HIOKI

INSTRUCTION MANUAL

SM-24GN

SUPER MEGOHM CHECKER

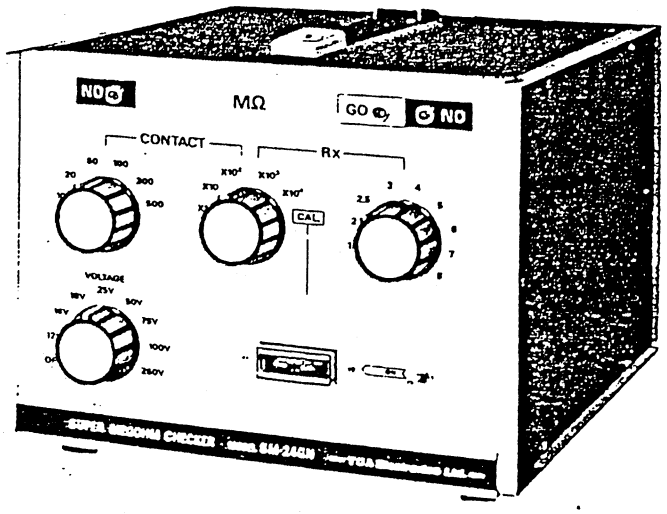
HIOKI E. E. CORPORATION

Super Megohm Checker, Model SM-24GN

Instruction Manual

Contents

Drawing



1. Operating Precaution

Pay attention to the following when operating this checker.

(1) Be careful when operating this checker, since high voltage is generated at the measurement terminals at power source low impedance.

(2) This is a super megohm checker which enables high resistance measurement. When measuring, pay special attention to induction and external noise.

(3) Measuring voltage polarity
Minus voltage appears at the red measuring rod.
Plus voltage appears at the black measuring rod.

(4) When insulation resistance of a measured object is almost equal to the rated setting resistance, both the $R_{\times}$ (GO) and $R_{\times}$ (NO) lamp may light up during resistance measurement.
The $R_{\times}$ (NO) lamp may light up during resistance measurement.
The $R_{\times}$ "NO" lamp always lights up at $R_{\times}$ = Rated setting resistance -20%.

(5) Generally, insulation material is capacitive and therefore measurement may take a long time, depending on the measured object.
See Item 6.5 in this manual.

(6) The rear (+) terminal of this instrument is common to the grounding terminal. Never ground the (-) CHARGE terminal.
See Figures 10 and 12 for grounding.

(7) This instrument uses a 0.5 A (TIME LAG) tubular fuse.
The instrument's output current is set to about 50 mA for each voltage, and if overload continues, the fuse burns out to protect the instrument.

When not in use, the instrument should be stored at a low humidity location.

2. Specifications

The instrument's specifications are as shown below.

1) Rated measuring voltage : 12/16/18/25/50/75/100 V DC and 250 V 8 ranges

2) Measuring voltage accuracy: Within ± 2% for each voltage accuracy

3) Rated setting resistance:

. Rated setting resistance: 1/1.5/2/2.5/3/4/5/6/7/8 10 points

. Multi-range : × 1/10/10^2/10^3/10^4 5 ranges plus CAL.

. Measuring range: 10^6 to 8 × 10^{10} Ω

. Measuring accuracy

Rated setting resistance / Multi-range	1 to 4	5 to 8
× 1	± 10%	± 20%
× 10		
× 10^2		
× 10^3		
× 10^4		

4) CONTACT setting resistance

. Rated setting resistance: 10/20/50/100/200/500 6 points

. Multi-range : Interlocked with rated setting resistance multi-range

. Measuring range : 10^7 to 5 × 10^{12} Ω

. Measuring accuracy

Rated setting resistance / Multi-range	10 to 50	100 to 500
× 1	± 20%	± 50%
× 10		
× 10^2		
× 10^3		
× 10^4		

5) Alarm signal : Lamp, and buzzer at R_x "NO"

6) Alarm output : Open-collector (Within 24 V DC, 300 mA)

7) Power supply : V AC, 50 to 60 Hz

8) Power consumption: Approx. 11 V A (at no load)

9) Dimensions : Approx. 242 (W) × 180 (H) × 280 (D) mm

10) Mainframe weight : Approx. 4.5 kg

11) Operating temperature range: 5℃ to 35℃

12) Operating humidity range: 40% to 85% RH

Standard accessories

Measuring rods (red/black) ..... 1 each

Connector plug (red) 1

Instruction manual ..... 1 copy

Fuse (TIME LAG) 0.5 A ..... 2 pcs.

