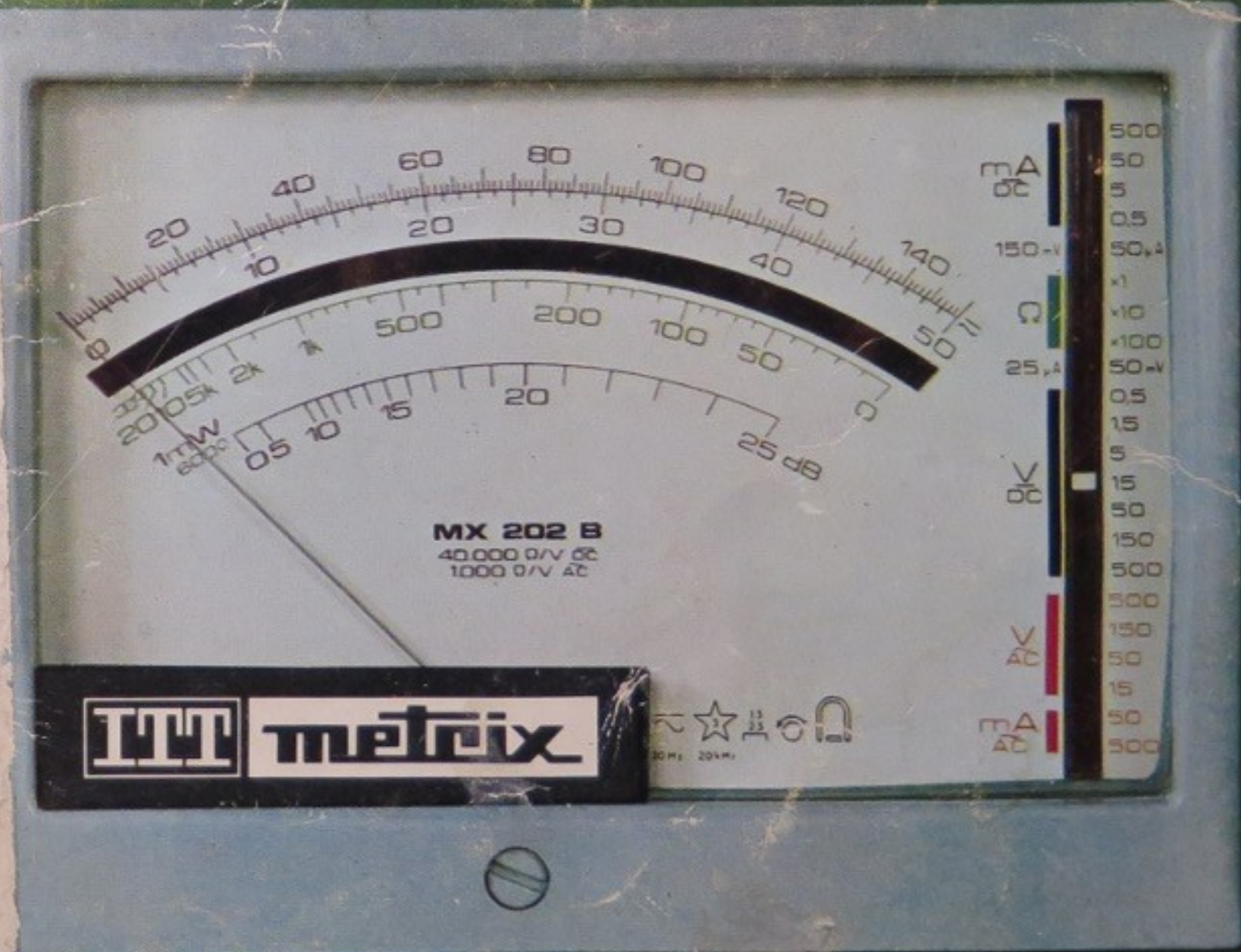




Type-offset, Vaccines, Annexes



TO AVOID THE MORE USUAL FAULTS WHEN USING MULTI-RANGE METERS

- 1 - Make sure that the pointer indicates exactly zero on the scale before attempting any measurement.
- 2 - Never switch to Ω or to mA current functions when testing voltages.
- 3 - If the order of a measurement is unknown start on the highest range and switch down afterwards if necessary.
- 4 - T.V. receivers : Never connect the instrument directly to the plate of the line frequency output tube. At this point a high voltage sawtooth superposed on the DC may damage the meter.
To measure the booster voltage take it at the base of the line frequency transformer.
- 5 - When using the split core transformer, never change ranges with the transformer in place.
High voltage induced transients may damage the transformer.
- 6 - The meter indications are correct on AC only for sine wave voltages and currents. Distorted and complex waveforms can only be measured with an oscilloscope. Incorrect results will be obtained when measuring for instance the output of a saturated reactor voltage regulator.
- 7 - Do not linger when measuring currents above 1.5 A.
- 8 - From time to time test the ohm function : Switch to $\Omega \times 1$ range, short the two test prods and check that the pointer indicates 0 Ω on the ohm scale ; if it fails replace the dry cell at once.

CONTENTS

- Specifications — To fit the dry cell and replace the fuse ...
- DC current measurements — With shunts added
- Resistance measurements — Printed circuit board
- DC volt measurements — With probe —
Illumination measurements
- AC volt and decibel measurements — With probe
- AC current measurements — With various accessories
- Schematic diagram — replaceable parts list
- Accessories on demand page 16

