

**Digital Multimeter**

**D2M2 series**

**Model 4050**

# ***INSTRUCTION MANUAL***



**SOAR CORPORATION**

Met dank aan A.R.A. van Rossum  
**Digital Multimeter**  
**D2M2 series**

Model **4050**

Ned. Ver. v.

**Instruction Manual**



We would like to express our appreciation for your purchase of the D2M2 series. This series was designed using the latest in technology to ensure high reliability.

To ensure that you get the most out of your new instrument, we recommend that you read carefully and follow the instructions in this manual.

Specialists in Testing and Measuring Instrumentation





# **SAFETY RULES**

- **Before operating this instrument, familiarize yourself with all instructions outlined in this manual.**
- **Always check to make sure that the function switch is set to the proper position.**
- **When making measurements, use CAUTION as dangerous voltages may be present in normally safe areas.**
- **Always disconnect the circuit under test prior to attaching test leads, as voltages may be present in capacitors even when the main power is disconnected.**
- **To avoid electrical shock, use CAUTION when working above 60V DC or 25V AC rms.  
Such voltages pose a shock hazard.**
- **Make sure all power (AC or DC) is disconnected (OFF) when making resistance (OHMS) measurements.**
- **Never make measurements with the battery cover OFF.**
- **Never fail to keep the maximum tolerable input.**
- **The input limitation for each function is shown below. To avoid electrical shock or damage to the DMM do not exceed the input limit.**

Function	Maximum input
V	DC1200V/AC900Vrms
40mV, 400mA	DC400mA/AC400mA rms
10A	DC10A/AC10A rms
$\Omega$ , $\mu\Omega$ , Hz, $\pm$	DC500V/AC500Vrms
A D P, $^{\circ}\text{C}$	DC250V/AC250Vrms

### ● Symbols

 **Caution symbol:** Indicates the operator should refer to an explanation in this manual to prevent damage to the DMM.

 **Danger symbol:** Indicates terminals at which dangerous voltages may exist. Take extreme care when measuring dangerous voltages to avoid shock.

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# **1. INTRODUCTION**

This product is a high-performance digital multimeter which uses the latest in technology combined with an in-house developed A/D chip and built-in microcomputer. It features an bar graph display as well.

Compared with previously available 3.5 digit multimeters, it provides a dramatic two-fold increase in dynamic range, with a full scale display of 4000 counts, providing high accuracy and resolution rivaling that of 4 digit meters (i.e., above 2000 counts). It is an extremely valuable tool in measuring analog outputs over a wide range. In addition, a 40 segment high-speed bar graph display corresponding to the digitally displayed value enables an analog-like indication of the constant variations in measured values, a feat heretofore impossible with digital-only meters. This is extremely useful in checking varying signals and in making such adjustments as offset adjustment of analog circuitry. In addition to these capabilities, autoranging with greatly improved speed and autoranging even for current measurements (except 10A range), temperature test and frequency test are provided to automatically optimize the measurement range instantly. Basic performance has been improved and a dramatic reduction in power consumption achieved as well. A resistance range capable of

measurements up to 40 M $\Omega$ , MIN/MAX hold, data hold, electrostatic pulse protection up to 6kV, redundant protective circuitry for current ranges (except for 10A), three-terminal input and simple, dustproof construction clearly demonstrate the SOAR commitment to high performance.

