which is the limit of the digital range) it will remain at end stop (analog overflow after graduation is 25 % of analog FSD).

For example : on 200 V digital range, an analog reading of up to 250 V can be read.

1.2. PROTECTION

A 10 A fuse in series with the COM input is fitted to protect against the presence of dangerous voltages on the multimeter circuits and to protect the user.

Generously rated components protect the multimeter against overloads 1000 V DC on V ranges, (500 V on mV ranges) and 380 V AC on all Ω ranges.

Note : On Ω range with nothing connected to the inputs, the pointer is stopped at FSD this does not create any problem for the meter mechanism.

If the user switches from an Ω position to a V position with inputs open-circuited short-circuit the VΩ and COM terminals for fast return of pointer to zero.

(Otherwise the pointer will move back slowly due to the high input impedance of the voltmeter circuits).

2 – SPECIFICATIONS

Only values with tolerances or limits may be considered as guaranteed values, others are given as indication values (NFC 42670 standards).

OPERATING CONDITIONS

- ambient temperature : 23°C ± 2°C
- operating temperature : + 5°C + 40°C
- relative humidity : < 80 % at + 40°C
  (+ 35°C 2 and 20 MΩ ranges)

POWER SUPPLY

1 x 9 V PP 3 type battery
battery life approx. 500 hours (using alkaline battery and on VDC range)

DIMENSIONS : 110 x 45 x 185 mm

MASS : approx. 0,55 kg

READING :

Digital display : 2000 counts (3 1/2 digits)
- 7 segments (liquid crystal)
- digit height 8 mm
- negative sign displayed w.r.t. COM terminal
- decimal point : function of range chosen
- overflow (1/2 digit 1 on, other digits off)
- "B" signals 50 working hours left in battery

Analog indication : scale length 85 mm
25 graduations (160 µV per graduation) continuity check on ohmmeter range (meter pointer at zero and additional buzzer sounder if switched on by the user).

MEASUREMENT RATE : 2.5 / second

COMMON MODE VOLTAGE : 500 V maximum

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DC VOLTAGES

Ranges		Resolution	Accuracy R = Reading C = Count		Permitted overload
analog.	digital	digital	analog. % FSD	digital	
20 mV	(1)200 mV	100 µV	± 2	± (0.1 % R	500 V p
200 mV	200 mV	100 µV	± 1.5	+ 1 C)	5 sec.
2 V	2 V	1 mV	± 1.5	± (0.1 % R	1100 V
20 V	20 V	10 mV	"	+ 1 C)	peak
200 V	200 V	100 mV	"	"	"
1 000 V	1 000 V	1 V	"	± (0,2 % R + 1 C)	"

Input resistance : 10 MΩ
Temperature coefficient : $<$0.1 x accuracy /°C
Series mode rejection AC digital : 50 Hz 60 Hz 60 dB
Common mode rejection digital : 50 - 60 Hz and DC $>$100 dB

RMS AC VOLTAGES

Measurements are made with the AC component only
Crest factor 5 at 1000 counts and 2.5 at 2000 counts

Ranges		Resolution	Accuracy R = Reading C = Count		Permitted overload
analog.	digital	digital	analog. % FSD	digital	
20 mV	(1) 200 mV	100 µV	± 2.5	± (0.6 % R	500 V p
200 mV	200 mV	100 µV	"	+ 3 C)	5 sec.
2 V	2 V	1 mV	± 2.5	± (0.6 % R	1100 V
20 V	20 V	10 mV	"	+ 3 C)	peak
200 V	200 V	100 mV	"	"	or
750 V	750 V	1 V		± (1.5 % R + 3 C)	750 V AC

(1) reduced measurement capacity to 250 points

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Measurement frequency range :

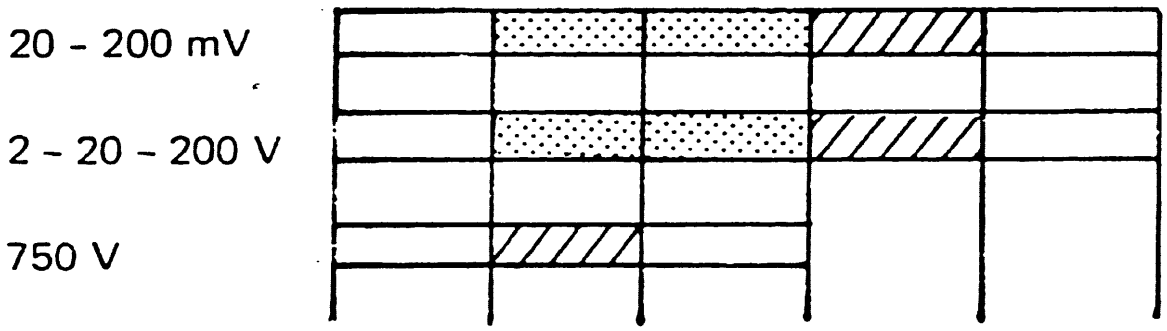
40 Hz ... 3 kHz (40 Hz ... 450 Hz on 750 V range)
For readings inside 5 % to 100 % of the range.

Frequency extension with reduced V AC accuracy

Digital + analog nominal accuracy (see table page 42)

± (1.5 % + 3 counts) (digital) ± 4 % FSD (analog)

± (5 % + 3 counts) (digital) ± 7.5 % FSD (analog)



Input impedance : 1 MΩ
Temperature coefficient : < 0.1 x accuracy /°C
Common mode rejection digital : 50 - 60 Hz 60 dB
Digital acquisition time : 1 sec.