mA
DC

150mV

Ω

* 50mV

V
DC

V
AC

mA
AC

2

3

4

5

6

7

8

9

10

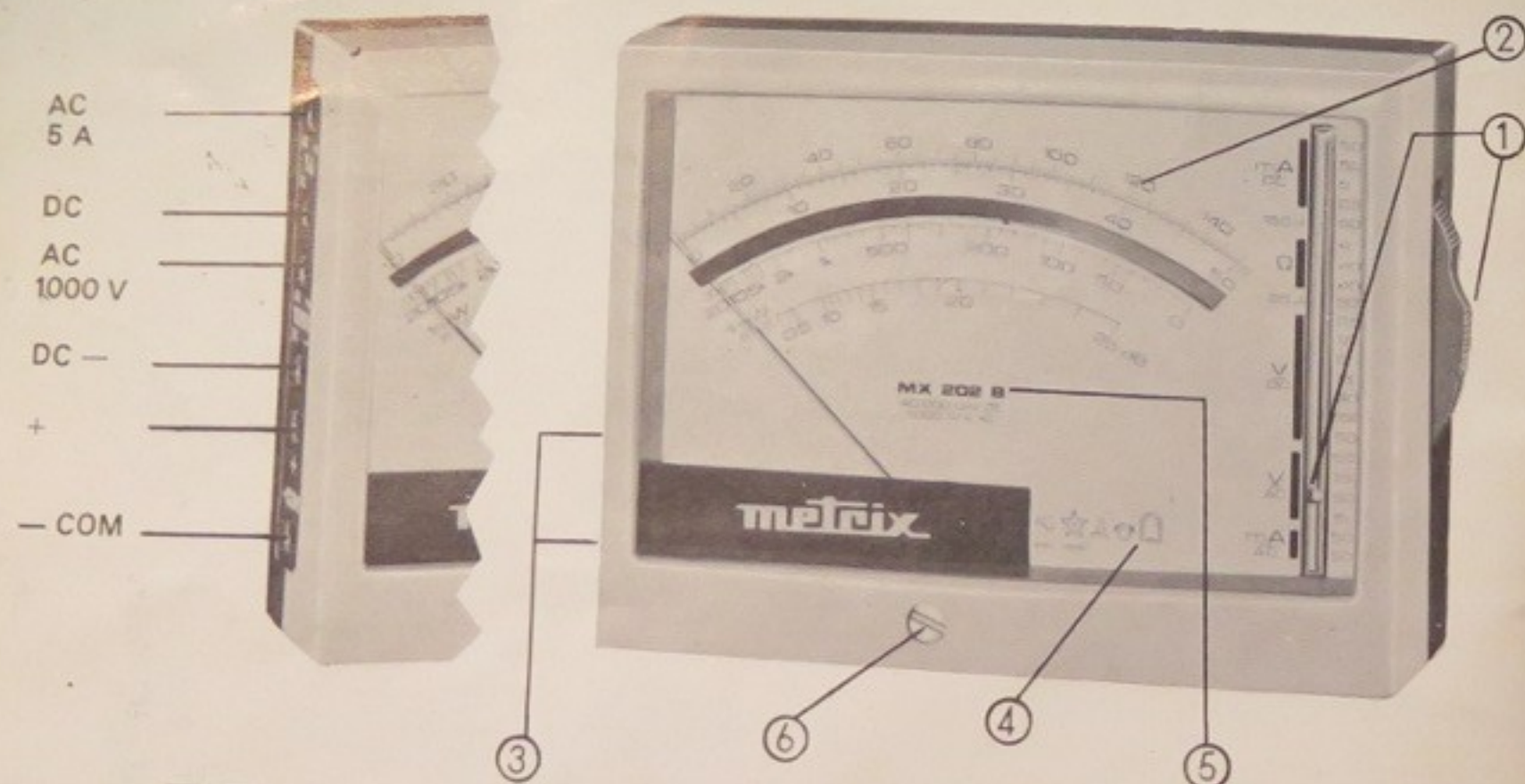
11

12

13

14

15



FEATURES

- ① Range indicator ganged to the thumb selector.
- ② Single linear 4" scale for all measurements. Direct reading.
- ③ Two terminal connection for all ranges.
- ④ Shock protected taut band meter.
- ⑤ 40,000 Ω/V DC. Low voltage drop on current ranges.
- ⑥ Zero set screw.

- Modern style case. Extra-large dial.
- Very good frequency response up to 20 KHz.
- Ohmmeter without zero adjustment.
- Whole instrument protected by diodes and fuse.
- Width : 5 3/4" - Depth : 4 1/8" - Height : 2 1/16"
- Net weight : 1 1/2 lb.

DRY CELL

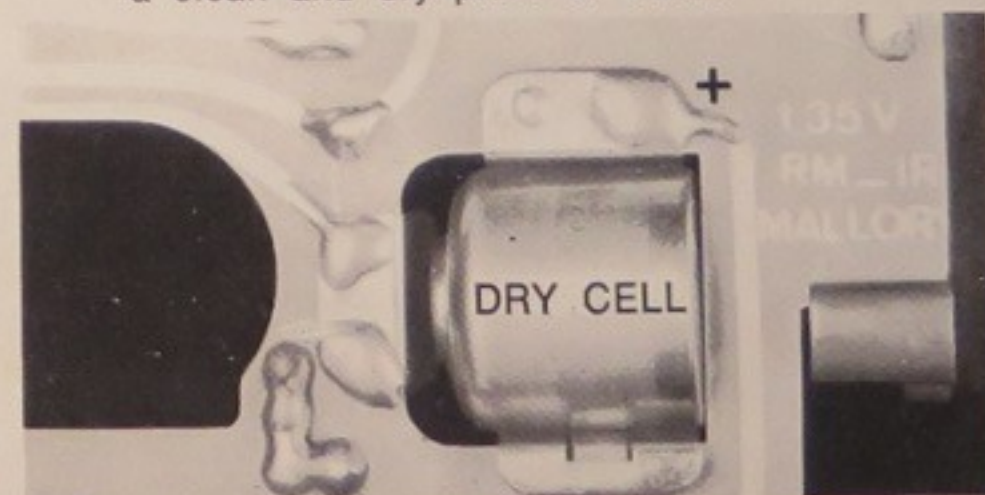
The BT1 dry cell to power this instrument is lodged inside the plastic foam packing case. Proceed as follows to fit it into MX 202 B.

① Gain access into the instrument :

Unscrew the two screws at the rear and remove the back screw side first.

② Replace the dry cell :

The BT1 dry cell is easily accessible. Polarity must be respected. When the instrument is not in use and to avoid corroded contacts remove the dry cell from MX 202 B and replace it into its plastic foam compartment. Twice yearly clean the cell with a clean and dry piece of cloth.



③ To replace the fuse :

Remove the back as explained in ①. Unscrew the two fuse screws ; fit a new length of the same fuse wire. A coil of spare fuse wire is kept under printed circuit board (See F 1 page 7).

SPECIFICATIONS :

Currents :

DC ranges : 25 μA to 5 A
AC ranges : 50 mA to 5 A
Voltage drop : from 50 mV to 350 mV

Voltages :

DC ranges : 50 mV to 1,000 V
AC ranges : 15 V to 1,000 V
Sensitivity : 40,000 Ω/V (DC)
1,000 Ω/V (AC)
Frequency response : 2.5 %
30 Hz to 20 KHz

Accuracy :

± 1.5 % FSD (DC)
 ± 2.5 % FSD (AC)

Decibels :

Ranges : 0 + 25 ; + 10 + 35 ;
+ 20 + 45 ; + 30 + 55 dB
0 dB = 1 mW in 600 Ω

Lighting intensities :

(using accessory)
0 — 300 foot candles

Resistances :

10 Ω to 2 M Ω in 3 ranges
Centre scale : 270 Ω ; 2.7 and 27 K Ω

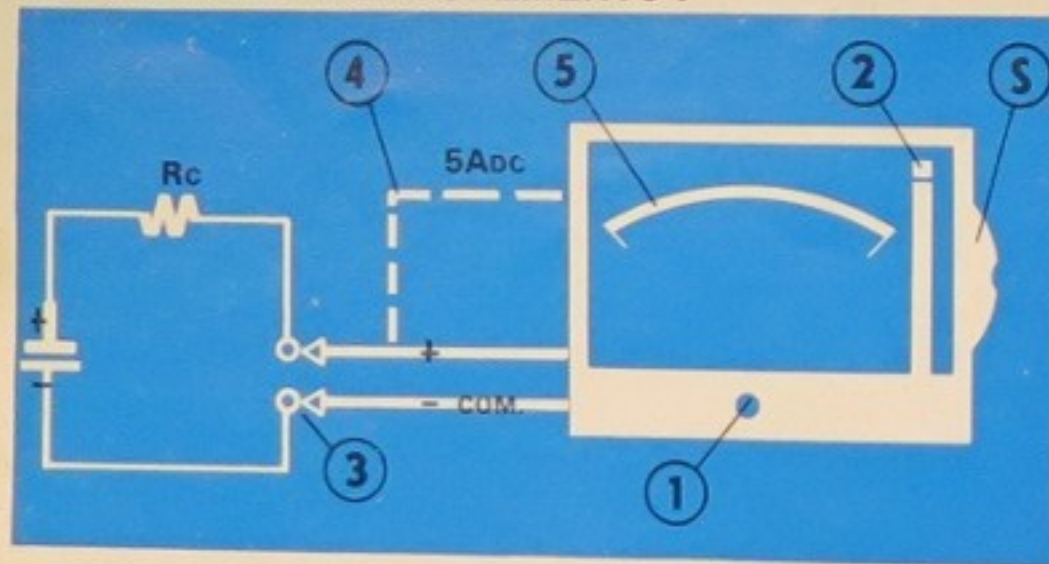
Accessories delivered with instrument :

- Set of test prod leads ref. AG 44
- BT1 dry cell ref. AL 18

Optional accessories :

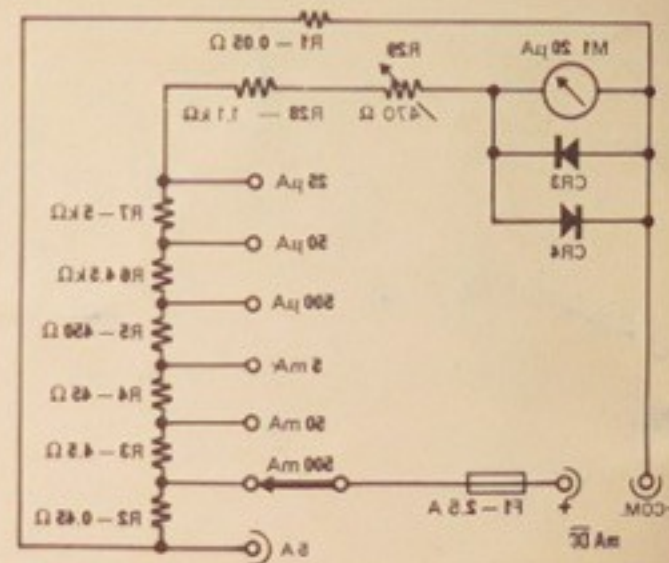
(See page 16)