## 2. SPECIFICATIONS

### 2—1 General Specifications

**Measuring method:** Dual integration mode

**Display:** LCD, 3.5 digits max. reading of 4000, 9999 (Frequency test) and annunciators


**Bar graph display:** 40 segments (100 counts resolution/ segment) with approx 23 times/sec. sampling

**Range:** Auto or manual ranging

**Polarity:** Automatic no indication for positive polarity, minus(—) sign for negative polarity.

**Sampling:** 2.3 times/sec. (digital display)

**Over range indication:** "OL" mark indication (Except DC 1000V, AC 750V and AC/DC 10A ranges.)

**Low battery indication:** " " mark is displayed when the battery voltage drops below operating voltage

**All segments display:** When the meter is turned on, all segments are displayed

**Operational temperature:** 0~40°C, 80%RH max.  
(Non-condensing)

**Storage temperature:** -25~60°C, 70%RH max.  
(Non-condensing)



**Temperature coefficient:** Specified accuracy ×  
(0~18℃ & 28~40℃) 0.1/℃

**Calibration:** 1 year for specified accuracy

**Max. common mode voltage:** ±1000V or AC peak  
(Between input terminals and outer case)

**Power supply:** 1.5V (AAA size, UM-4) × 2

**Power consumption:** Approx 2mW (TYP)  
(DCV mode)

**Battery life:** 1000 hours or more (Alkaline batteries)

**Size:** 80(W) × 176(H) × 37(D)mm

**Weight:** Approx 310g (included batteries)

**Accessories:** Instruction manual .....1  
Safety test lead .....1 set  
Batteries (1.5V, AAA size, UM-4) .....2  
Spare fuse (0.5A/250V, Fast) .....1

## 2-2 Measurement Ranges (23°C ± 5°C)

Accuracy specified: ± (% of reading ± number of digits)

### DC Voltage

Range	Resolution	Accuracy	Input resistance	Maximum input
400mV	100μV		10MΩ	1200V DC or 900V AC ms (sine)
4V	1mV		11MΩ	
40V	10mV	0.1+1		
400V	100mV		10MΩ	
1000V	1V	0.2+1		

NMRR : > 60dB (50Hz/60Hz)

CMRR : > 120dB (50Hz/60Hz, Rs = 1kΩ)

Response time : 1 second max. to rated accuracy within selected range

### ~ AC Voltage

Range	Resolution	Accuracy		Input impedance	Maximum input
		40Hz ~ 500Hz	500Hz ~ 1kHz		
400mV	100 $\mu$ V	0.75 + 2	1.5 + 4	10M $\Omega$ // < 50pF	1200V DC or 900V ACrms (sine)
4V	1mV		—	11M $\Omega$ // < 50pF	
40V	10mV	0.75 + 2	1.5 + 4	10M $\Omega$ // < 50pF	
400V	100mV				
750V	1V				

CMRR : > 60dB (DC ~ 60Hz,  $R_s = 1k\Omega$ )

Response time : 1 second max. to rated accuracy within selected range

Conversion Type : AC coupled, average sensing, calibrated to read rms value of sine wave.

### DC Current

Range	Resolution	Accuracy	Burden Voltage	Maximum input
40mA	10 $\mu$ A	1.0 + 2	< 0.25V	0.4A
400mA	100 $\mu$ A	1.5 + 2	< 2.5V	
10A	10mA		< 0.25V	10A

Response time : 1 second max. to rated accuracy within selected range

Input protection : 40, 400mA — 0.5A/250V & 4A/600V fuse protection. 10A — Unfused

~ AC Current (40Hz ~ 1kHz)

Range	Resolution	Accuracy	Burden voltage	Maximum input
40mA	10 $\mu$ A	2.0+5	<0.25V	0.4A
400mA	100 $\mu$ A		<2.5V	
10A	10mA		<0.25V	

Conversion Type : AC coupled, average sensing, calibrated to read rms value of sinewave.

Response time : 1 second max. to rated accuracy within selected range

Input protection : 40,400mA--0.5A/250V & 4A/600V fuse protection. 10A--Unfused.

$\Omega$  Resistance

Range	Resolution	Accuracy	Test current	Open circuit voltage	Input protection
400 $\Omega$	100m $\Omega$	0.3+2	1.4mA	<3.3V	500V DC or ACrms
4k $\Omega$	1 $\Omega$		80 $\mu$ A		
40k $\Omega$	10 $\Omega$	0.3+1	10 $\mu$ A	<1.3V	
400k $\Omega$	100 $\Omega$		1.3 $\mu$ A		
4M $\Omega$	1k $\Omega$	0.5+1	130nA		
40M $\Omega$	10k $\Omega$	1.0+1			

Response time : 400 $\Omega$ ~40k $\Omega$ .....1 second max. to rated accuracy within selected range