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DECIBELMETER AC RMS

Ranges analog digital	Coverage dB	Resolution	Accuracy (from −10 to +10 dB range) analog % FSD	digital C = Count
− 20 dB	− 45 to − 10	0.1 dB	5	± (1 dB + 3 C)
0 dB	− 25 to + 10	0.1 dB	"	± (0.5 dB + 3 C)
+ 20 dB	− 5 to + 30	0.1 dB	5	± (1.5 dB + 3 C)
+ 40 dB	− 15 to + 50	0.1 dB	"	"

Total digital coverage : − 60 to + 50 dB

Protection : maximum level + 59 dB

Selector switch set to dB position

Function/ranges switch set to V AC or mA AC

Reference 0 dB = 775 mV (0 dBm/600 Ω) for telephone measurement usage - see table dBm/AC voltages page 55).

Temperature coefficient : ± 0.05 dB/°C at 0 dB/600 Ω (digital)

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DC CURRENTS

Ranges analog + digital	Resolution digital	Accuracy R = Reading C = Count analog. % FSD	Accuracy R = Reading C = Count digital	Voltage drop	Permitted overload
200 µA	100 nA	± 1.5	± (0.6 % R + 1 C)	< 0.3 V	250 VAC
2 mA	1 µA	"	"	"	"
20 mA	10 µA	"	"	"	"
200 mA	100 µA	"	± (0.75 % R + 1 C)	"	"
2 A	1 mA	"	"	0.6 V	"
10 A	10 mA	"	"	"	"

Temperature coefficient : < 0.1 x accuracy / °C
Protection : fuses 2 A and 10 A 250 V (2 inputs)

AC RMS CURRENT

Frequency spread : 40 Hz - 450 Hz

Ranges analog + digital	Resolution digital	Accuracy R = Reading C = Count analog. % FSD	Accuracy R = Reading C = Count digital	Voltage drop	Permitted overload
200 µA	100 nA	± 2.5	± (1 % R + 5 C)	< 0.3 V	250 VAC
2 mA	1 µA	"	"	"	"
20 mA	10 µA	"	"	"	"
200 mA	100 µA	"	"	"	"
2 A	1 mA	"	"	0.6 V	"
10 A	10 mA	"	"	"	"

Temperature coefficient : < 0.1 x accuracy / °C
Protection : fuses 2 A and 10 A
Crest factor : 5 at 1000 counts, 2.5 at 2000 counts

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RESISTANCES

Ranges analog. + digital	Resolution digital	Accuracy R = Reading C = Count analog % FSD	Accuracy R = Reading C = Count digital	I measurement	Permitted overload
200 Ω	100 mΩ	± 2.5	± (0.2 % R + 3 C)	1 mA	380 VAC
2 kΩ	1 Ω	± 1.5	± (0.2 % R + 1 C)	0.1 mA	"
20 kΩ	10 Ω	"	"	10 µA	"
200 kΩ	100 Ω	"	"	1 µA	"
2 MΩ	1 kΩ	"	"	0.1 µA	"
20 MΩ	10 kΩ	"	± (1 % R + 1 C)	0.01 µA	"

Temperature coefficient : < 0.1 x accuracy / °C
Voltage on open circuit : 2.8 V approximately

DIODE CHECK

Set function ranges switch to special mark position ⊣◀
Measurement current : 1 mA
Protection : 380 V AC

CONTINUITY CHECK

Set switch selector to 🔊
Visual check : meter pointer to zero
Audible check R ⩽ 20 Ω : the buzzer signals the operator (the buzzer is inhibited when setting the operating selector back to ON).

Note : When switching from a Ω function to a V function range when in open circuits short-circuit VΩ and COM terminals to reset the pointer quickly to zero.

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ACCESSORIES

Delivered with the instrument :

1	Set of leads	AG0476
1	2A medium fuse	AT0078
1	10A fast fuse	AA2346
1	9V battery type 6LF22 (alcaline)	AL0042

Delivered on request :

HF probe (100kHz - 750MHz)			HT 208
3kV AC/DC probe			HT 203
30kVDC probe			HT 212
Temperature probes :			
	environmental use	- 25° C to + 350° C	HK 200
	surface	- 25° C to + 350° C	HK 201
Shunt	30mV	30ADC	HA 303
Shunt	30mV	300ADC	HA 300
Shunt	50mV	50ADC	HA 512
Shunt	50mV	500ADC	HA1029
Transclip		1000A Ø 100 mm	HA 768
Transclip		300A S 11 x 15 mm	AM 010
TV filter probe			HA 902
Grip test leads			HA 932
Carrying case			AE 181
Rubber shock absorber			MC 136
Charger and NiCd 9V battery			HN 207