3. Functional Description

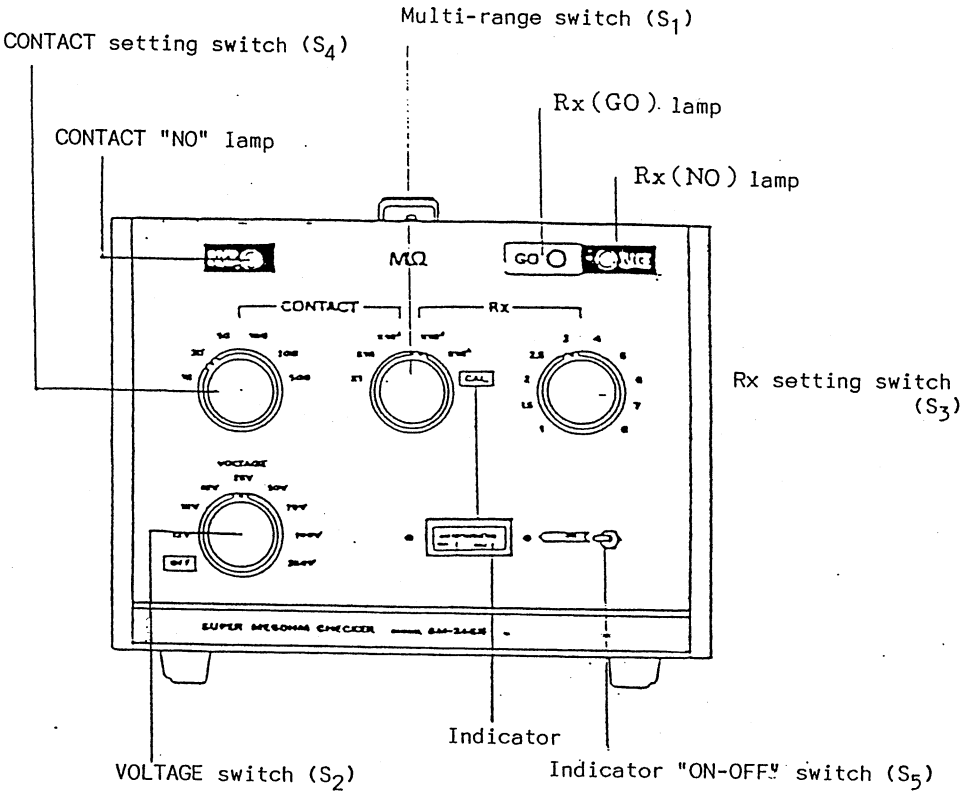


Figure 1 Front Panel

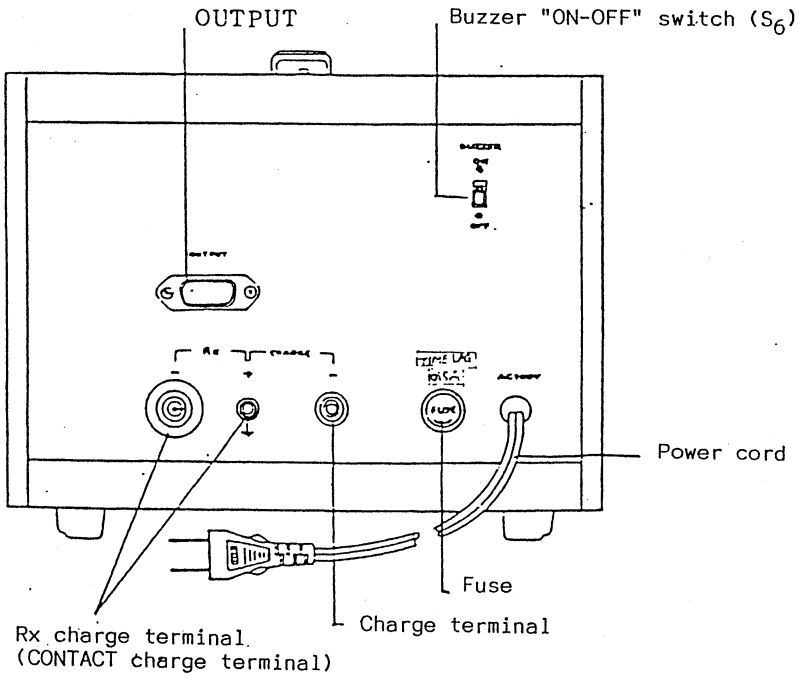


Figure 2 Rear Panel

4. Description of Each Component

1) Front panel (Figure 1)

. VOLTAGE switch (S_2) (Figure 3)

Used for selecting measured voltage applied to a sample in 8 ranges between 12 V DC and 250 V DC. Also used as a power switch to turn OFF the power at its OFF position at left.

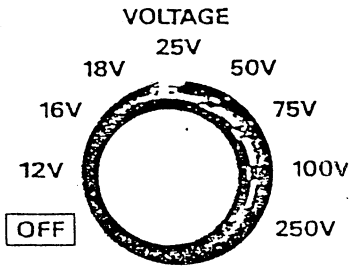


Figure 3 VOLTAGE Switch

. Indicator (Figure 4)

Monitors the instrument's operation status and is mainly used for self-calibration.

. Indicator "ON-OFF" switch (S_5) (Figure 4)

Turn this switch ON to monitor the indicator.

To prevent indicator damage, turn this switch "OFF" during measurement.

Figure 4 Indicator and "ON-OFF" Switch

. R_x setting switch (S_3) (Figure 5)

Used to set the insulation resistance value to be measured in combination with the multi-range switch (S_1).