400k $\Omega$ .....2 second max. to rated accuracy within selected range

4M $\Omega$ .....5 second max. to rated accuracy within selected range

40M $\Omega$ .....10 second max. to rated accuracy within selected range

### Hz Frequency Test (Auto Ranging)

Range and measuring span	Resolution	Accuracy	Maximum input
5Hz ~ 9999Hz	1Hz	0.02 + 1	500V AC rms
9.00kHz ~ 99.99kHz	10Hz		100V AC rms

Input attenuator range (manual setting)	Input voltage		Input impedance
	5Hz ~ 10kHz	10kHz ~ 100kHz	
4	100mV ~ 4V	300mV ~ 4V	Approx 2.3MΩ // < 50pF
40	400mV	~ 40V	Approx 1.3MΩ // < 50pF
400	4V ~ 400V	4V ~ 100V	Approx 1.2MΩ // < 50pF

Coupling : AC

Sampling : 1 time/s

### °C Temperature Test

Range	Resolution	Accuracy (Less thermocouple sensor's error)	Input protection	Sensor
-20 ~ +700°C	1°C	2.0 + 2(°C)	250V rms	K type (CA) sensor

•)) Continuity Check

Range	Resolution	Continuity beeper	Test current	Open circuit Voltage	Input protection
400 $\Omega$	100m $\Omega$	< Approx40 $\Omega$	<1.4mA	<3.3V	500V rms

← Diode Test

Range	Resolution	Accuracy	Test current	Open circuit Voltage	Input protection
0~2.000V	1mV	1.0+2	1mA ( $V_F=0.6V$ )	<3.3V	500V rms

ADP

Range	Resolution	Accuracy	Input resistance	Input sensitivity	Input protection
0~4000	1	0.3+2	>1000M $\Omega$	0.1mV/count	250V rms

**Data Hold** Applicable in all functions

**MIN/MAX Hold** Applicable in all functions except frequency test.

### **3. PREPARATION AND CAUTION BEFORE MEASUREMENT**

- Before making measurements, install the batteries. Two "AAA" size batteries can be used.
- Avoid using the D.M.M. in places subject to high temperatures, humidity or excessive vibration.
- Avoid using the D.M.M. in places with rapid temperature variations.
- If the D.M.M. is used near noise generating equipment, be aware that the display may become unstable or indicate large errors.
- If the function must be switched during a measurement, always remove the test leads from the circuit being measured. After measurement, set the power switch to "OFF".