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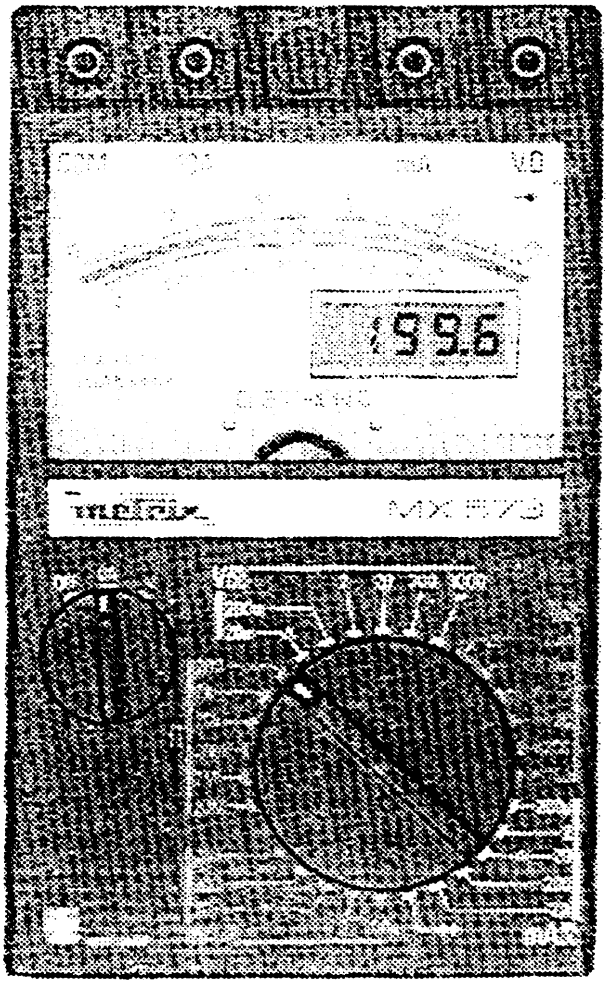

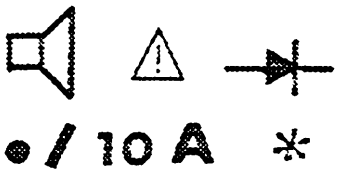

Symbols for use

See working instructions

3 - WORKING INSTRUCTIONS

3.1. SECURITY INSTRUCTIONS

Test leads must be in good conditions. If insulation is defective (burnt, cut, etc ...), replace the leads.

Before changing fuses or battery, disconnect leads from measurement circuit and multimeter terminals.

Never exceed the allowed limits of the instrument.

If the order of magnitude of a measurement is not known, start measuring with the meter in its highest range, then decrease range as necessary. Highest accuracy is obtained when resolution is maximum.

Before function changing, remove the test leads from the measurement points. With the mA function range, do not connect or disconnect the leads from circuit and multimeter before verifying that the circuit is switched off.

It is dangerous to measure directly at certain TV receiver points as pulses attain high values which can damage the instrument. It is preferable to integrate pulses, with the filter probe (see HA 0902 with instructions leaflet).

Avoid measuring resistances when the circuit is on.

3.2. TO REPLACE THE BATTERY

Open the compartment at the back of the instrument, (see illustration page 112).

Slide the lid at the back of the meter to open the battery compartment :

- Pull the stand up
- Press the legs of the stand towards the center
- Slide in the direction of the arrow as shown the stand and the back together, so as to gain access to the battery compartment.

Warning : Remove the leads from the input sockets before accessing the compartment.

Install the 9 V PP3 battery as indicated.

3.3. TO OPERATE THE INSTRUMENT

Set the operating selector switch to position ON.

Analog and digital displays must indicate zero except if the ohmmeter function is selected.

In which case the pointer is at FSD and the digital indication is "overflow" (open circuit $R_X = \infty$).

- If switching from a Ω function to a V function short-circuit VΩ and COM terminals to quickly reset the pointer to zero.

3.4. TO REPLACE THE FUSES

Select the appropriate type :

F101	2 A	5 x 20 semi delayed	AA 2501
F102	10 A	80 000 A	AA 2346

Warning : A wrong fuse replacement will endanger the meter safety.

3.5. MEASUREMENTS

3.5.1. DC VOLTAGE MEASUREMENT

- Connect red and black leads to VΩ and COM terminals respectively.
- Set the range/function switch to the appropriate V DC range from 1000 V down to 20 mV.

Nota : For unknown values start with 1000 V then decrease progressively for maximum resolution (maximum number of digits after the decimal point).

- Measure and take readings as follows :

Ranges	Analog reading	Digital reading	Digital resolution
20 mV DC	mV x 1 scale 0 - 25	19.9 mV 25.0 mV (1)	100 µV
200 mV DC	mV x 10 scale 0 - 25 (2)	199.9 mV	100 µV
2 V DC	V x 0.1 scale 0 - 25 (2)	1.999 V	1 mV
20 V DC	V x 1 scale 0 - 25 (2)	19.99 V	10 mV
200 V DC	V x 10 scale 0 - 25 (2)	199.9 V	100 mV
1 000 V DC *	V x 1 scale 0 * 1 000	1 000 V (3)	1 V

(1) Digital reading capacity limited to ⚠ 250 counts
If analog deviation above 25 mV → pointer is at end stop select 200 mV DC range

(2) Overflow 20 - 25 x range factor : extension for analog reading only (scale 0 - 25)

(3) Digital reading capacity reduced to 1000 counts

3.5.2. AC RMS VOLTAGE MEASUREMENT

- Connect red and black leads to VΩ and COM terminals respectively.
- Set the range/function switch to the appropriate V AC range 750 V down to 20 mV.

Nota : For unknown values start with the 750 V then decrease progressively for maximum resolution (maximum number of digits after the decimal points).

