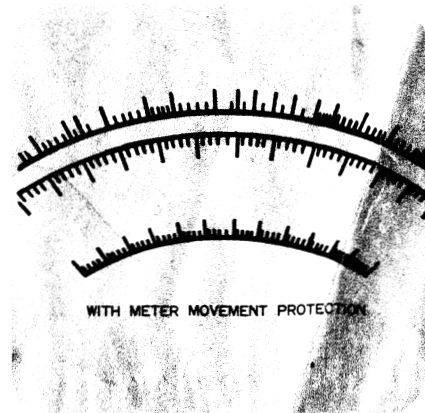
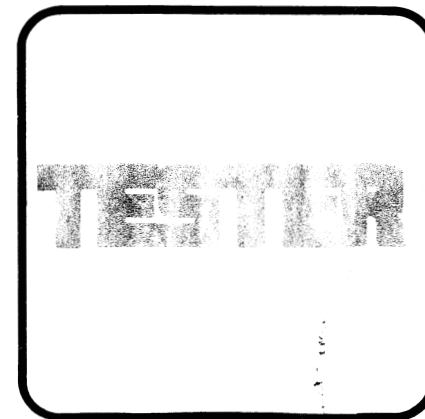
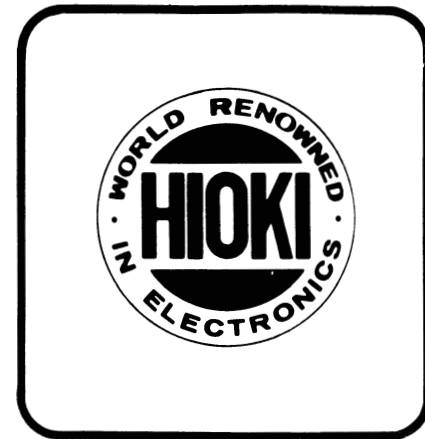
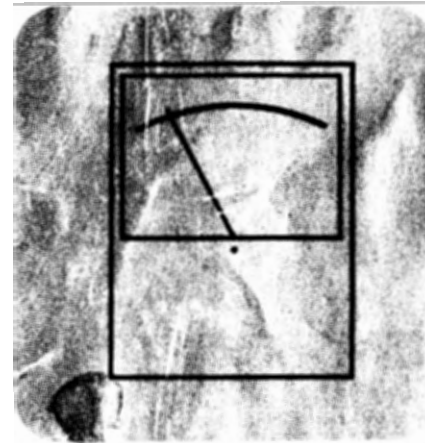


M-230A

OPERATOR'S MANUAL

Hioki HIOKI ELECTRIC CO., LTD.



Printed in Japan

FOREWORD:

We extend our sincere thanks for selecting Hioki's M-230A tester. It is a very delicate instrument, but if handled properly, it will have a long service life. Please read this booklet before using the tester.

List of our products

- Testers** [P-70, P-80, TH-L33D, F-75, L-44D, F-75J, K-228A, L-55FET, M-230A, OL-64D, AF-105, F-77, AS-100D, AS-500F, A-10, CT-300]
- Transistor checkers** [Tr-1 (12 μ A range), Tr-2 (30~60 μ A range) Tr-3 (exclusively for F-75)
- High voltage probe** [HP-300 — for AF-105
HP-300D — for AS-100D
HP-250 — for A-10]
- Thermal probe** [TP-1 — TP-1 R \times 100 range tester possible]
- Panel meters** [MK series — 38, 45, 52, 65, 85, 4]
[KR series — 45, 52, 65]
[PF series — 45, 52, 55, 75]
[HK series — 52, 65, 85, 4, 120 6]
[LS-65, 85 — wide angle measuring instrument, swing angle 240°]
[R series — 55, 65]
- Portable testers** Lab Meter with sloping stand.