## 4. OPERATION

### 4—1 Panel Descriptions

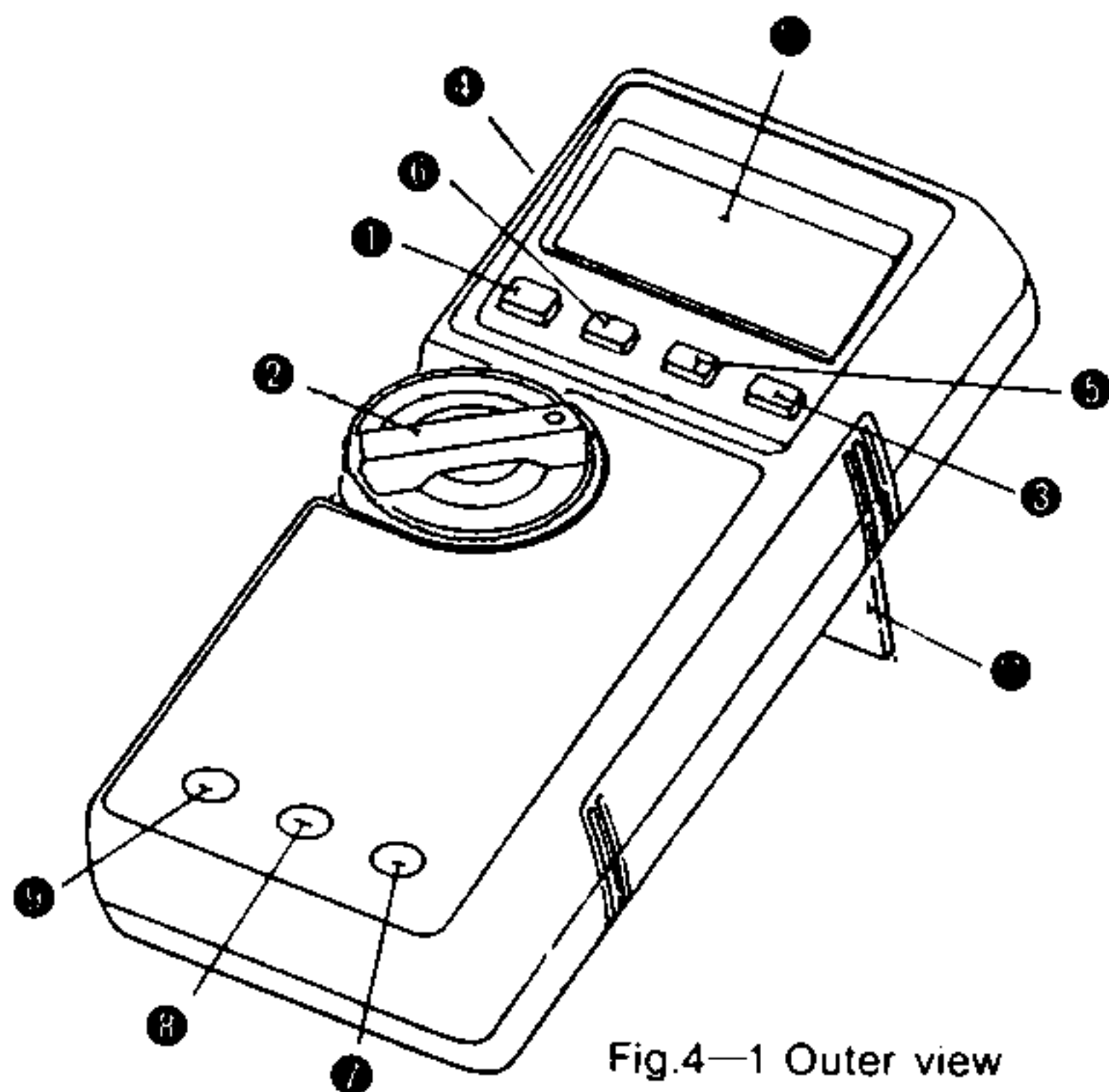


Fig.4—1 Outer view

#### ① Power Switch

This locking pushbutton switch applies power to the unit when pressed in and removes it when released.

#### ② Function Switch

This rotary switch selects the measurement func-



tion when aligned with function symbols on the panel.

## ● Range Switch

This switch cancels the autoranging function and enables selection of any desired range. When power is first applied, autoranging is automatically selected and the optimum range selected. For such measurements as linearity of analog circuitry, however, in which the range must be fixed, this can be overridden. Pressing the switch once changes to the manual ranging mode and locks the unit in the current range. Subsequent pressing of the switch increases the range until the uppermost range is reached, after which return is made to the lowest range and the sequence is repeated. With the range fixed, if an excessive input signal is applied, the "OL" display will appear. If this occurs, increase the range. To return the unit to the autoranging mode, hold this switch down for one second continuously. In the autoranging mode, "AUTO" will appear in the display and for each individual range, **4**, **40** or **400** will appear (with the exception of the highest voltage range). This switch is usable in all modes having autoranging and is operative for DC/AC voltage, DC/AC current (except for 10A), frequency test and resistance modes. The autorang-

ing function ranges up at 4001 and above and down at 359 and below. However, if a signal is applied which causes a sudden up-range operation, three digit display may result. If this occurs, selecting the range with the corresponding switch will return the unit to four digit display.

### ④ **Data Hold Switch**

This switch is used to hold data during a measurement.

When pressed, the current data is held and changes in input signals from that point will not change the display. This function is operative in all measurement modes and, in the held state, D.H appears in the display. Pressing the switch once again releases the hold condition.