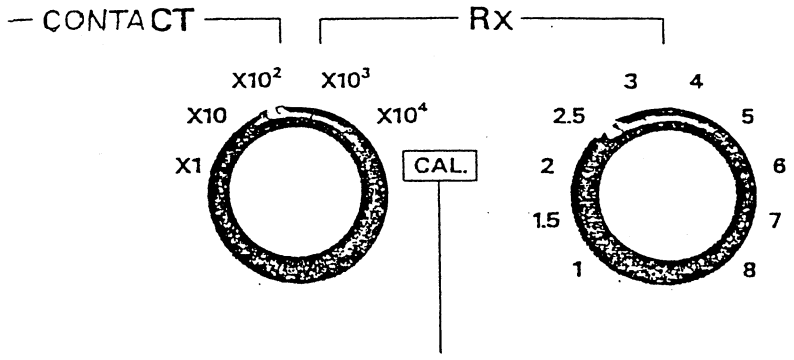


Figure 5 R_x Setting Switch (Right) and Multi-Range Switch (Left)

. R_x "GO" lamp

Lights up when measured-object resistance is higher than the rated setting resistance (also when the R_x terminals are opened).

. R_x "NO" lamp

Lights up when measured-object resistance is lower than the rated setting resistance.

. Multi-range switch (S_1) (Figures 5 and 6)

R_x and contact setting resistance can be increased from 1 to 10,000 times by setting this switch between × 1 to × 10^4. For self-calibration, set this switch to "CAL.".

. CONTACT setting switch (S_4) (Figure 6)

Used when contact value setting is to be measured in combination with the multi-range switch (S_1).

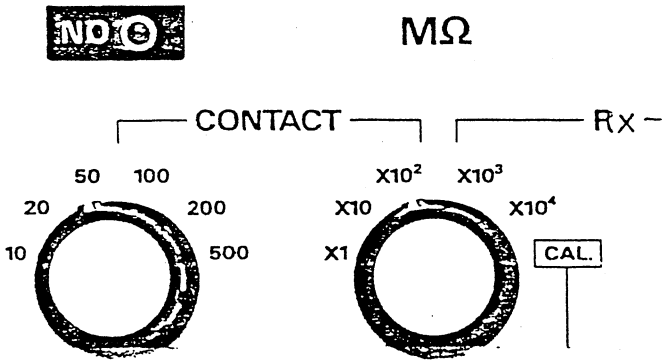


Figure 6 Contact Setting Switch (Left) and Multi-Range Switch (Right)

. Contact "NO" lamp

Lights up when measured-object resistance is higher than the contact setting resistance value.