9. List of Main Parts

Symbol	Description
M	Meter 48uA, 700 Ω
B1	Battery 1.5V (UM-2)
B2	Battery 9V (006P)
PL	Pilot Lamp 1.5V, 0.15A
R1	1W P type Fixed Resistor 9M Ω
R2	1/2W P type Fixed Resistor 1.8M Ω
R3	" " 900K Ω
R4	" " 180K Ω
R5	" " 90K Ω
R6	" " 22.6K Ω
R7	" " 30K Ω
R8	1W P type Fixed Resistor 261 Ω
R9	1W L type Wiring Resistor 10 Ω
R10	" " 1 Ω
R11	1/2W P type Fixed Resistors 18K Ω
R12	" " 36K Ω
R13	" " 180K Ω
R14	" " 360K Ω
R15	" " 1.8M Ω
R16	" " 3.6M Ω
R17	1W P type Fixed Resistor 18M Ω
R18	1/2W P type Fixed Resistor 94.9K Ω
R19	" " 5.01K Ω
R20	" " 199 Ω
R21	" " 14.7 Ω
R22	" " 3.53 Ω
R23	" " 7.41K Ω
R24	" " 749 Ω
R25	" " 75.6 Ω
R26	1W L type Wiring Resistor 8.5 Ω
R27	1/2W P type Fixed Resistor 26K Ω
R28	" " 3.12K Ω
R29	" " 2.26K Ω
R30	" " 100K Ω
R31	" " 7.5K Ω
R32	1/2W L type Wiring Resistor 0~1 Ω
VR1	Half-Fixed Resistor 330 Ω
VR2	" " 220K Ω
VR3	" " 2.2K Ω
VR4	" " 4.7K Ω
VR5	Rheostat 10K Ω
D1,2,3,4	Germanium Diode SD-34
D5,6	Silicon Diode 1S1588
C1	MP Tubular Condenser 1uF 500WV
C2	Ceramic Condenser 0.1uF 50WV
C3	" " 0.001uF 50WV
C4	" " 33pF 500WV
C5	" " 15pF 500WV

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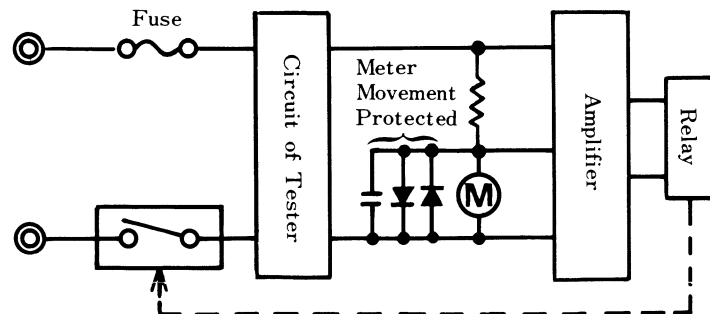
1. Features of M-230A tester

1) Accuracy is 1% up – 2% in DC, 3% in AC – higher than that of a conventional tester.

- A metal film resistor is used, which greatly improves the thermal properties and safety in secular change etc.
- An all-wave rectification system is adopted in the ACV rectification system, with a result that measurement errors owing to distorted wave form has been lessened.
- The scale board is wider and reading is easier. As a mirror is provided, errors due to parallax at the time of measurement are eliminated.

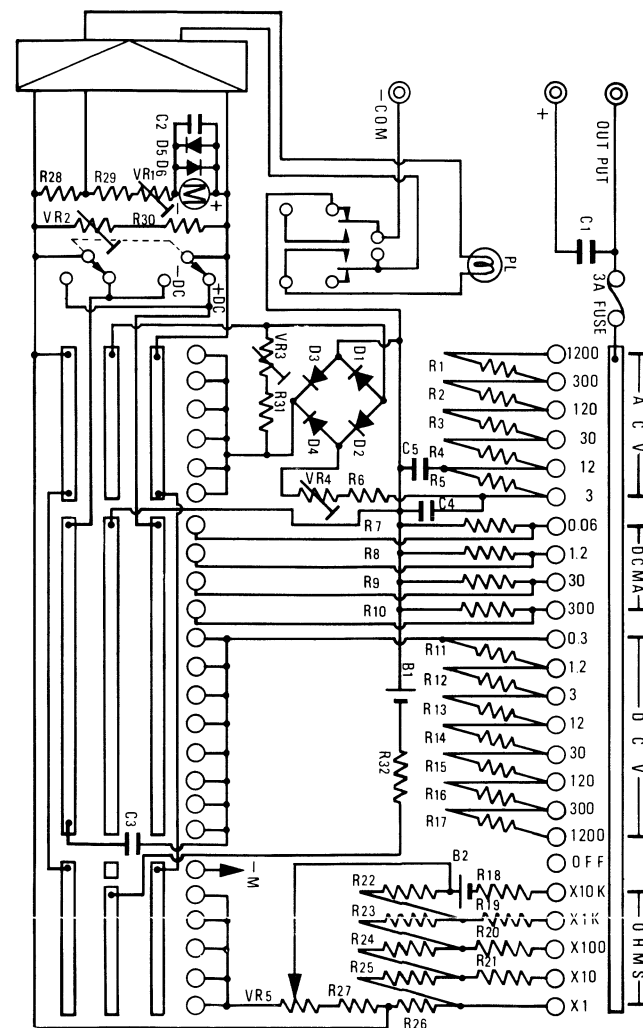
2) Triple safety protective device

- First As the plus terminal is intercepted by means of a relay system protective circuit using 3 transistors, the tester circuit is protected. Its operation can be confirmed by sound and indicating lamp.
- Second A circuit protecting system with a fuse protects the circuit as the fuse blows even if the relay should fail to take care of it.
- Third The above provisions should be sufficient, but to make assurance doubly sure, we have added a meter protecting circuit of diode system.