- Measure and take readings as follows :

Ranges	Analog reading	Digital reading	Digital resolution
20 mV AC	mV x 1 scale 0 - 25	19.9 mV 25.0 mV (1)	100 µV
200 mV AC	mV x 10 scale 0 - 25 (2)	199.9 mV	100 µV
2 V AC	V x 0.1 scale 0 - 25 (2)	1.999 V	1 mV
20 V AC	V x 10 scale 0 - 25 (2)	19.99 V	10 mV
200 V AC	V x 10 scale 0 - 25 (2)	199.9 V	100 mV
750 V AC *	V x 1 scale 0 * 1 000	750 V (3)	1 V

(1) Digital reading capacity limited to ⚠ 250 counts
If analog deviation above 25 mV → pointer is at end stop (select range 200 mV DC)

(2) Overflow 20 - 25 x range factor : extension for analog reading only (scale 0 - 25)

(3) Digital reading capacity reduced to 750 counts
Analog reading reduced to 750 (red-mark-on scale 0 - 1000)

3.5.3. DECIBELMETER

- Reference : 0 dB = 775 mV / 600 Ω on 2 V AC range.
- Connect red and black leads to VΩ and COM terminals.
- Set the operating selector switch to dB.
- Set the function range switch to either 200 V AC, 20 V AC, 2 V AC, or 200 mA AC range (start with the 200 V AC) These four ranges are only operated with the dB functions For I AC, 200 mA, 20 mA, 2 mA, 200 µA - see Nota end of page 54.
- Reading is direct with reference to the 2 V AC range only.
- Reading of two levels allows measuring ratios in dB's (see V1 and V2 next page).

Digital reading (*)		Analog reading (*)	
2 V AC (dB) + 15 - 25 counts	2 V AC (ON) (2000 counts	2 V AC dB direct	2 V AC ON scale 0 - 25 (V ÷ 10)
– 025 (1)	.043 V	(3) 25	0.43 (43.6 mV)
– 020 ///	.077 V	(3) 20	0.77 (77.5 mV)
000 ///	.775 V	0	7.75 (775 mV)
+ 010 ///	1 (2)	(3) 10	24,55 (2,455 V)
+ 015 (1)	1 (2)	(3) 15	(4) (4,365 V)
(1) reduced accuracy /// accuracy as indicated page 44	(2) overflow 3 zeros + decimal point blanked	(3) add sign according to digital reading on dB	(4) pointer at scale end

(*) The negative sign displayed must be taken in account

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- Read V_1 and V_2 according to the previous table

  for the range 2 V AC
  add -20 dB if range chosen is 200 mV AC
  (voltage divided by 10)
  add $+20$ dB if range chosen is 20 V AC
  (voltage multiplied by 10)
  add $+40$ dB if range chosen is 200 V AC
  (voltage multiplied by 100)

- Then compare V_1 and V_2

  If $V_2 > V_1$

  $$\text{Gain } \frac{V_2}{V_1} = V_2 \text{ dB} - V_1 \text{ dB}$$

  Positive value means GAIN

  If $V_2 < V_1$

  $$\text{Attenuation } \frac{V_2}{V_1} = V_2 \text{ dB} - V_1 \text{ dB}$$

  Negative value means ATTENUATION

Application :

V_1 digital reading (operating selector switch on dB) : + 10
Range 2 V AC $V_1 = +10$ dB
Set the operating selector to ON read 1 ... (digital overflow)
(2.455 V corresponds to 24.55 divisions on the analog scale 25)

V_2 digital reading (operating selector at dB) -10
Range 200 mV AC :
add -20, $V_2 = -30$ dB
Set the operating selector to ON, digital reading is 024 mV
(24.5 mV corresponds to 2.4 divisions on the analog scale 25)

V_2 dB $- V_1$ dB $= (-30 \text{ dB}) - (+10 \text{ dB}) = -40$ dB

According to the previous considerations minus means attenuation of 40 dB
This result is good for changes from 2.455 V (level V_1) to 24.55 mV (level V_2)

Nota : For I AC measurements in dB this can be realised using same method as for voltages with a 0 dB reference = 0.775 mA (range 2 mA AC)

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dBm measurement (TELEPHONE APPLICATIONS)

Purpose :

Allows a digital RMS measurement - from — 45 to + 55 dBm within the frequency range 400 Hz to 3 kHz (1) (line loaded with 600 Ω - reference 0 dBm = 0.775 V RMS (1 mW). This accessory is specially designed for the telecommunications maintenance engineers (2).

	Veff.				
+ dBm	+ 40	+ 30	+ 20	+ 10	+ 0
0	77.5	24.5	7.75	2.45	0.775
1	87.1	27.5	8.70	2.75	0.871
2	97.6	30.9	9.76	3.09	0.977
3	109.5	34.6	10.95	3.46	1.096
4	122.8	38.9	12.30	3.89	1.230
5	137.8	43.6	13.80	4.36	1.380
6	154.6	48.9	15.50	4.89	1.549
7	173.5	54.9	17.35	5.49	1.738
8	194.6	61.6	19.47	6.16	1.950
9	218(3)	69.0	21.8	6.91	2.19

(1) Frequency limits 400/450 Hz for voltages over 200 V

(2) Values instable are given according to digital ranges (with the best round number)

(3) 245 → + 50 dBm

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	V eff.		mV eff.			
-dBm	– 0	– 10	– 10	– 20	– 30	– 40
0	0.775	0.245		77.5	24.5	7.75
1	0.691	0.218		69.1	21.8	6.91
2	0.616		195.0	61.6	19.50	6.16
3	0.549		173.0	54.9	17.30	5.49
4	0.489		154.0	48.9	15.40	4.89
5	0.436		138.0	43.6	13.80	
6	0.389		123.0	38.9	12.30	
7	0.346		109.0	34.6	10.90	
8	0.309		97.7	30.9	9.77	
9	0.275		87.1	27.5	8.71	

3.5.4. DC CURRENTS MEASUREMENT

- Connect red and black leads to mA and COM terminals if measured current is < 2000 mA (2 A) or to COM and 10 A terminals if measured current is >2 A.
- Set the range/function switch to the convenient range from 2 A to 200 µA (if range 10 A is required set to 20 mA) mA DC sector.
- Connect the multimeter in series with the measurement circuit read the displayed result.