Lights up when the input is opened.

If this lamp goes OFF when connected to a jig, it is considered that the insulation resistance of the jig is lower than the setting value, or the instrument is influenced by induction noise from the jig.

2) Rear panel (Figure 2)

. R_x terminals (CONTACT terminals)

Terminals to connect to the attached red and black measuring rods

When connecting to automatic equipment, connect a shielded wire to the attached connector plug, since the shielded side is used as a guard line.

. Power cord

Supplies AC commercial power to this instrument.

. Fuse

A 0.5 A (TIME LAG) tubular is used.

The output current of this instrument is see to about 50 mA for each voltage. If overload continues, the fuse burns out to protect the instrument.

. OUTPUT (Figure 7)

Each output of CONTACT "NO", R_x "GO" and R_x "NO" is open-collector output. The connector used is Daiichi Denshi's 57-30140 (Amphenol).

. Buzzer "ON-OFF" switch (Figure 7)

The lamp on the panel surface lights up at R_x "NO" as an alarm signal and simultaneously the buzzer inside the instrument case sounds. This switch can stop (OFF) the buzzer sound.

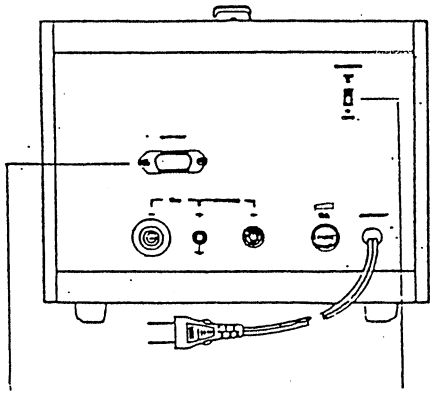


Figure 7 OUTPUT and Buzzer "ON-OFF" Switch

. CHARGE terminals

Used for charging power between CHARGE (-) and R_x (+).

For details, see Item 5.6 (2).

5. Operation

5.1 Preparation

1) Set the switches on the panel as shown below.

   (1) VOLTAGE switch (S_1) ..... OFF

   CONTACT setting switch (S_4) 10

   Multi-range switch (S_1) ..... × 1

   R_x setting switch (S_3) 1

   Indicator "ON-OFF" switch (S_5) ..... ON

   R_x terminals (CONTACT terminals) ..... Not connected

2) Insert the power cord plug into an AC receptacle, then set S_2 to 12 V. The indicator indicates ZERO.

3) Measurement is ready a few minutes later, thereby ending preparation.

5.2 Operation Check

After the instrument has fully stabilized, check instrument operation in accordance with the following steps.

1) Check to see if the indicator indicates "ZERO".

2) Turn S_2 and then check to see if the indicator indicates "ZERO" at any voltage.

3) Set the multi-range switch (S_1) to "CAL." to see if the indicator indicates "CAL." (Figure 8 The boundary between the white and red sections) (See operating cautions Item (5).)

4) Check to see if the CONTACT "NO" lamp goes OFF with S_1 set to "CAL.".

If the above results are successful, the instrument is operating normally. Otherwise, follow 6. Maintenance and

Inspection.

5) Indicator ON-OFF switch

Set (S_5) to "OFF".

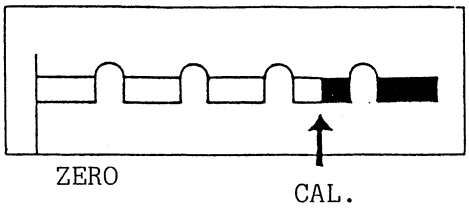


Figure 8 Indicator Scale Diagram

5.3 Measurement

1) Set the desired voltage value with S_2.

2) Set setting resistance to the discriminative value with S_3 and S_1. (See Figure 5.)

3) Connect the red and black measuring rods to the R_x terminals at the rear. Contact these rods to a measured object to determine whether the resistance is good or bad.