Meter Protecting Circuit of Diode System

8. Circuit Diagram



etc. It is used for simplification of calculation. For instance, if the amplification of one stage is 10dB, we can easily see that the amplification of 2 stages will be $10\text{dB} + 10\text{dB} = 20\text{dB}$. However, if calculation is made on this basis as it is, it will involve multiplication, which is not a simple process.

Now, if measurement is made with M-230A tester in AC 3V, 12V range, the scale can be read directly. If the indicating needle swings full in 12V range, raise it to 30V range, 120V range. In this instance, the following value is to be added to the dB value used:

AC 30V range	add + 8dB to value of 12V range
AC 120V range	+20dB to value of 12V range
AC 300V range	+28dB to value of 12V range
AC 1200V range	+40dB to value of 12V range

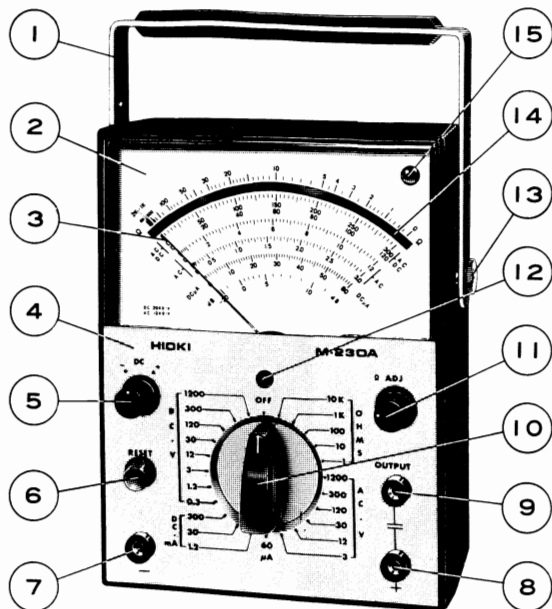
However, if DB is measured by applying the test bar to the output side of amplifier in AC range, it is doubtful whether the value obtained is correct or not, for with this tester the circuit impedance of 300Ω , 1mW is taken as the standard level and considered as 0dB in calibration. In other words, 0.7745V is 0dB as in $\sqrt{600 \times 0.001} = 0.7745\text{V}$.

Therefore, when the circuit impedance is 600Ω , the dB scale can be read directly.

3) We paid attention even to handling, which is apt to be overlooked.

- A case for storing the measurement test bars has been provided. The test bars, which had no place to belong to, have found a handy depository now.
- The batteries can be exchanged from outside.
- Operation is very easy. Number of ranges is 24. Just a turn of the rotary switch makes necessary measurement.
- Switch of plus minus polarities in DC is possible. As this is so devised as to work on DCV, A circuits only, reverse swing will not occur in ACV Ω measurement.
- Besides, easy handling and safety were given the first consideration in every detail, such as, anti-skid rubber feet and handle, elimination of exposed metal parts of test bars by burying the measuring terminals, etc. etc.

2. Identification of parts



- | | |
|--|-------------------------------------|
| 1) Handle | 8) Plus (+) measuring terminal |
| 2) Scale board | 9) Output measuring terminal |
| 3) Indicating needle | 10) Rotary switch |
| 4) Panel indicating plate | 11) Zero ohm adjustor |
| 5) DC polarity switch | 12) Meter Zero adjustor |
| 6) RESET push button switch
(OUTPUT RELAY return
and test push button) | 13) Decorative screw |
| 7) Minus (-) measuring terminal | 14) Mirror |
| | 15) CUTOFF RELAY indicating
lamp |

important that reading should be made at the center of the scale board as far as possible.

Insert the black test bar into the minus terminal and the red one into the plus terminal, and short both ends of the test bars, and the indicating needle swings to the right end of the scale board. Then, turn the 0 ohm adjustor (11 of page 4 illustration), and set the needle to the 0 of OHM graduation marks on the scale board.