Caution : For unknown values set to the 20 mA (10 A) range then decrease progressively 2 A ... 200 µA for maximum resolution (maximum number of digits after the decimal point)

Ranges	Analog reading	Digital reading	Digital resolution
200 µA	µA x 10 scale 0 - 25 (1)	199.9	100 nA
2 mA	mA x 0.1 scale 0 - 25 (1)	1.999	1 µA
20 mA	mA x 1 scale 0 - 25 (1)	19.99	10 µA
(10 A •)	A x 1 scale 0 - 25 (2)	9.99	10 mA
200 mA	mA x 10 scale 0 - 25 (1)	199.9	100 µA
2 A	A x 0.1 scale 0 - 25 (1)	1.999	1 mA

(1) Overflow 20 - 25 x (multiplication factor) for the analogue scale only

(2) Scale limit : graduation 10 for the 10 A input range only

3.5.5. RMS AC CURRENT MEASUREMENTS

Same procedure as for the DC current except the range switch is set to the mA AC range.

3.5.6. RESISTANCES MEASUREMENT

- Connect red and black leads to VΩ and COM terminals.
- Set the range/function switch to one of the 20 MΩ to 200 Ω ranges.

  Nota : For unknown resistances start on the 20 MΩ then decrease progressively for maximum resolution (maximum number of digits after the decimal point).

- Measure resistance with all voltages disconnected from the terminals and read as follows.

Ranges	Analog reading	Digital reading	Digital resolution
200 Ω (1)	Ω x 10 scale 0 - 25 (2)	199.9 Ω	100 mΩ
2 kΩ	kΩ x 0.1 scale 0 - 25 (2)	1.999 kΩ	1 Ω
20 kΩ	kΩ x 1 scale 0 - 25 (2)	19.99 kΩ	10 Ω
200 kΩ	kΩ x 10 scale 0 - 25 (2)	199.9 kΩ	100 Ω
2 MΩ	MΩ x 0.1 scale 0 - 25 (2)	1.999 MΩ	1 kΩ
20 MΩ	MΩ x 1 scale 0 - 25 (2)	19.99 MΩ	10 kΩ

(1) For continuity check on 200 Ω range : the circuit to be tested is placed across the VΩ and COM terminals
Moreover for fast short-circuit indication, a buzzer indication is given to the user.
The buzzer is activated when R < 20 Ω across VΩ and COM terminals, and when the operating selector switch is set to

(2) Overflow 20 - 25 x (multiplication factor) analog scale only

Nota :

A - When there is no resistance connected across the input or when an overflow occurs, the pointer is at the end of the full scale deviation and the digital display is 1 . . . with three zeros and decimal point blanked.

B - When changing from an Ω function to a V function (open-circuit) short-circuit VΩ and COM terminals so as to speed up the pointer return to zero.

C - Avoid any resistance measurement when voltages are present across the resistance outputs.

3.5.7. DIODES CHECK

- Connect red and black leads to the VΩ →| and COM terminals.
- Set the range function switch to →|

  The multimeter will display the voltage of the semi-conductor junction in volts DC for a 1 mA DC
- Reads from .000 to 1.999 V
- If the diode connection is reversed or open circuited overflow will be displayed.

3.6. ACCESSORIES - WORKING INSTRUCTIONS

3.6.1. HF probe

Frequency range : 100 kHz - 750 MHz

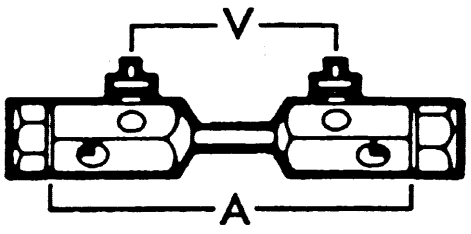
Input : 1 V AC → output : 1 V DC

Range : 250 mV - 50 V DC

Connect the probe to the suitable DC range
(200 V up to 50 V 20 V or 2 V)

3.6.2. Shunts 30 mV and 50 mV

Multimeter
at range 200 mV DC

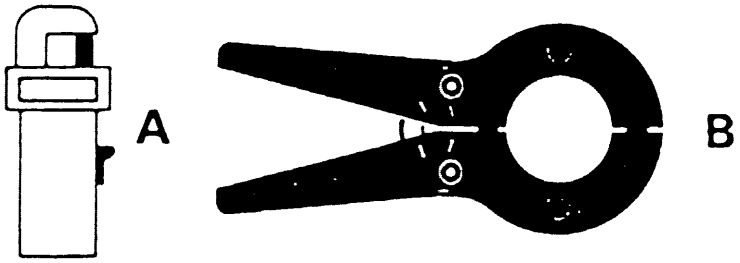


Shunts 30 mV (50 mV)	Analog reading	Digital reading
30 A (50 A)	3 divisions x 10 (1) (5 divisions)	30.0 (50.0)
300 A (500 A)	3 divisions x 100 (1) (5 divisions)	30.0 (50.0) (2)