### ⑤ **Minimum/Maximum Hold Switch**

This function automatically senses the minimum and maximum values of the input signal and holds these values. It is a valuable aid in measuring the amount of variation of a signal and can provide valuable longterm minimum and maximum value data for the production line as well. When this switch is pressed, the MIN and MAX marks appear in the display indicating that subsequent signal variations will be tracked by this min/max function. The display, however, indicates the current signal value so that normal measurements

can continue. To view the maximum value, press the switch a second time. On the third pressing, the minimum value is displayed and, on the fourth pressing, return is made to the current input value. Subsequent pressing will switch through the sequence (maximum value) → (minimum value) → (current value). To cancel this function or start reset the currently stored minimum and maximum values, press the switch and hold it down for at least 1 second. This function is operative for all measurement functions except frequency.

### ● $\Omega / \rightarrow$ , $\rightarrow / \sim$ (A) mode Selection Switch

When the power is first switched on, DC current measurement mode is automatically selected in "A" range and resistance measurement mode is automatically selected in " $\Omega / \rightarrow$ " range.

Press this switch for measuring AC current in "A" range.

Press this switch for measuring continuity check in " $\Omega / \rightarrow$ " range.

To cancel AC current and continuity check modes, press this button continuously for one second or longer.

In continuity check mode, the range switch ● is disabled.

### ⑦ **V, $\Omega$ , mA, $\leftrightarrow$ Input Terminal**

This is the positive side input terminal for all functions except 10A current measurements. Connection is made here using the accessory red test lead. When making an adaptor range, temperature test and frequency test, connection is made between this terminal and the COM ⑧ terminal.

### ⑧ **COM Input Terminal**

This is the negative (ground) input terminal for all measurement modes. Connection is made to it using the accessory black test lead.

### ⑨ **10A Input Terminal**

This terminal enables large current measurements up to a maximum of 10A. Connection is made to it using the accessory red test lead (this test lead enables measurements up to 10A).

This terminal has no protective circuit and has extremely low internal resistance, so that if a large-capacity supply is accidentally connected to this terminal directly, an extremely dangerous condition will exist. When making such high-current measurements, therefore, always use such protective circuitry as a 20A breaker.

## ● Liquid Crystal Display

This liquid crystal display provides a 3.5 digit measurement data display having a maximum count of 4000, an bar graph display, as well as unit and mode annunciators. When power is first applied to the unit, all segments of the display are driven and the display appears as follows.