Since this operation is in preparation for measurement of resistance, do it every time the ohm range is changed. This preparatory operation is called "Zero ohm adjustment."

If the indicating needle does not reach 0 with the zero ohm adjustor, replace the batteries. (For replacement of batteries, refer to the instructions given in page 7.)

When Zero ohm adjustment is over, open the ends of the test bars, make their tips touch both ends of the resistance to be measured, and read the resistance value.

Remarks: 1) The resistance of circuit where electric current is running cannot be measured.

- 2) When using an Ohm range, + voltage is on the — side test bar and — battery voltage on the + side. Therefore, take this into consideration when measuring semi-conductor products.

5. Measurement of low frequency output (dB)

Low frequency output voltage of amplifiers etc. can be measured. Generally, low frequency output voltage of the circuit of vacuum tubes or transistors often come in the form of an overlap with DC. Measurement must be made by eliminating the needless DC. To do this, a condenser (over $0.1\mu\text{F}$) is to be inserted in series between either of the plus and minus test bars and the part to be measured. If measurement is made in this way, only the AC value can be measured. Measurement of low frequency output is made in the same way as measurement of ordinary AC V.

The dB is a unit representing the relative ratio (voltage ratio, electric current ratio, electric power ratio) between the input side and output side of the transmitting circuits of amplifiers,

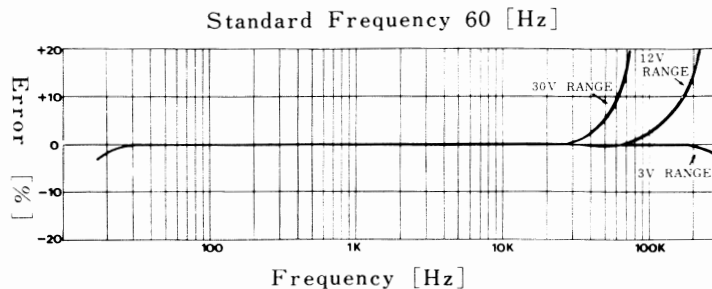
2. Measurement of AC V

Measurement of AC V applies to household mains, tap voltage of transformers used in electric instruments and voltages of sine wave AC electric source.

Measurement can be made with the test bars connected in parallel with the parts to be measured regardless of polarity, but make a habit of plugging the black test bar into the minus terminal and the red one into the plus terminal.

The polarity switch may face either side.

The frequency properties of ACV range are as follows:



3. Measurement of DC mA

The tester is used when measuring the electric current of circuit using DC electric source.

In making measurement, pay full attention to polarity. The polarity switch is to be set to the + DC position, and the black test bar plugged into the minus terminal and the red one into the plus terminal. The measurement circuit is to be left open and the tester connected in series there (the red test bar connected with the plus side and the black one with the minus side).

If the indicating needle makes a reverse swing, turn the polarity switch to the - DC side.

4. Measurement of resistance (OHM)

Select optimum range for the object to be measured. It is

3. Specifications

Range of measurement:

DCV	0~1.3, 1.2, 3, 12, 20, 120, 200, 1200V
DCmA	0~60 μ A, 1.2mA, 30mA, 300mA
ACV	0~3, 12, 30, 120, 300, 1200V
OHM	0~2K Ω (central graduation 10 Ω) R \times 1, R \times 10, R \times 100, R \times 1K, R \times 10K

Standards:

DC voltmeter:	Internal resistance 20K Ω /V Tolerance: Within $\pm 2\%$ of maximum scale value
DC ammeter:	Internal voltage drop 300mV Tolerance: Within $\pm 2\%$ of maximum scale value
AC voltmeter:	Internal resistance 10K Ω /V Tolerance: Within $\pm 3\%$ of maximum scale value
Ohmmeter:	Batteries used: UM - 2 \times 1, 006P \times 1 Tolerance: Within $\pm 2\%$ of scale length

Auxiliary circuit etc:

OUTPUT terminal	0.5 μ F, 400WV condenser
Plus minus polarity switch	works on DC voltmeter and DC ammeter only
OFF range	Circuit OFF - meter terminal short circuit
Circuit protection	1. Circuit protection with CUTOFF relay Battery used: 006P \times 1 for working relay Battery used: UM - 2 \times 1 for operation indicating lamp 2. Circuit protection with a fuse (3A) 3. Circuit for protection against overvoltage of meter by means of a silicon diode

Size and weight:

150mm (wide) \times 197mm (high) \times 80mm (deep)
1.3 kgs.