DC CURRENT MEASUREMENTS :

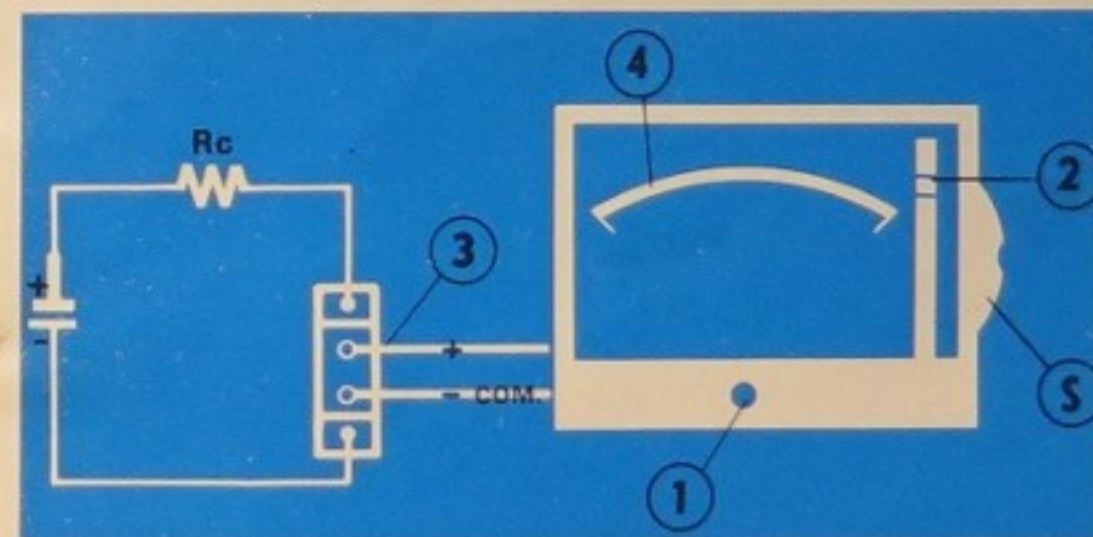




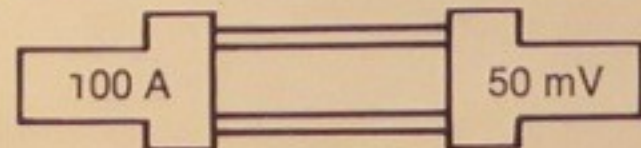
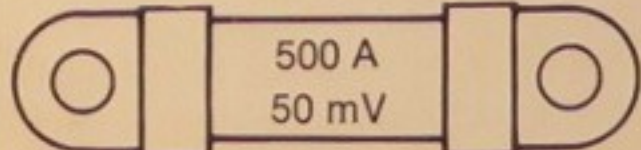
- Check that pointer is at zero, if not adjust by turning the screw.
- Revolve thumb selector (S) until index indicates the appropriate mA DC range.
- Check that polarity is correct when connecting leads as shown on diagram.
- Do not plug test lead into « + » jack when using the meter on range 5 A. Plug it into 5 A jack (dotted line).
- Read scale « 0 - 50 » as indicated in table.

Range in use	Reading	Corresponding volt drop
5 A	in Amps and divide by 10	250 mV
500 mA	in mA and multiply by 10	350 mV
50 mA	in mA directly	250 mV
5 mA	in mA and divide by 10	250 mV
0.5 mA	in mA and divide by 100	250 mV
50 μ A	in μ A directly	150 mV
25 μ A	in μ A and divide by 2	50 mV



WITH SHUNTS ADDED

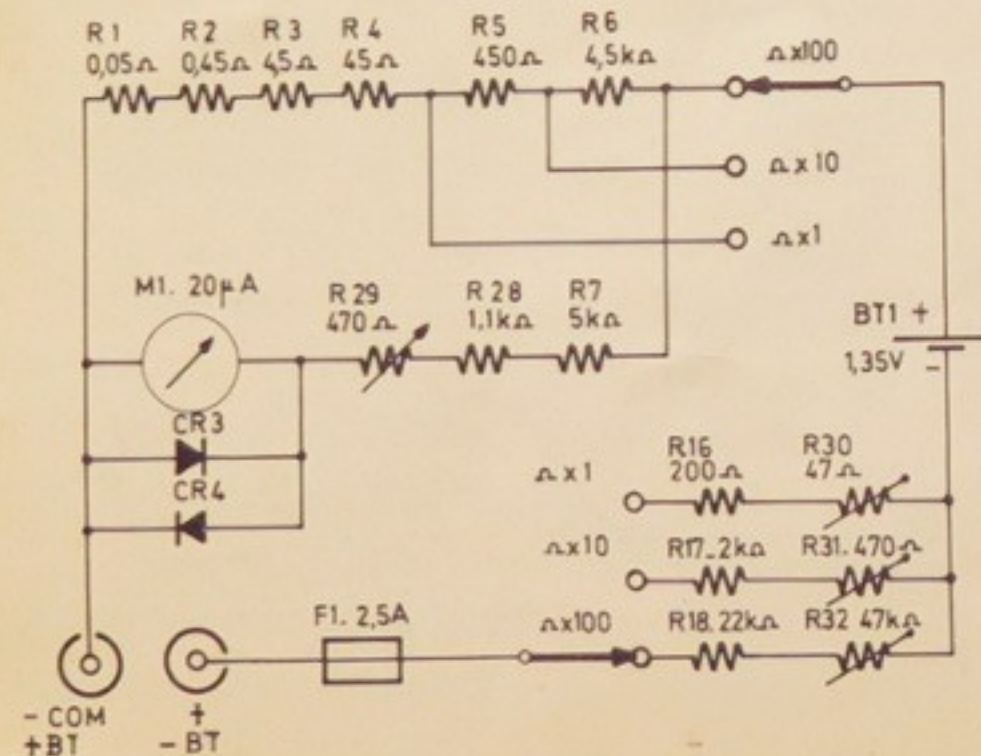
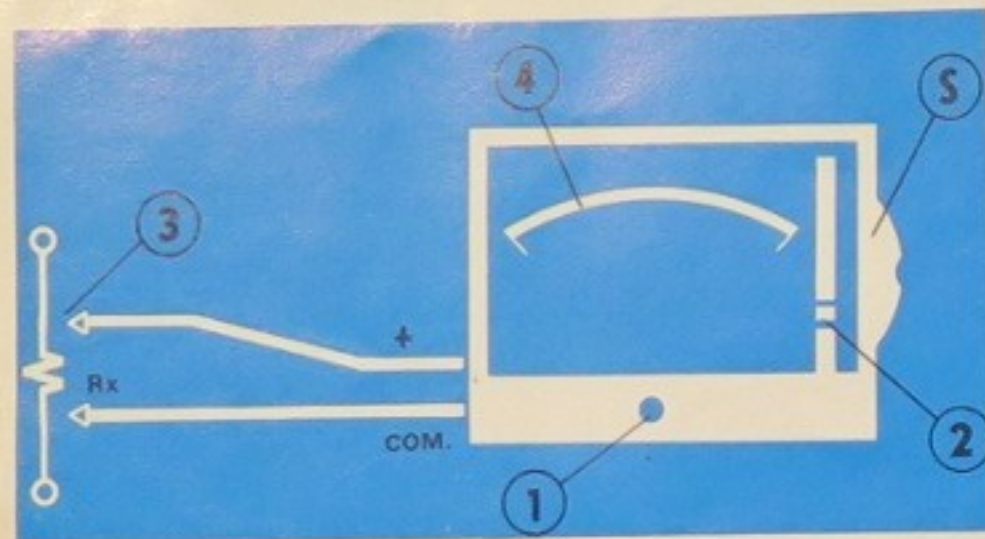


Shunt in use	Ref.	Reading
10 A  50 mV	XHA 514	Divide by 5
50 A  50 mV	XHA 512	Direct
100 A  50 mV	XHA 511	Multiply by 2
500 A  50 mV	XHA 350	Multiply by 10

- Check that pointer is at zero, if not adjust by turning the screw.
- Revolve thumb selector (S) until index indicates 50 mV 25 μ A DC.
- Check that polarity is correct when connecting leads as shown on diagram.
- Read scale "0 — 50" as indicated in table.