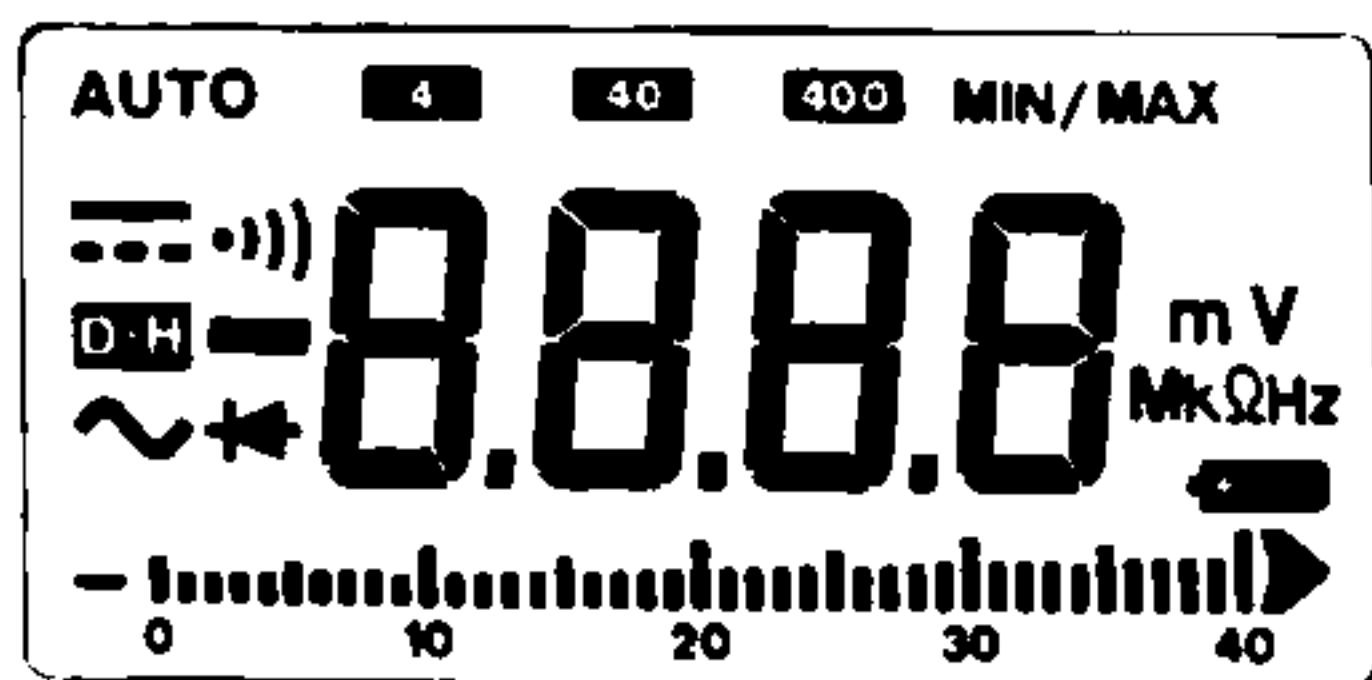






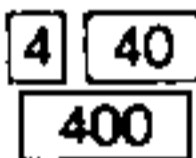



Table 4-1 Displayed Symbols and Units

Symbols/ Units	Descriptions
	Indicates DC and appears for the DC voltage and current modes.
	Indicated AC and appears for the AC current and voltage modes.
	Polarity marks which appears when a DC signal measurement value is negative.
	Appears when the diode test mode has been selected.
	Appears when the continuity check mode has been selected.
	Indicates that the data hold condition has been enabled.
MIN/MAX	MIN/MAX : Indicates that the minimum/maximum value hold function is operating. MIN : Indicates that the minimum value is being displayed. MAX: Indicates that the maximum value is being displayed.
	Range indicators which indicate the currently set range (no display for the highest voltage range).
AUTO	Appears to indicates that autoranging has been selected.
mV,V	Units for voltage measurements
$\Omega$ ,k $\Omega$ ,M $\Omega$	Units for resistance measurements
Hz	Unit for frequency measurements
	Lights to indicate that battery voltage has dropped excessively.

**Notes:** Units are not indicated for the current and temperature ranges.

## ● Stand

This stand can be extended for benchtop use.

## ● Other Functions

This selection will describe functions do not appear on the panel.

## ● Bar Graph Display

The major feature of this multimeter is the provision of an bar graph display. This is a 40 segment display which corresponds to a full count of 4000 on the numerical display, so that one segment corresponds to 100 counts. The operating speed of this display is 10 times that of the numerical display. This enables it to quickly track fastchanging analog signals, greatly simplifying adjustment of such signals.