4. Hints to use of the tester

1. The meter is adjusted and tested in a horizontal position. It is to be used in this state when measurement is made to a high accuracy.
2. See to it that the tester does not get heavy vibration or shock. As the meter section is made very precise, movement of the Zero position, friction, loss of balance are apt to occur.
3. When making measurement, confirm the movement of the CUTOFF relay. (Push the red RESET button and confirm that the red lamp on the scale board has lit.)
4. When the red lamp on the scale plate has lit, it is proof of overload being on the tester. Remove the test bars from the measuring circuit, push the RESET button, return the relay circuit, recheck the range of measurement and method of measurement before operation.
5. If there is a strong magnetic field near the tester, error occurs in the measured value. Place the tester far from a transformer, speaker, magnet, etc. that generate a magnetic field. It might cause a permanent change of sensitivity.
6. Do not leave or use the tester in a very warm or humid place.
7. If vibration or shock is given the tester by being carried around, set it OFF range.
8. Make a habit of connecting the red test bar with the plus terminal and the black one with the minus terminal.
9. In making measurement, select a range as close to the maximum scale value as possible.

7. Methods of measurement

1. Measurement of DC V

Measurement of DC V applies to batteries in general, B electric source voltage or radio and TV receiving sets, amplifiers, etc., polarity voltage of plate, grid, cathode, etc. of vacuum tubes, voltage of various parts of transistors and voltages of other DC sources. In making measurement, pay full attention to polarity. In Principle, the polarity switch (5 of page 3 illustration) is to be set to DC + operation.

The black test bar is to be plugged into the minus terminal (7 of page 3 illustration) and the red one into the plus terminal (8), and connect the red test bar with the plus side of voltage and the black one with the minus side.

When the voltage to be measured is known beforehand, select a range closest to that voltage. If it is unknown, measure in a high voltage range, and determine the optimum range after getting an idea about the voltage.

If the indicating needle makes a reverse swing, turn the polarity switch to the - DC side.

The second graduation mark from the top on the scale board (2 of page 3 illustration) is to be read. (For details, refer to "How to read the scale" on page 9.)

Internal resistance in DCV range of M-230A tester are shown below for your reference.

Range of measurement	0.3V	1.2V	3V	12V	30V	120V	300V	1200V
Internal resistance	6K Ω	24K Ω	60K Ω	240K Ω	600K Ω	2.4M Ω	6M Ω	14M Ω

In case the measurement circuit has a high internal resistance, a value lower than the actual value is indicated. To correct this, the following calculation is made:

$$E_o = E \left(1 + \frac{R_s}{R_v} \right)$$

E = Measurement voltage E_o = Real voltage

R_s = Circuit resistance

R_v = Internal resistance of tester range used.

5. General method of using the tester

1. Zero position adjustor

Make the tester ready for use (with the handle fixed) and confirm that the indicating needle is set to Zero. If not, turn the meter 0 adjustor (12 of page 3 illustration) with a screw driver, and so adjust it that the needle come to the center of the 0 line at the left end of the scale board.

2. Plugging of test bars

The black test bar is to be connected with the minus terminal, while the red one is to be plugged into the plus terminal in ordinary measurements and into the OUTPUT terminal when the DC voltage is cut and AC voltage alone is measured.

3. Selection of range of measurement

Set the rotary switch to measurement value (in such a range that measurement can be made as near the maximum scale value as possible). When the measurement value is unknown, try and measure in a big range (1200V in case of voltage and 300mA in case of electric current), and find the best range.

4. DC polarity (plus minus) switch

Ordinarily the switch is to be on the plus side. Even when measurement is made on the minus side, return it to the plus side after use. This switch works on DCV, A only.

5. RESET push button switch

● Test of overload protective circuit

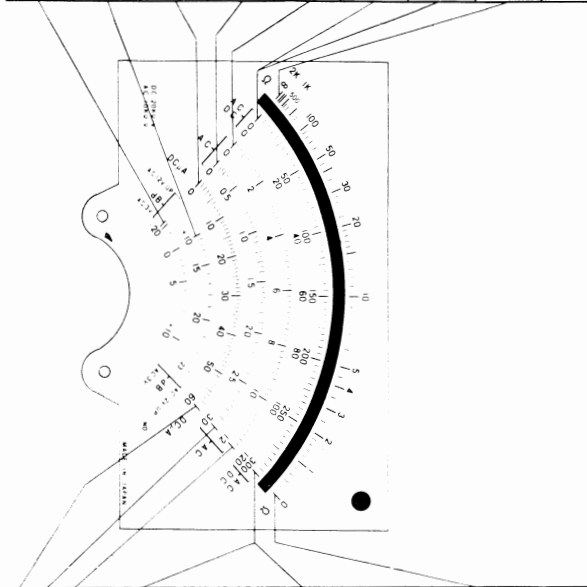
Push the RESET button, and if the red lamp on the scale board is lit up, circuit operation is OK. Release your finger and if the lamp goes out, circuit returning operation is OK.