(1) As a guidance

(2) In that case do not take into account the decimal point position

3.6.3. Clip- on transformers (see specific instructions)



Use multimeter
mA AC function

1000/1 ratio

A - 250 A maximum

Range	Analog reading	Digital reading
200 mA AC	A x 10 scale 0 - 25	199.9 A
2 A AC	(1)	.250 A (2)

(1) The analogue reading not of interest

(2) Direct reading from .200 to .250
without taking into account the decimal point position

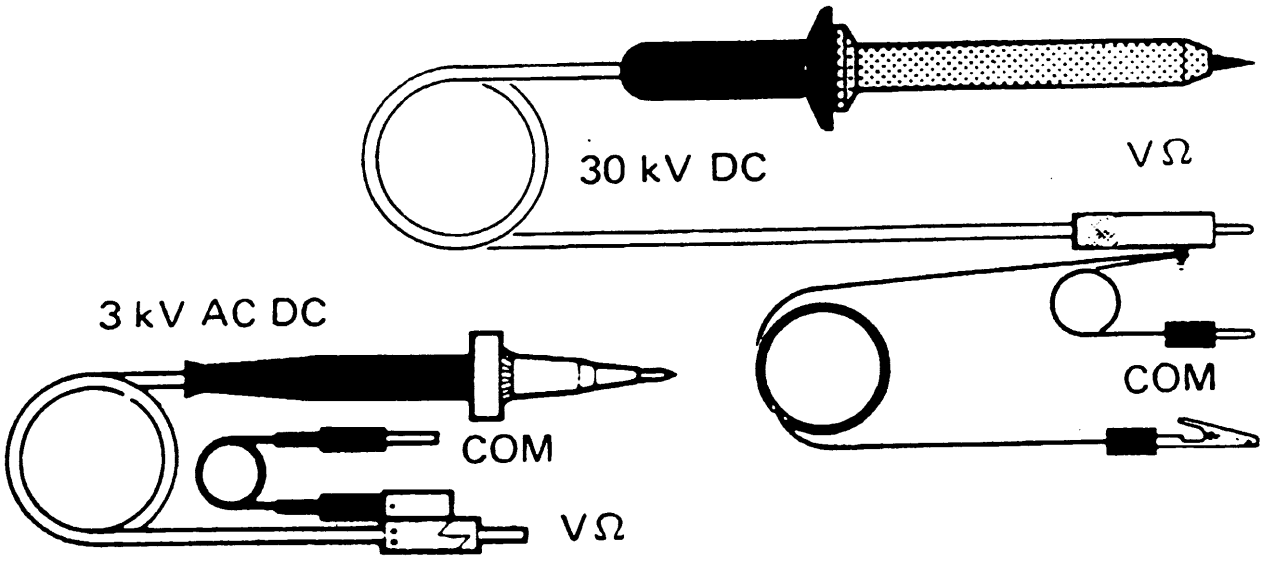
B - 1000 A maximum

Range	Analog reading	Digital reading
2 A AC	A x 100 scale 0 - 25 (1)	1.000 A (2)

(1) Up to division marking 10 (limit 1000 A)

(2) Up to 1000 points
without taking into account the decimal point position

3.6.4. High voltage probes



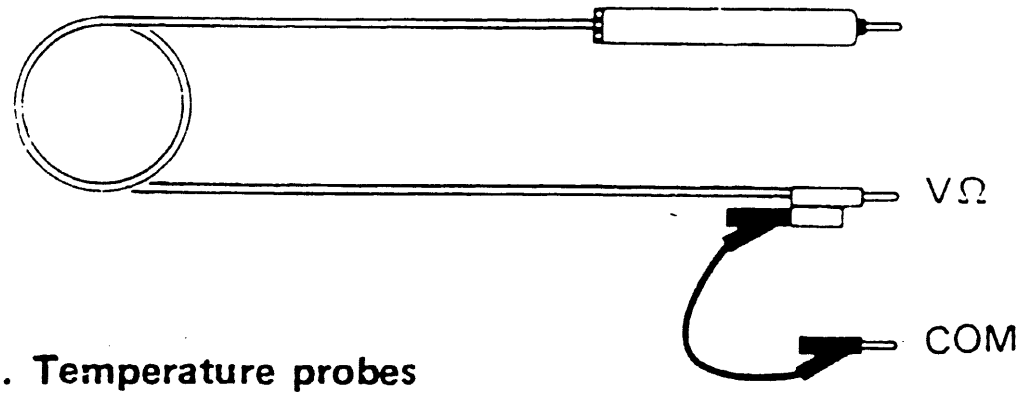
Multimeter Range	Probes connected to COM and VΩ	Digital reading	Analog reading scale 0 - 25
2 V AC or DC	3 kV AC DC 1/1000 ratio	1.999 kV	25 x 0.1 kV
20 V AC or DC	3 kV AC DC 1/1000 ratio	3.00 kV	(1)
20 V DC	30 kV DC 1/100 ratio	19.99 kV	25 kV
200 V DC	30 kV DC 1/100 ratio	30.0 kV	(2)