Optional : 50/60 mV shunt adaptor ref. HA 824 (see page 16).

RESISTANCE MEASUREMENTS

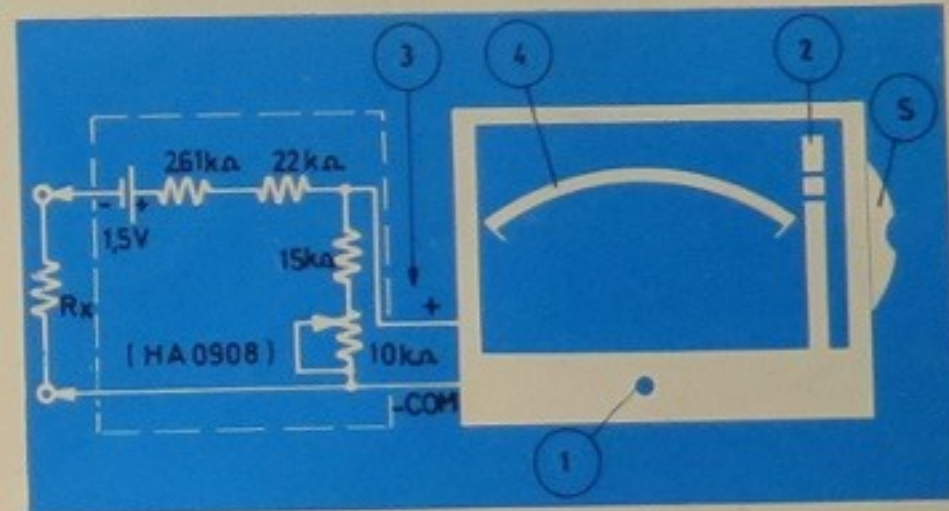


- ① Check that pointer is at zero, if not adjust by turning the screw.
- ② Revolve thumb selector (S) until index indicates the proper Ω range ($\times 1$, $\times 10$, $\times 100$).
- ③ Check the power cell by shortening the two test prods. Replace the dry cell if the pointer does not reach zero ohm.
- ④ Make sure that there is no voltage across the resistance to be tested. Polarity is of no importance.
- ⑤ Read the green ohm scale either directly if index is set on $\times 1$ or multiply by 10 or by 100 if index is set on $\times 10$ or $\times 100$.

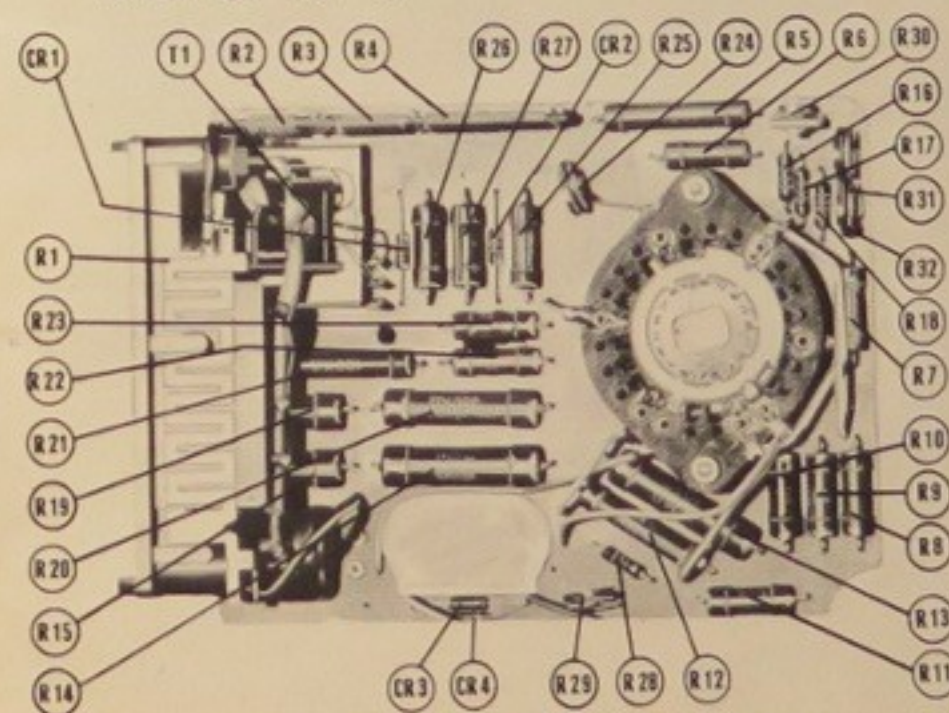
To increase the resistance range of measurements:

(with optional HA 968 adaptor)

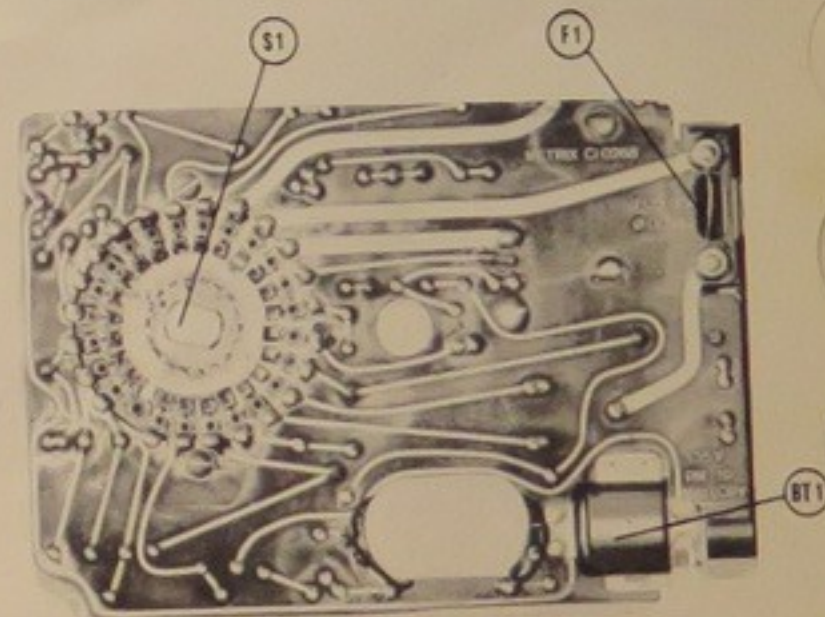
- ① Check that pointer is at zero, if not adjust by turning the screw.
- ② Revolve thumb selector (S) until index indicates $25\mu\text{A}$ 50 mV DC.
- ③ Connect adaptor ref. HA 908 as shown in schematic diagram.
- ④ Read on the green ohm scale and multiply readings by 1,000.