This means that if "GO" lights up, measured-object insulation resistance is higher than the setting value of "$S_1 \times S_3$". On the contrary, if "NO" lights up, the same resistance is lower than the "$S_1 \times S_3$" setting value.

At this time, the internal buzzer sounds to notify the operator that the resistance is low.

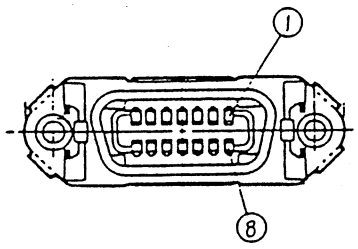
4) Simultaneously, CONTACT measurement is conducted.

If S_4 is set to 10 in preparation, the CONTACT "NO" lamp operates at the "$S_1 \times 10$" resistance value set in 6.3 2).

If R_x is "GO" in 6.3 3) and CONTACT "NO" goes OFF, the insulation resistance of the measured object is between "$S_1 \times 10$" and "$S_1 \times S_3$". (See Figure.)

5.4 OUTPUT Connection Method

Figure 9 shows the OUTPUT of this instrument.



⑧ to ⑭ COMMON
① R_x "NO"
③ R_x "GO"
⑤ CONTACT "NO"

Figure 9 OUTPUT Diagram

When R_x "GO" lights up, ③ and ⑧ are shorted. When "NO" lights up, ① and ⑧ are shorted, and when CONTACT "NO" lights up, ⑤ and ⑧ are shorted.

Each output is transistor open-collector and is used within 24 V DC, 300 mA.

Figure 10 shows example of an output terminal application.

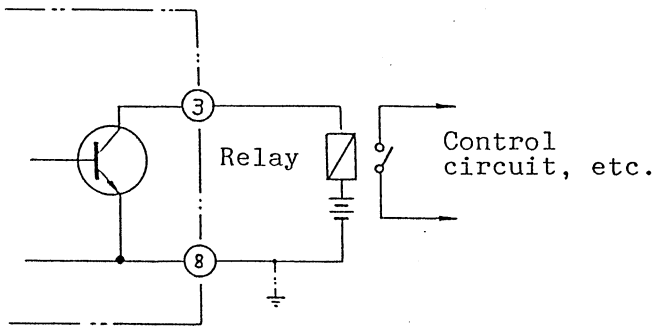


Figure 10 Example of Output Terminal Application

5.5 Measurement Speed

Generally, insulation materials are considered to be capacitive, so measurement speed is determined by capacitance C (F) and time constant τ = CR (sec.) by range resistance R_s (Ω) used for insulation measurement.

The time constant when insulation resistance is high, even if

capacitance is small, becomes long.

Table 1 shows this instrument's range resistances.

Table 1 R_s of This Instrument

Multi-range (S1)	R_s (Ω)
× 1	10 K
× 10	100 K
× 10^2	1 M
× 10^3	10 M
× 10^4	100 M

5.6 Precharging Method

1) When measuring rod is used (Figure 11)

When a capacitor is to be measured, the black measuring rod is brought into contact with one of the condenser's terminals and then the guard terminal of the red rod is brought into contact with the other terminal. After 2 to 3 seconds, the input terminal of the red rod is brought into contact with the terminal. In this manner, the time required to measure a large capacity condenser can be reduced considerably. When it is not required, the measuring rod's guard terminal can be easily removed from the rod by turning it counterclockwise.