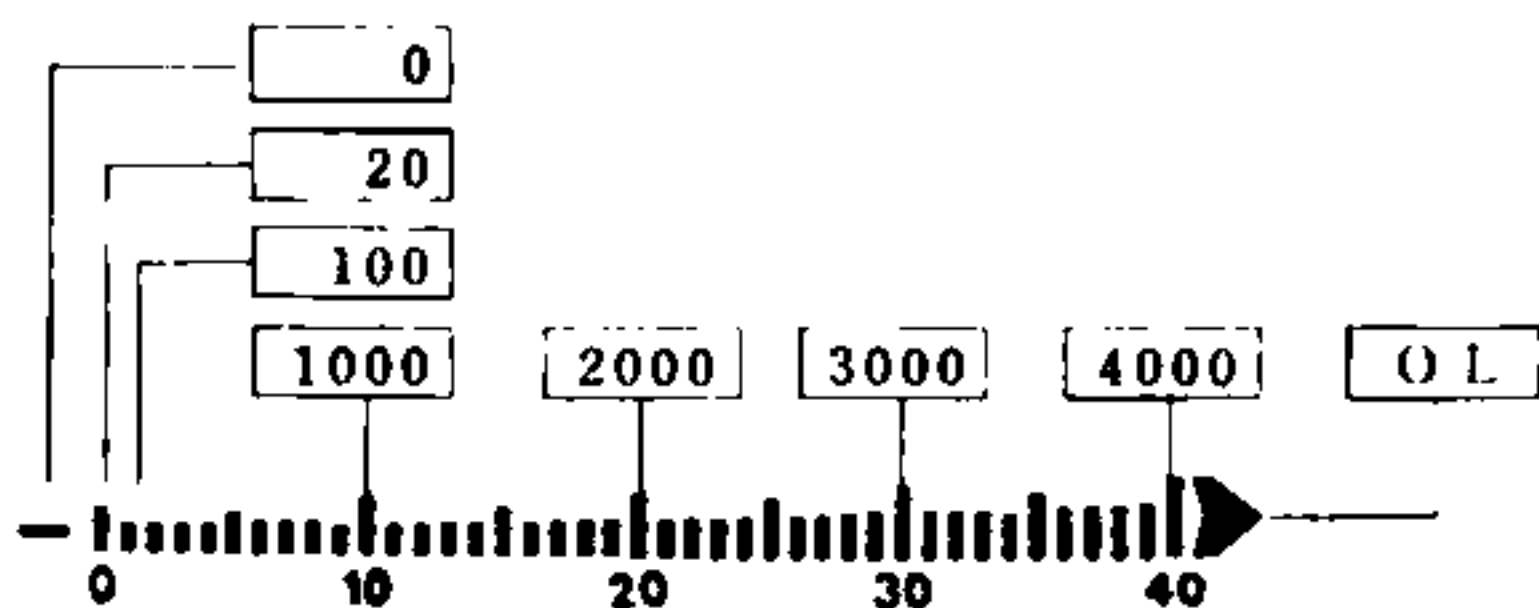


Fig.4—3 Relation of the Analog Bar Display and Numerical Display

## **4—2 Measurement Method**

First, apply power to the unit. When this is done, a beep tone will sound and all segments on the display will appear for approximately two seconds, after which another beep tone will be heard and measurement will be possible. Next, connect the test leads to the input terminals. Connect the red lead to the V terminal and the black lead to the COM terminal. All connections with the exception of 10A measurements are made at these terminals.

### **(1) DC and AC Voltage Measurements**

Set the function switch ● to " $\text{---} V$ " or " $\text{---} V$ ", depending upon whether a DC or AC voltage is to be measured and depending upon the level to be measured. If necessary, set the range using the range switch ●. Finally, apply the test leads to the circuit to be measured. For either DC or AC measurements, connect the black test lead to the circuit ground and the red test lead to the point to be measured. Read the displayed value after the display stabilizes. Care is required as the "OL" display will not appear for the DC 1000V and AC 750V ranges.

### **(2) DC and AC Current Measurements**

Set the function switch to "A". Press the " $\text{---} / \text{---} (A)$ " mode selection switch ● to alternately



AC or DC measurement.

This applies to the 10A range as well. Next, connect the test leads in series with the circuit to be measured, connecting the red lead to the positive side and the black lead to the negative side. As is the case for the voltage measurement mode, if required, set the range switch ③ to the desired range.

For 10A range measurements, connect the red test lead to the 10A terminal and the black test lead to the COM terminal. When doing this, verify that the range is "40". If it was "400", set the "40" range using the range switch or set AUTO. There is no OL display with 10A range, so extreme care is required so that the 10A input limit is not exceeded.

### **(3) Resistance Measurement and Continuity Checks**

Set the function switch to both " $\Omega/ \rightarrow$ )" and, if required, set the range. Next, connect the test leads to the circuit to be measured and read the display value after the display stabilizes.

For  $40M\Omega$  ranges measurements, the accessory test leads may pick up noise from the power line and the display, therefore, may flicker. In such cases, use shielded test leads (optionally available) to stabilize the display.

To perform continuity checks, leave the unit in the

resistance mode and press the " $\Omega/ \rightarrow$ " mode selection switch to select the continuity check mode.