— Range : 10 K Ω - 20 M Ω
centre scale : 270 K Ω

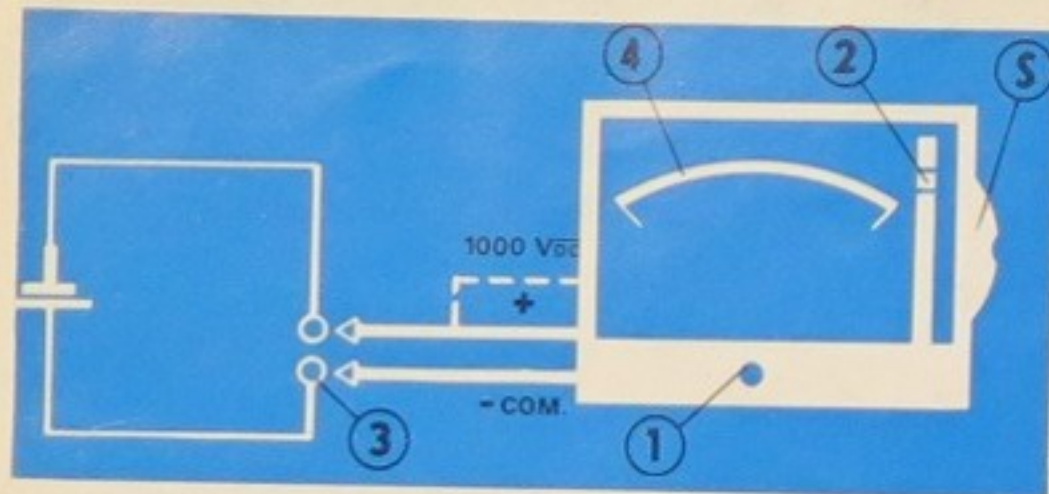


Printed circuit board (top side)

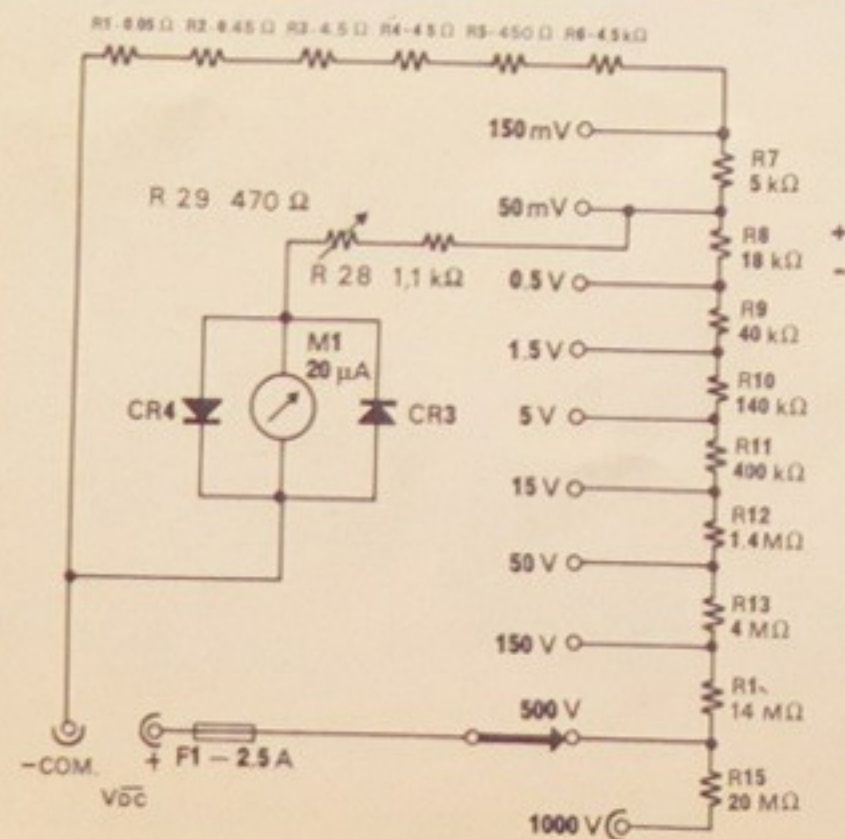


Printed circuit board (upside down)

DC VOLTAGE MEASUREMENTS

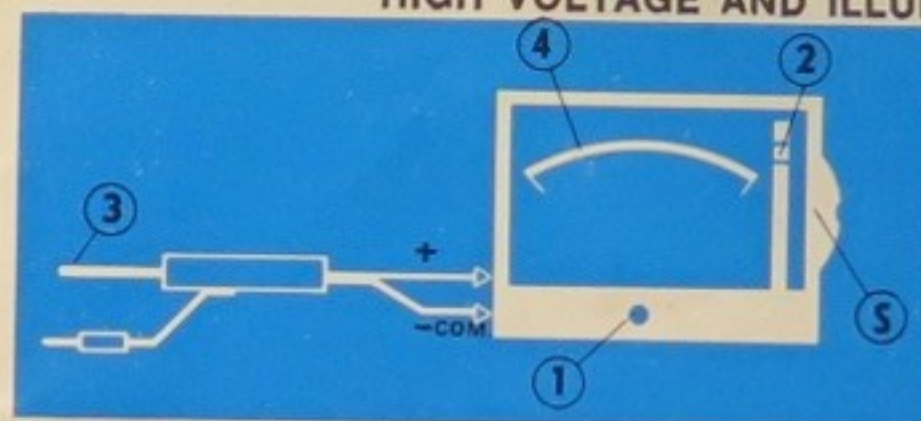


- 1 Check that pointer is at zero, if not adjust by turning the screw.
- 2 Revolve thumb selector (S) until index indicates V DC.
- 3 Check that polarity is correct (When connecting " + " lead to " 1,000 V jack " ; set index on V DC range, read on scale " 0—50 " and multiply readings by 20).

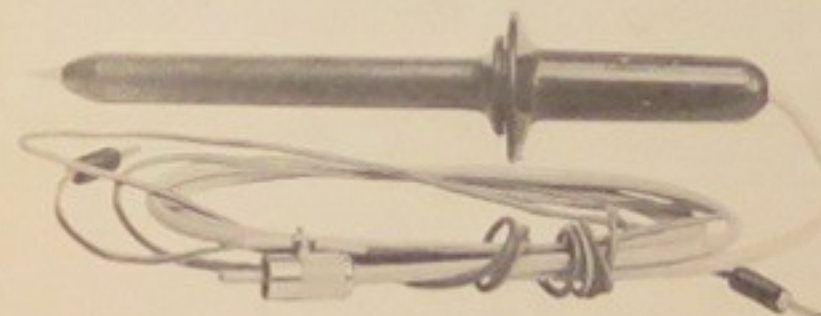


Range in use	Red on scale	Reading
150 mV	0 — 150	in mV directly
50 mV	0 — 50	in mV directly
0.5 V	0 — 50	in Volt and divide by 100
1.5 V	0 — 150	in Volt and divide by 100
5 V	0 — 50	in Volt and divide by 10
15 V	0 — 150	in Volt and divide by 10
50 V	0 — 50	in Volt directly
150 V	0 — 150	in Volt directly
500 V	0 — 50	in Volt and divide by 10

HIGH VOLTAGE AND ILLUMINATION MEASUREMENTS



High voltage probes

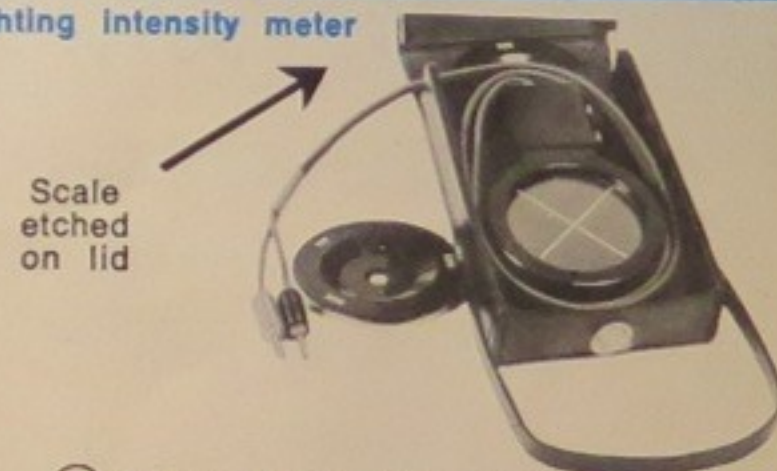


- 1 Check that pointer is at zero, if not adjust by turning the screw.
- 2 Revolve thumb selector (S) until index indicates 150 mV DC.
- 3 Check that polarity is correct. (Probe connected to high voltage side).
- 4 Read as indicated in table below :

Probe in use	Read on scale	Reading
5 KV	0 — 50	in Volt and multiply by 100
30 KV	0 — 150	in Volt and multiply by 200

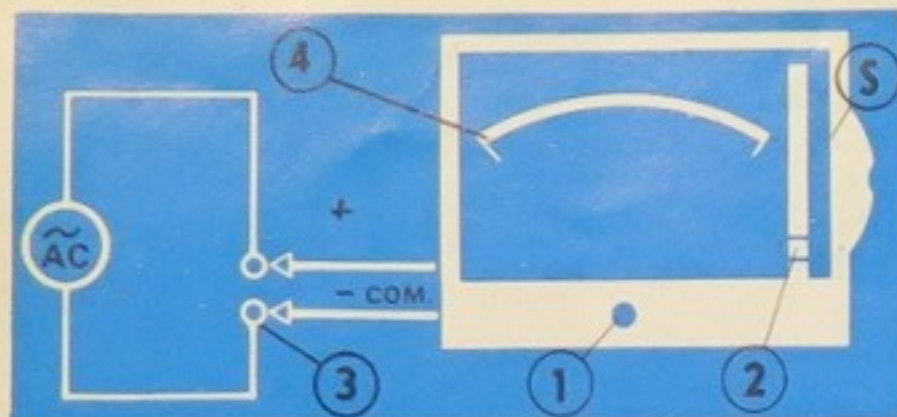


Lighting intensity meter



- 1 Check that pointer is at zero, if not adjust by turning the screw.
- 2 Revolve thumb selector (S) until index indicates 50 mV DC.
- 3 Check that polarity is correct.
- 4 Read on MX 202 B top scale "0 — 150" and follow instructions supplied with the photocell accessory.