(1) As a guidance
3 divisions are equal to 3 kV on the analog scale 0 - 25

(2) As a guidance
3 divisions are equal to 30 kV on the analog scale 0 - 25

3.6.5. Filter probe TV use (see specific instructions)

V AC HF peak pulses are eliminated on ranges 200 and 1000 V DC

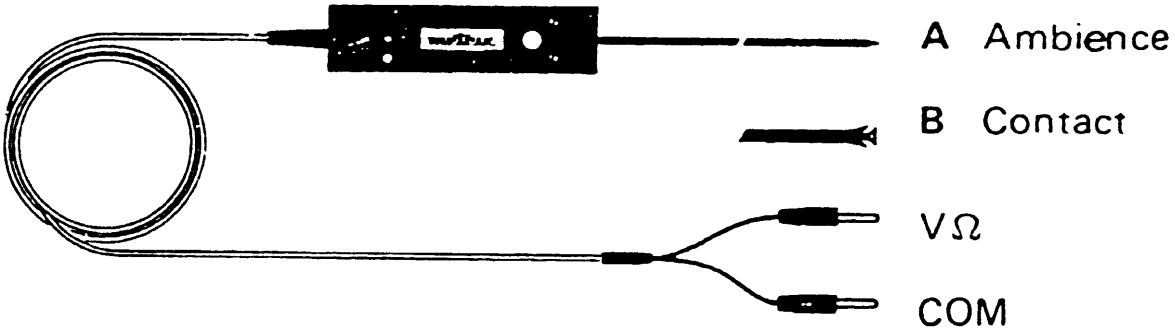


3.6.6. Temperature probes

A - General purpose/Environmental HK 0200

B - Surface HK 0201

Sensitivity : 1 mV DC/°C
Measurement range : − 25 °C up to + 350°C



Multimeter range	Probes	Digital reading	Analog reading scale 0 - 25
200 mV DC	HK 200 / HK 201	199.9°C	25 x 10°C
2 V DC	HK 200 / HK 201	.350°C (1)	(2)

(1) Do not take into account the decimal point position

(2) Analog reading is not of interest

4 - MAINTENANCE - CALIBRATION

Adjustments are needed only if the repair (out of guarantee period) is carried out by the user himself.

4.1. BATTERY

For storing over a long period remove the battery.
If the battery is run down, the indicator "B" displays that there is only 50 hours life left in the battery.

4.2. AUTOCHECKING OF FUSES

Can be done externally without opening the multimeter. With the multimeter turned on, open the back so as to gain access to the fuses on the printed circuit board.

To check fuse continuity :

For F101 :
2 A, connect mA socket to VΩ socket.
Set the function/range switch to →|
and read .600 (1 x V_{BE} of the protection diodes)
If reading is 1 "overflow" fuse F101 is blown.

For F102 :
10 A, connect COM socket to VΩ socket
Read 00.0 (± 1 digit)
If reading is 1 "overflow" fuse F102 is blown.

4.3. CALIBRATION

1) If the LSI Z103 device is replaced, instrument has to be recalibrated (respect the order).

2) For any recalibration is required, the instrument must be powered with 9 V DC.

Pilot clock pulse frequency R122 :

Connect a periodmeter to pin 21 of Z103. Frequency must be 50 Hz (40000 Hz/800). Adjust R122 to read 20 ms ± 0.1 % (periodmeter display).

"Battery exhausted" threshold R130 :

Apply with a variable DC source 7 . . 9 V to the multimeter battery terminals.

- Adjust R130 to display "B" when DC source is exactly 7.2 V (required threshold)

Analog DC zero reset range 20 mV DC R115 :

- Connect VΩ socket to COM socket and set the range/ function switch to 20 mV DC.
- Adjust R115 for minimum deviation of the meter pointer.

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Nota : For the following adjustments the standard sources must be chosen with a better than 10 accuracy of the ranges to be calibrated.

Reference voltage (digital adjustment) R104

- Set the range/function switch to 200 mV DC.
- Connect the VΩ socket to the COM socket and check that the display is 00.0.
- Connect 190 mV DC to VΩ and COM sockets, adjust R104 to read 190.0.
- Reverse the source polarity and check that — 190.0 is displayed.

Reference voltage (analog adjustment) R109

- Check pointer deflection w.r.t. the division 19.
- Adjust R109 to improve the coincidence.

Range 20 mV DC (analog calibration) R112

- Connect 19 mV DC to VΩ and COM sockets.
- Set the range/function switch to 20 mV DC.
- Check pointer deflection w.r.t. the division 19.
- Adjust R112 to improve the coincidence

Range 1000 V DC (analog calibration) R245

- Connect 900 V DC to 1000 V and COM sockets.
- Set the range/function switch to 1000 V DC.
- Check pointer deflection w.r.t. the division 900 (scale 1000)
- Adjust R245 to improve the coincidence.

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Digital AC zero reset range 200 mV AC R219

- Connect VΩ socket to COM socket and set the range/function switch to 200 mV AC.
- Adjust R219 for minimum display (less than ± 2 counts).

Digital 200 mV AC range calibration R213

- Connect 190 mV AC to VΩ and COM sockets.
- Set the range/function switch to 200 mV AC.
- Adjust R213 to display 190.0.

0 dB and 20 dB levels calibration R240 - R241

- Connect 775 mV AC to VΩ and COM sockets.
- Set the range/function switch to 2 V AC and the operating selector switch to dB.
- Adjust R240 to display ± 00.0 dB.
- Connect 77.5 mV AC to VΩ and COM sockets. Adjust R241 to display — 20.0 dB.

Analog 2 kΩ range calibration R215

- Connect 1.9 kΩ (standard resistance) to VΩ and COM sockets.
- Set the range/function switch to 2 kΩ
- Adjust R215 for meter pointer to display division 19.