● Return of operation

When the protective circuit worked under an overload, the red lamp on the scale board is lit up. In this instance, detach the test bars from the circuit and push the RESET button. When you release your finger, the red lamp goes out with a click. Return is completed now, but find the cause of overload and remove it before making measurement.

6. How to read the scale

Scale Section
OHMS (Resistance)
DC V (Voltage) DC mA (Amperage)
AC 30V UP
AC 12V ONLY
AC 3V ONLY
DC 60uA ONLY
Decibel (dB) AC 12V UP range used
Decibel (dB) AC 3V range used

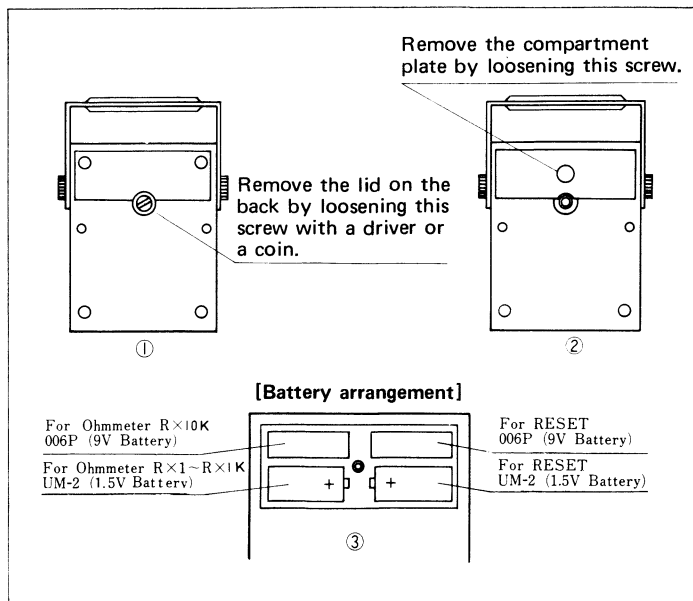


Measurement range for Scale	Multiplying factor for Scale
OHMS	
1	× 1
10	× 10
100	× 100
1K	× 1000
10K	× 10000
DC V	
0.3	× 0.001
1.2	× 0.01
3	× 0.01
12	× 0.1
30	× 0.1
120	× 1
300	× 1
1200	× 10
AC V	
30	× 0.1
120	× 1
300	× 1
1200	× 10
AC 12V	× 1
AC 3V	× 1
DC 60uA	× 1

6. Grip handle fixing

Loosen the decorative screw of the handle, and the handle is ready to turn. Fix the decorative screw at a proper place, and you can use the tester in a tilted position.

7. Exchange of batteries



• For ohmmeter:

In case the plus minus terminals are shorted in the ohmmeter condition, if a full turn of the 0 ohm adjustor to the ri

• For ohmmeter:

In case the plus minus terminals are shorted in the ohmmeter condition, if a full turn of the 0 ohm adjustor to the right does not help the needle adjust to 0Ω position, the batteries are exhausted and must be replaced with new ones. Here if 0Ω adjustment is impossible in any of the ranges $R \times 1$,

$R \times 10$, $R \times 100$, replace the 1.5 volt battery for ohmmeter. If 0Ω adjustment is impossible in $R \times 1K\Omega$ range, replace the 9V (006P type) battery for ohmmeter.

• For RESET

If the RESET button is pushed and the red lamp does not light, though a click sound comes from inside or if the light is weak, the battery for lighting the lamp is exhausted. Replace the 1.5V battery.

If the red lamp does not light with the RESET button pushed, the battery for RESET is exhausted (do not bother, if click sound comes from inside). Replace the 9 volt battery.

• Order of replacement of batteries

- 1) Remove the lid of battery test-bar compartment on the back by loosening its screw with a driver or a coin.
- 2) A compartment plate with a decorative screw is inside. Remove the screw and you can see the compartment plate and the batteries. Change the batteries in accordance with the diagram, making sure that the polarities are correct.