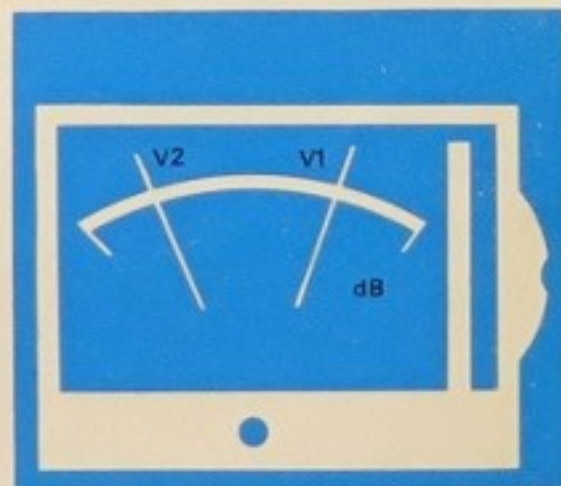
Note : One foot candle is approx. equal to ten lux.



AC VOLTAGE and DECIBEL MEASUREMENTS

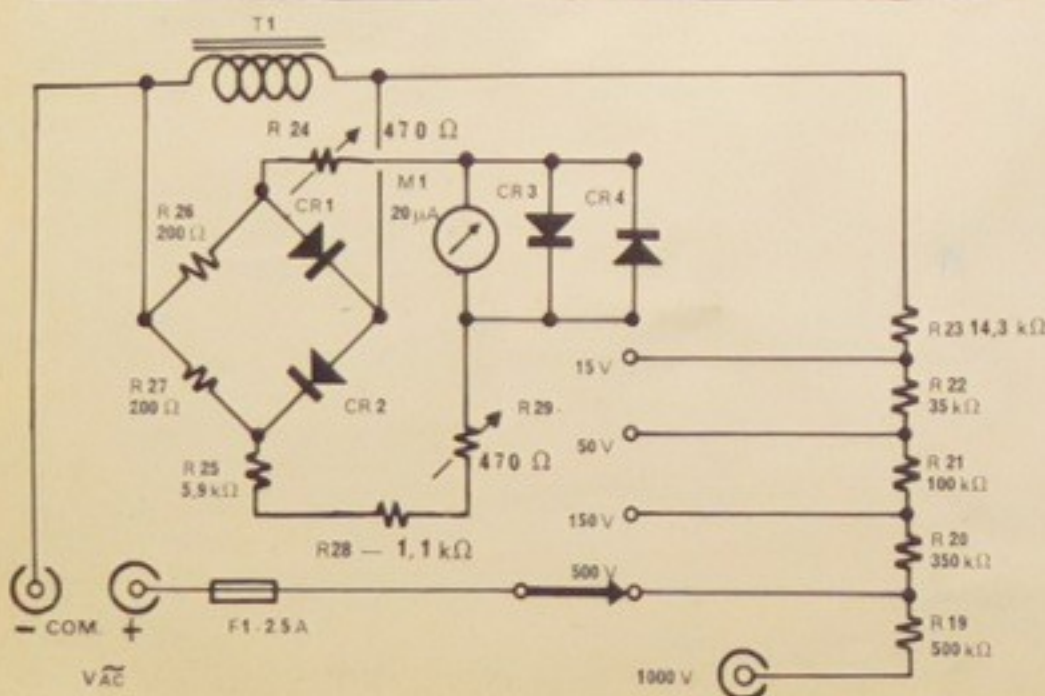
- ① Check that pointer is at zero, if not adjust by turning the screw.
- ② Revolve thumb selector (S) until index indicates the appropriate V AC range. Polarity is of no importance.
- ③ Read in Volt or in Decibel as indicated in table.

Index at	Read on scale	Volts readings	Decibels readings
15 V	0 — 150	divide by 10	direct on dB scale
50 V	0 — 50	direct	Add 10 dB to reading
150 V	0 — 150	direct	Add 20 dB to reading
500 V	0 — 50	multiply by 10	Add 30 dB to reading



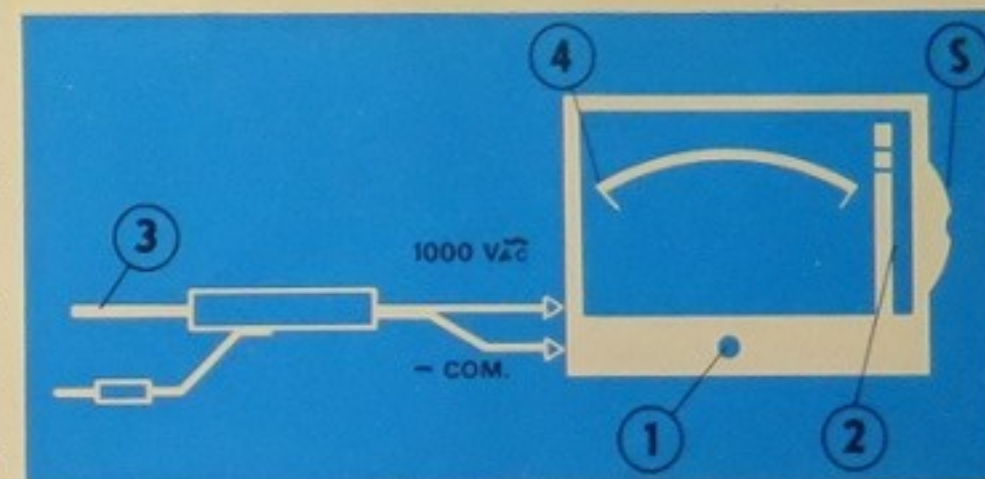
The dB gain corresponding to two AC voltage levels V1 and V2 (V1 is higher than V2, see above diagram) is equal to V1 dB reading minus V2 dB reading.

Note: Readings are carried out according to instructions ① ② ③. $0\text{ dB} = 1\text{ mV in } 600\ \Omega$.



USE OF 1,000 V JACK AND HIGH VOLTAGE PROBE

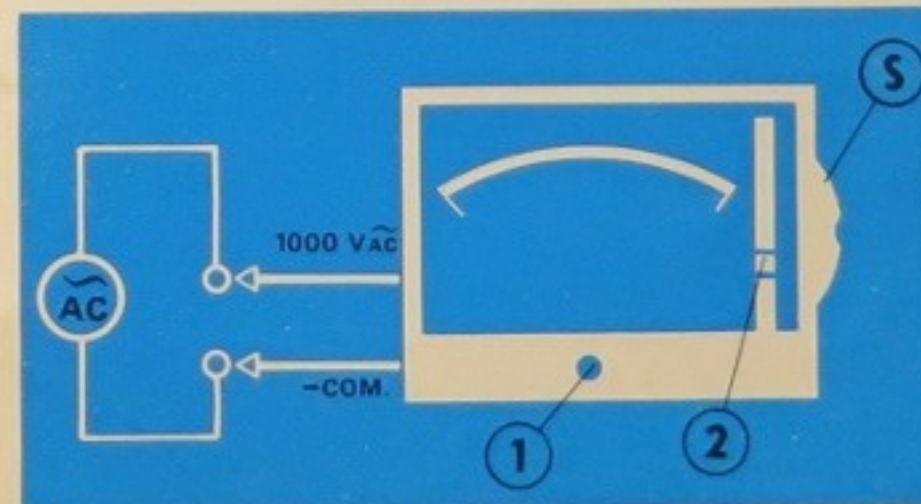
- ① Check that pointer is at zero, if not adjust by turning the screw.
- ② Revolve thumb selector (S) to set index to the appropriate V AC range.
- ③ Connect test probe leads to jacks "1,000 V AC" and "— COM" as shown on opposite diagram. Polarity is of no importance.
- ④ Read directly in Volts on scale 0 — 150 and multiply by 20.