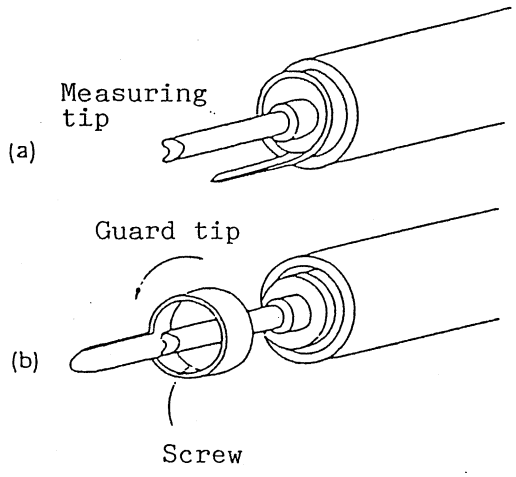


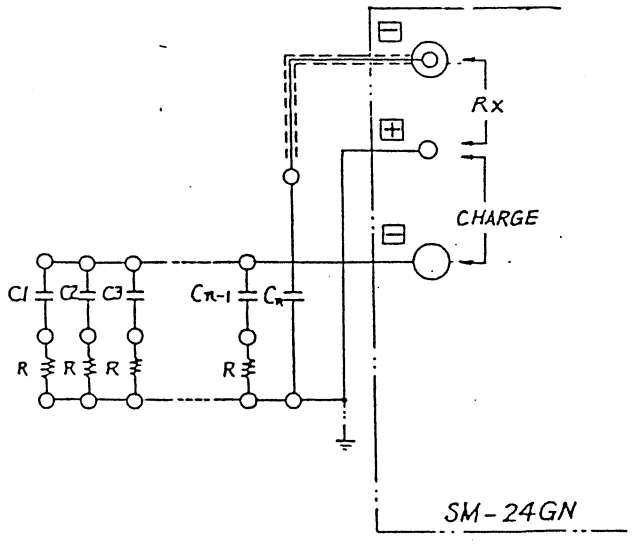
Figure 11 Red Measuring Rod

2) When output terminals are used. (See Figure 12.)

When precharge is required for continuous measurement of automatic equipment, etc., conduct connection as shown in Figure 12.

Set the resistance (R) to a value so that the total current which flow does not exceed 50 mA when all the measured objects connected are shorted.

If the overload state continues, the fuse in this instrument burns out.



C1 to Cn : Measured objects
C1 to Cn-1: Under charge
Cn : Under measurement
R : Current limiting resistor

Figure 12 How to Use Charge Terminals

Example: When the number of measured objects is 60, measured voltage is assumed to be 50 V.

Current (i) = 0.05 (A) ÷ 60 ≒ 0.000833 (A)

Resistance to be obtained (R) = 50 (V)

÷ 0.00083 (A) ≒ 60.2 kΩ

From the above, a resistor with the above resistance is connected.

5.7 Connection to Automatic Equipment

1) Connector plug (red) wiring

When this instrument is connected to automatic equipment, use a connector plug connected with a ϕ 6 (mm), high insulation shielded wire.

Figure 13 shows connector plug assembly.

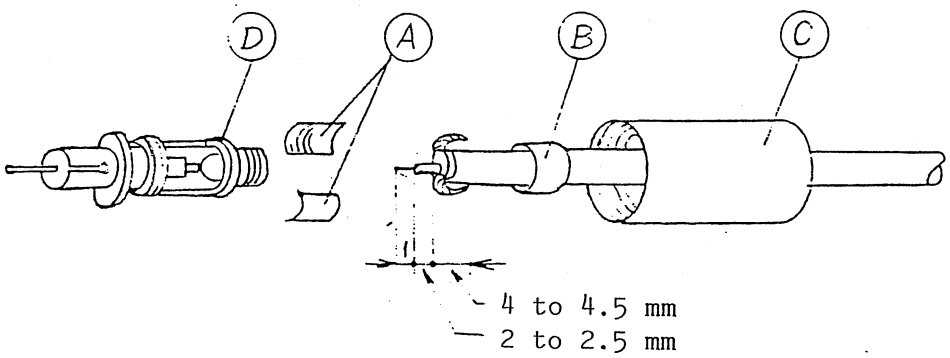


Figure 13 Connector Plug Assembly

Treat the cable as shown in the above Figure, cover the shielded section with Ⓐ, then insert it into the connector (D). Tighten B, solder the core, then cover it with Ⓒ.

2) Other cautions

After finishing wiring preparation, insert the connector plug into the R_x terminal, then check to see if CONTACT "NO" lamp lights up for the "$S_1 \times S_4$" setting with the automatic equipment measuring terminals (jig) opened. (See Figure 6.)

If the lamp goes OFF, it indicates that insulation resistance is already low without a measured object connected. This may be caused by insulation deterioration or external induction and noise.