Buzzer warning threshold adjustment on range 200 Ω R138

- Connect 20 Ω (standard resistance) to VΩ and COM sockets.
- Set the range/function switch to 200 Ω
- Adjust R138 for buzzer threshold limit.

4.4. PRINCIPLE – SPECIAL FEATURES

The multimeter consists of :

- input circuits
- the LSI Z103
- the 7 segments display unit Z105
- the power supply 9 V DC (PP 3 battery)
- the buzzer circuit Z107 LS101
- the logical display circuit Z106

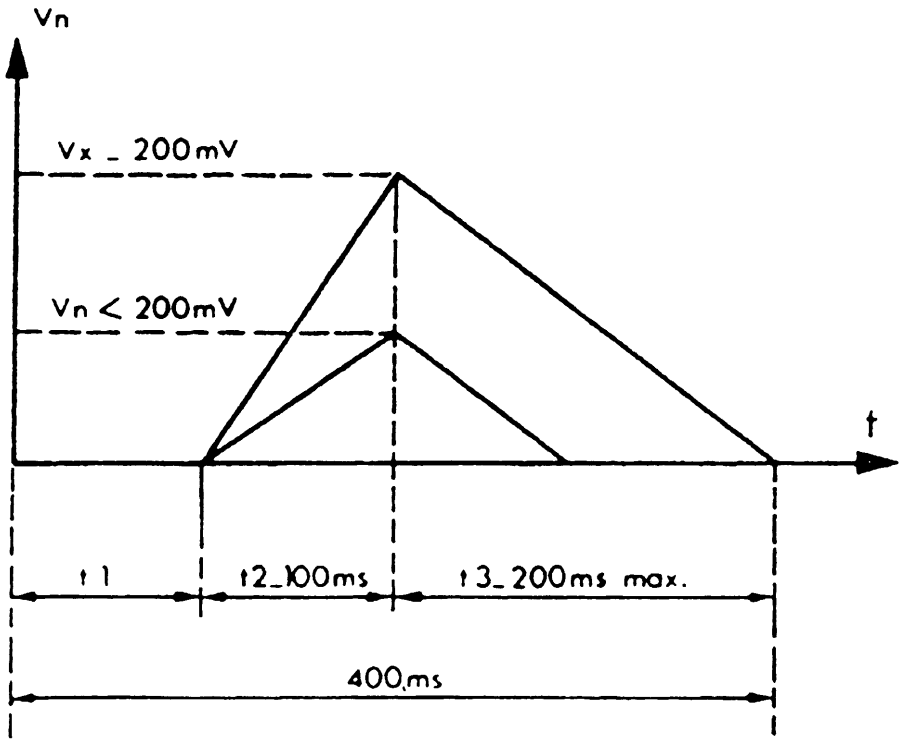
4.4.1. Z103 LSI

Z103 circuit is a LSI circuit (low power with high scale integration) which drives the display (3 1/2 digits 7 segments liquid crystal).

This circuit includes :

- the analog digital converter, (double ramp)
- the counting circuits, the display control
- the reference voltage and a 40 kHz clock pulse adjusted by R222.

This 40 kHz clock is divided by 4 to give count pulses of 100 μs.



During t1 reset to zero (amplifier input grounded, analog circuits offset compensated).

During t2 - V_X is integrated for 1000 cycles of the clock pulse t2 = 1000 . 100 μs = 100 ms.

V_X (in the range 0 to 200 mV) is directly proportional to the measured value.

During t3 the reference voltage is integrated. At the beginning of this sequence, the integrator input is switched from V_X to V_{ref}.

During t2 the reference voltage polarity is determined by polarity of V_X.

The sum of counted pulses from the beginning of the T3 cycle and the moment when the output of the integrator reaches 0 is proportional to the V_X input voltage thus :

$$N = V_X / V_{ref.} \times 1000$$

if V_X = 200 mV and $V_{ref.}$ = 100 mV N = 2000

4.4.2. RESISTANCE MEASUREMENT

Ohmmeter principle consists of a digital ratio measurement and an accurate analogue current generator.

The current generator is comprised of Z201, R215, R216, Q206, R214, R217, CR206.

The current I which feeds R_X and R_{std} reference (R204) generates a voltage drop IR_X and IR_{std}.

V_X across R_X is directly applied to pins IN + (31) and IN — (30) of Z103.

V_{std} from R_{std} reference is applied to pins + Ref. (36) and — Ref. (35) of Z103.

Since the number of counted pulses is equal to :

$N = V_X / V_{Ref.}$ (see following paragraph)

$N = (I R_X / I R_{std})\ 1000 = (R_X / R_{std})\ 1000$

N (number of impulsions) does not depend upon the standard resistance (digital function mode)

The Z107 Q103 circuit generates if required on range 200 Ω and when $R_X \leqslant 20\ \Omega$:

An audible signal (operating selector set to) which signals the user using an internal buzzer LS101.

4.4.3. RMS converter Z204

Operating selector switch allows the choice of one the two outputs of Z204 :

- in position ON a linear output is provided at pin 10 of Z204 which feeds the input + V_X (IN +) pin 31 of Z103
- in position dB a logarithmic output is provided at pin 7 of Z204 which feeds the input + V_X (IN +) pin 31 of Z103 (input – V_X (IN –) pin 30 grounded).

All dB ranges display a decimal point which is activated by Z104.