XHA 762 probe

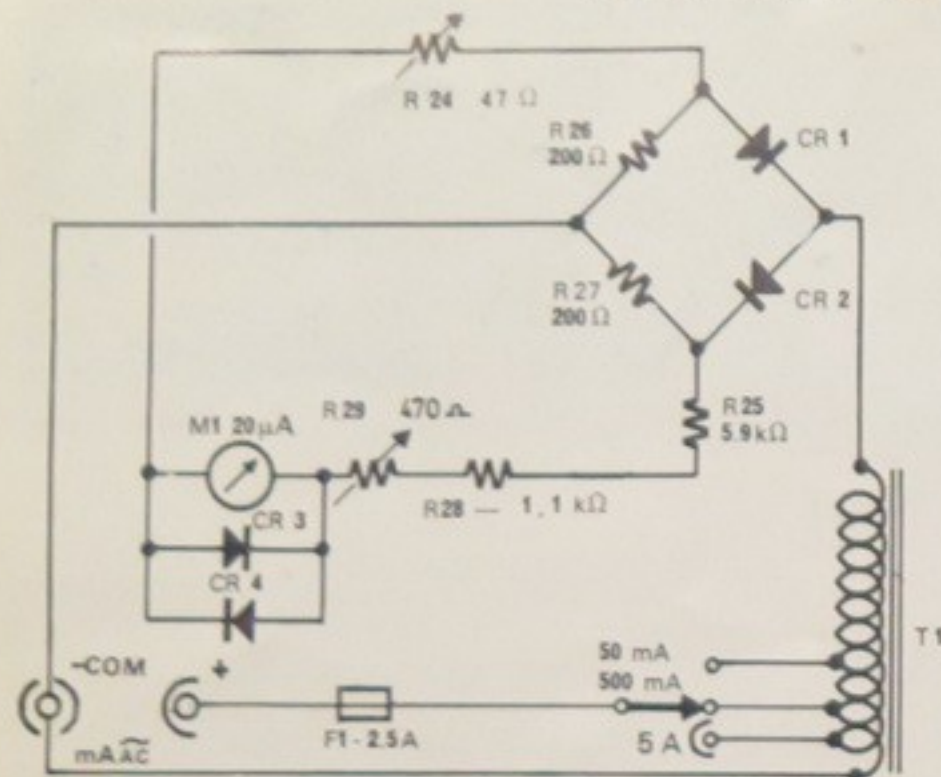


1,000 V AC jack

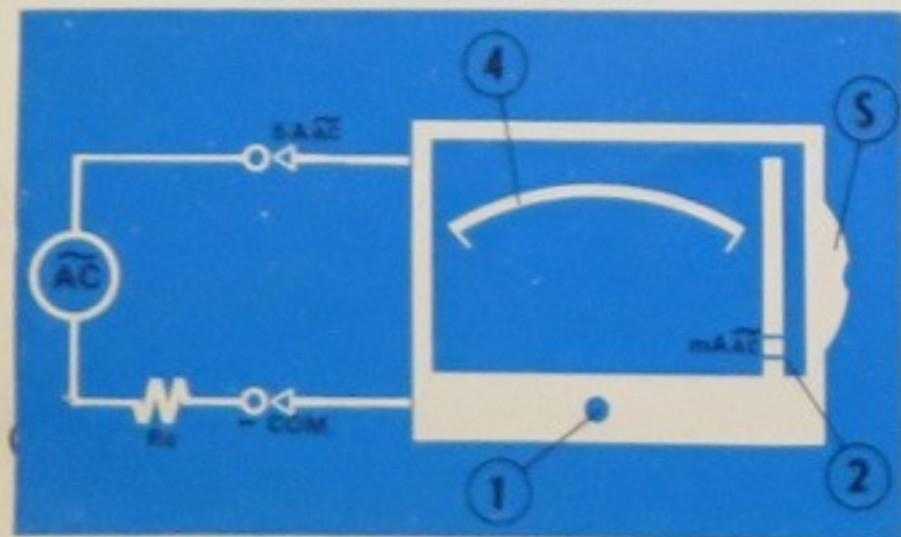


- ① Check that pointer is at zero, if not adjust by turning the screw.
- ② Revolve thumb selector to set index to the appropriate V AC range (Set it to 15 V when in RF voltages).
- ③ Connect leads to jacks "1,000 V AC" and "— COM". Check polarity.
- ④ Read in volts on "0 — 50" scale and multiply readings by 20.

AC CURRENT MEASUREMENTS



5 A AC connection



Low currents

- ① Check that pointer is at zero, if not adjust by turning the screw.
- ② Revolve thumb selector (S) to set index to the appropriate mA AC range.
- ③ Polarity is of no importance
- ④ Read as indicated in table below:

Range	Scale	Readings	Volt drop
50 mA 500 mA	0 — 50	Read directly Multiply by 10	130 mV

Currents up to 5 A (with 5 A AC jack)

Operations ① ② ③ as above.

- ④ Connect test leads as shown on left hand side diagram.
- ⑤ Read as indicated in table below:

Range	Scale	Readings	Volt drop
5 A	0 — 50	in Amps and divide by 10	34 mV



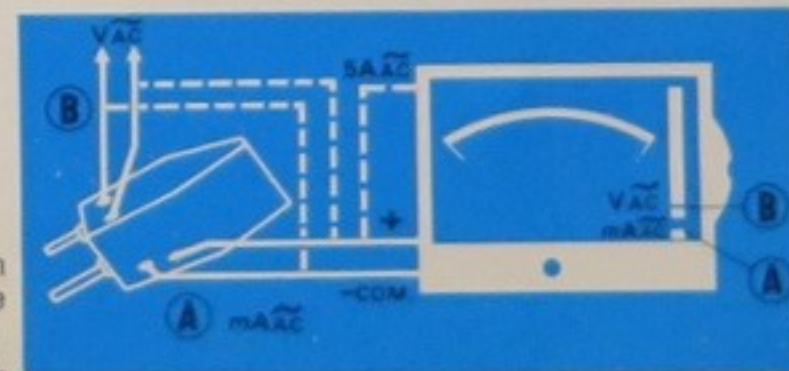
Clip-on transformer
AM 15

Multicurrent connector XHA 709



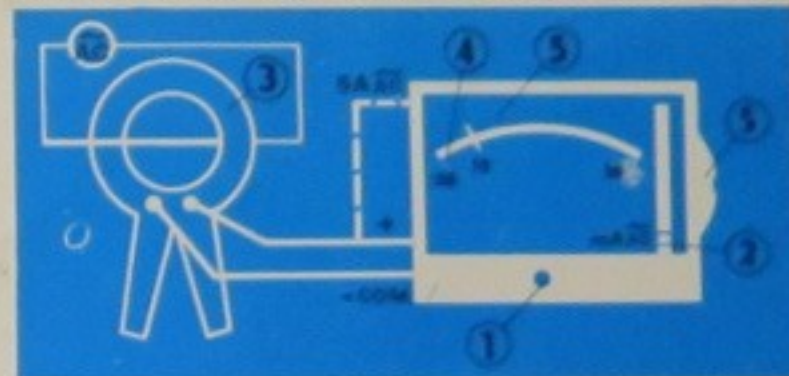
To measure voltage and current on machines fed by the mains and without breaking circuit.

- (A) Measurements up to 5 A AC are carried out as explained page 12. Connect as shown below and press the red button.
- (B) Voltage measurements — up to 380 V AC — are carried out as explained page 10.



Note: Written instructions are provided with the instrument.