6. Troubleshooting and Repairs

Although this instrument has been carefully inspected before shipment, it should be checked in accordance with the following instructions if it experiences any trouble.

1) If the indicator does not indicate "ZERO" as a result of the operation check in Item 5.2, it is likely to be caused by the offset deviation of the instrument's amplifier. Remove the cover at the top of the instrument, then slowly turn the V.R. Ⓐ (R52) until the indicator indicates "ZERO".

2) If the indicator deviates from the "CAL." point with S_1 set to "CAL.", connect a class 0.5 DC voltmeter between CHARGE (-) and R_x (+) at the rear of the instrument.
Slowly turn the V.R. Ⓑ (R3) in Figure 14 until the voltmeter indicates the correct voltage.
Thus, the indicator matches the "CAL." point.

3) <u>If the fuse is burnt out</u>
Output current required to maintain the instrument's rated measuring is about 50 mA. The precharge current limit is set as shown in Item 5.6 2), but if the current increases, the fuse burn out to protect the instrument.
In this case, remove the R_x and charge terminals connected to the instrument, then insert the attached spare fuse (0.5 A TIME LAG).
Next, check instrument operation according to Items 6. 1) and 2).
Check the load side, and if there is abnormal current flow prior remove the causes to using the instrument.

4) Others

If the instrument cannot be adjusted by following the procedures described in par. 1) and 2) above, please contact our agent or our company.

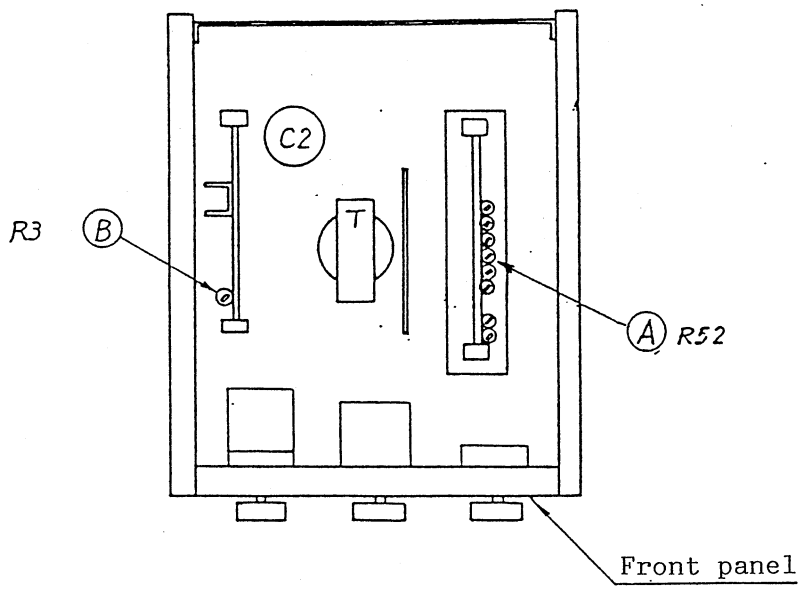
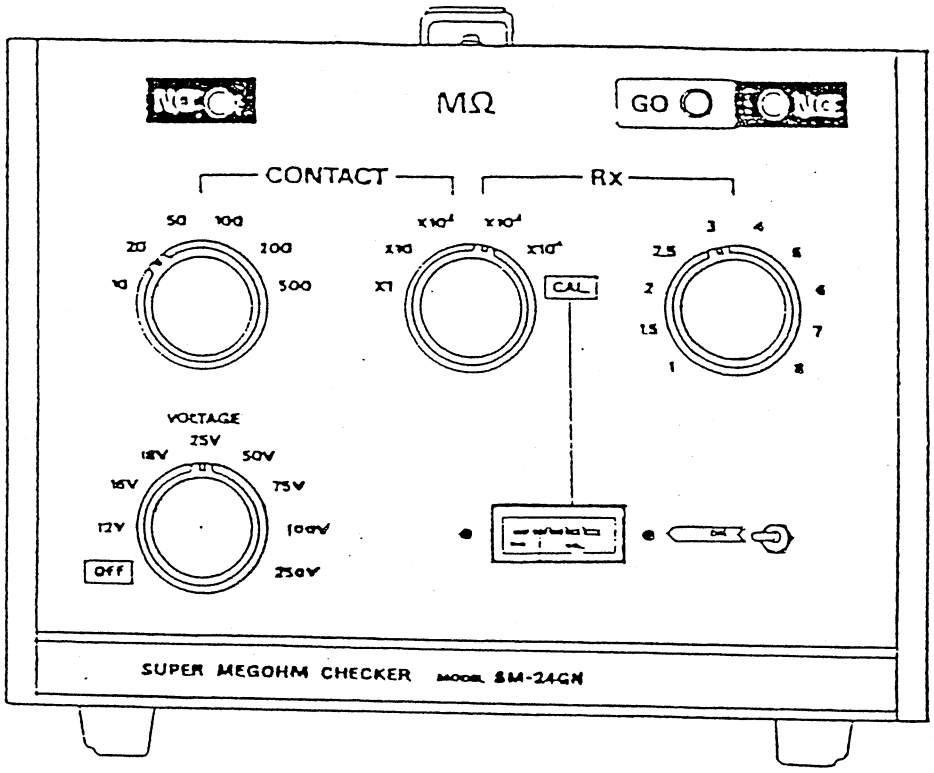
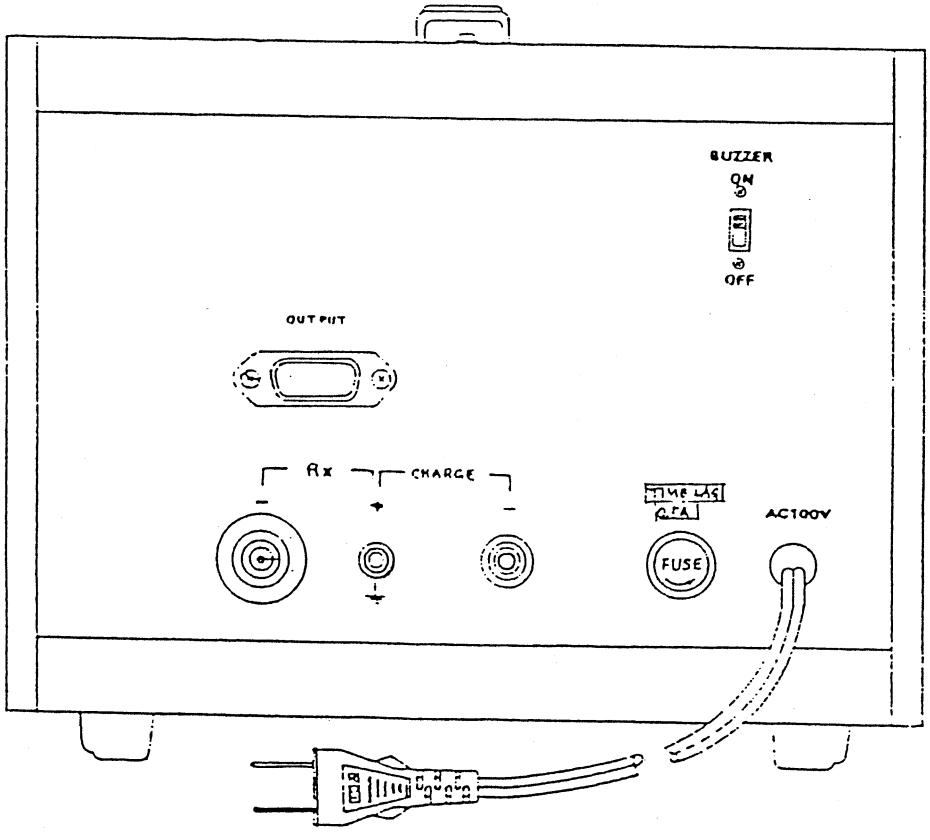


Figure 14 Diagram of Parts Arrangement on the Top of the Instrument

Drawing


MΩ
GO
CONTACT
Rx
CAL
VOLTAGE
Off
SUPER MEGOHM CHECKER


BUZZER
ON
OFF
OUTPUT
Rx
CHARGE
FUSE
AC100V

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