USE WITH TWO OPTIONAL ACCESSORIES



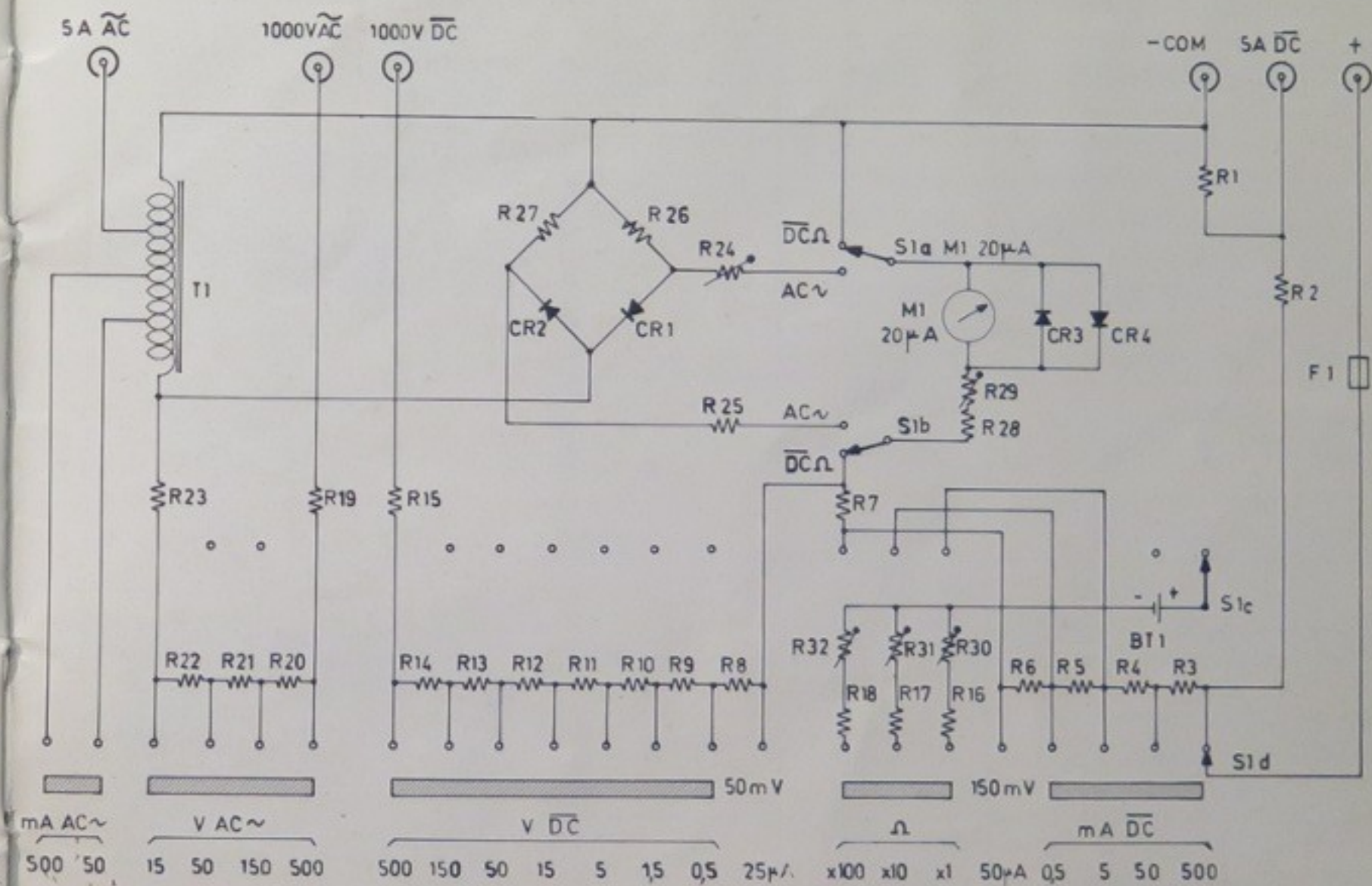
- ① Check that pointer is at zero, if not adjust by turning the screw.
- ② Connect as shown above.
- ③ Clip AM 15 round the conductor on test.
- ④ Read as indicated in table below:
- ⑤ Highest permissible measurements with AM 15 : 1,000 A AC.

Range	Set index to	Amps reading
50 A	50 mA	Direct
500 A	500 mA	Multiply by 10
1,000 A *	500 mA AC	Multiply by 100

* Connect to " — COM " and " 5 A AC " jacks as shown in dotted line on top diagram.

REPLACEABLE PARTS LIST

Symb.	DESIGNATION	Réf.	Symb.	DESIGNATION	Réf.
R 1	0.05 $\Omega \pm 0.5 \%$	LE 274	R 24	470 Ω Adjustable linear	01 241 047 000 304
R 2	0.45 $\Omega \pm 0.5 \%$	LE 273	R 25	5.9 k $\Omega \pm 1 \%$ 1/4 W	00 211 300 590 131
R 3	4.50 $\Omega \pm 0.5 \%$		R 26	200 $\Omega \pm 1 \%$ 1/4 W	00 211 320 000 031
R 4	45 $\Omega \pm 0.5 \%$		R 27	200 $\Omega \pm 1 \%$ 1/4 W	00 211 320 000 031
R 5	450 $\Omega \pm 0.5 \%$ 1/2 W		R 28	1.1 k $\Omega \pm 5 \%$ 1/3 W	01 213 300 110 151
R 6	4.5 k $\Omega \pm 0.5 \%$ 1/4 W	00 211 300 450 121	R 29	470 Ω Adjustable linear	01 241 047 000 304
R 7	5 k $\Omega \pm 0.5 \%$ 1/4 W	00 211 300 500 121	R 30	47 Ω 20 % linear	01 241 004 700 301
R 8	18 k $\Omega \pm 0.5 \%$ 1/4 W	00 211 301 800 121	R 31	470 Ω 20 % linear	01 241 047 000 304
R 9	40 k $\Omega \pm 0.5 \%$ 1/4 W	00 211 304 000 121	R 32	4.7 K Ω 20 % linear	01 141 000 470 406
R 10	140 k $\Omega \pm 0.5 \%$ 1/4 W	00 211 314 000 121	CR 1	diode AA 143 - SPT 59	01 820 111 500 004
R 11	400 k $\Omega \pm 0.5 \%$ 1/4 W	00 211 340 000 121	CR 2	diode AA 143 - SPT 59	01 820 111 500 004
R 12	1.4 M $\Omega \pm 0.5 \%$ 1/2 W	00 211 400 140 221	CR 3	diode IN 4148 - 1N 914	01 820 211 500 018
R 13	4 M $\Omega \pm 0.5 \%$ 1 W	00 211 500 400 221	CR 4	diode IN 4148 - 1N 914	01 820 211 500 018
R 14	14 M $\Omega \pm 1 \%$ 1 W	00 211 501 400 231	S 1	— 22 position 2 deck 4 circuit contact unit	KE 760
R 15	20 M $\Omega \pm 1 \%$ 1 W	00 211 502 000 231	T 1	— Autotransformer	LA 301
R 16	200 $\Omega \pm 5 \%$ 1/3 W	01 213 320 000 051	BT 1	— 1.4 V dry cell	AL 18
R 17	2 k $\Omega \pm 5 \%$ 1/3 W	01 213 300 200 151	F 1	— 2.5 A fuse	LC 502
R 18	22 k $\Omega \pm 5 \%$ 1/3 W	01 213 302 200 151	M 1	20 μ A meter I.T.T. version S.T.T.A. version*	NA 2206 NA 2253 NA 2257
R 19	500 k $\Omega \pm 1 \%$ 1 W	00 211 550 000 131			
R 20	350 k $\Omega \pm 1 \%$ 1 W	00 211 535 000 131			
R 21	100 k $\Omega \pm 1 \%$ 1 W	00 211 410 000 131			
R 22	35 k $\Omega \pm 1 \%$ 1/4 W	00 211 303 500 131			
R 23	14.3 k $\Omega \pm 0.5 \%$ 1/4 W	00 211 301 430 121			



R30 ($\Omega \times 1$) R31 ($\Omega \times 10$) R32 ($\Omega \times 100$)