When the resistance of the circuit being measured is less than approximately  $40\Omega$ , a beep tone will sound and the measured resistance value will be displayed.

#### (4) Diode Test

This function enables a check of a diodes forward voltage, deterioration in characteristics and damage. It is selected by setting the function switch to " $\rightarrow$ " and connecting the test leads across the diode. As shown in Fig.(a), when measuring the forward voltage across the diode, a normal diode will indicate 0.4 to 0.7V and, as shown in Fig.(b) the reverse voltage will indicate "OL" (same as an open condition). This mode enables display up to 2.2V, although care is required as the specifications are 2.0V

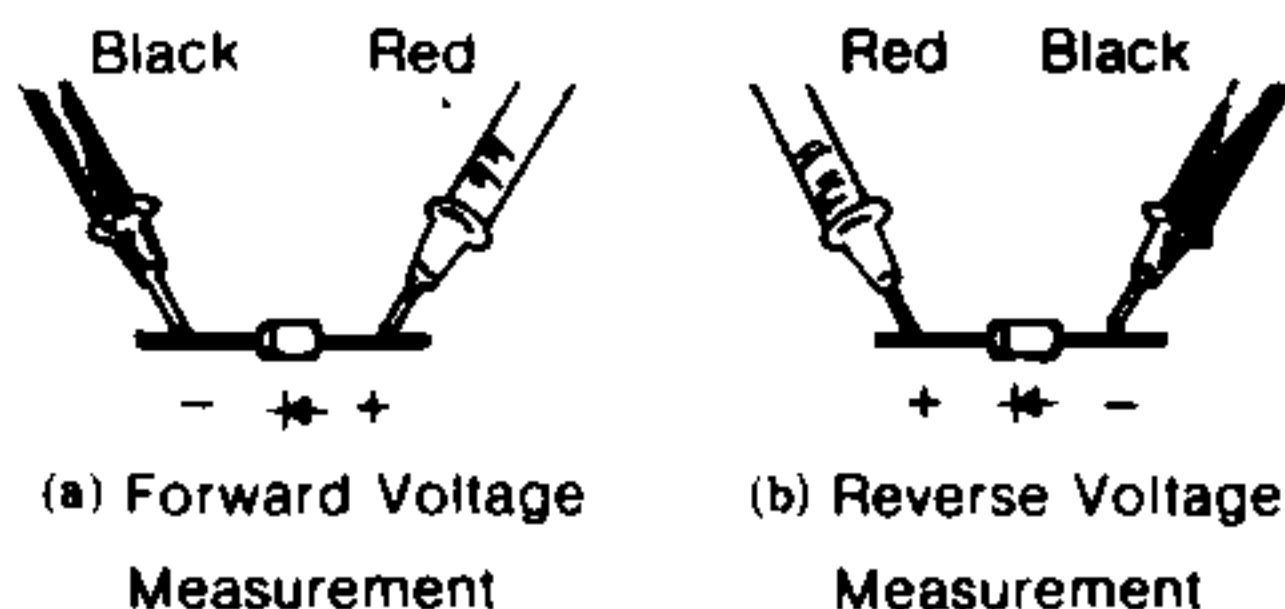


Fig.4—4 Diode Test Method

## (5) Frequency Test

The frequency measurement function is provided with auto-ranging. In this mode, sampling period is 1 second.

The auto-ranging function ranges up at 10kHz and above and down at 9000Hz and below.

The input sensitivity is manually set in the voltage range as shown in the table below.

Input attenuator range (manual setting)	Input voltage		Input impedance
	5Hz ~ 10kHz	10kHz ~ 100kHz	
4	100mV ~ 4V	300mV ~ 4V	2.3MΩ // < 50pF
40	400mV ~ 40V		1.3MΩ // < 50pF
400	4V ~ 400V	4V ~ 100V	1.2MΩ // < 50pF

- 1) Connect the red test lead to the "V,Ω,mA,←" terminal and the other (black) lead to the "COM" terminal.
- 2) Set the function switch to "Hz".
- 3) Connect the test lead to the circuit to be measured.

## (6) Temperature Test

Set the function switch to "C"

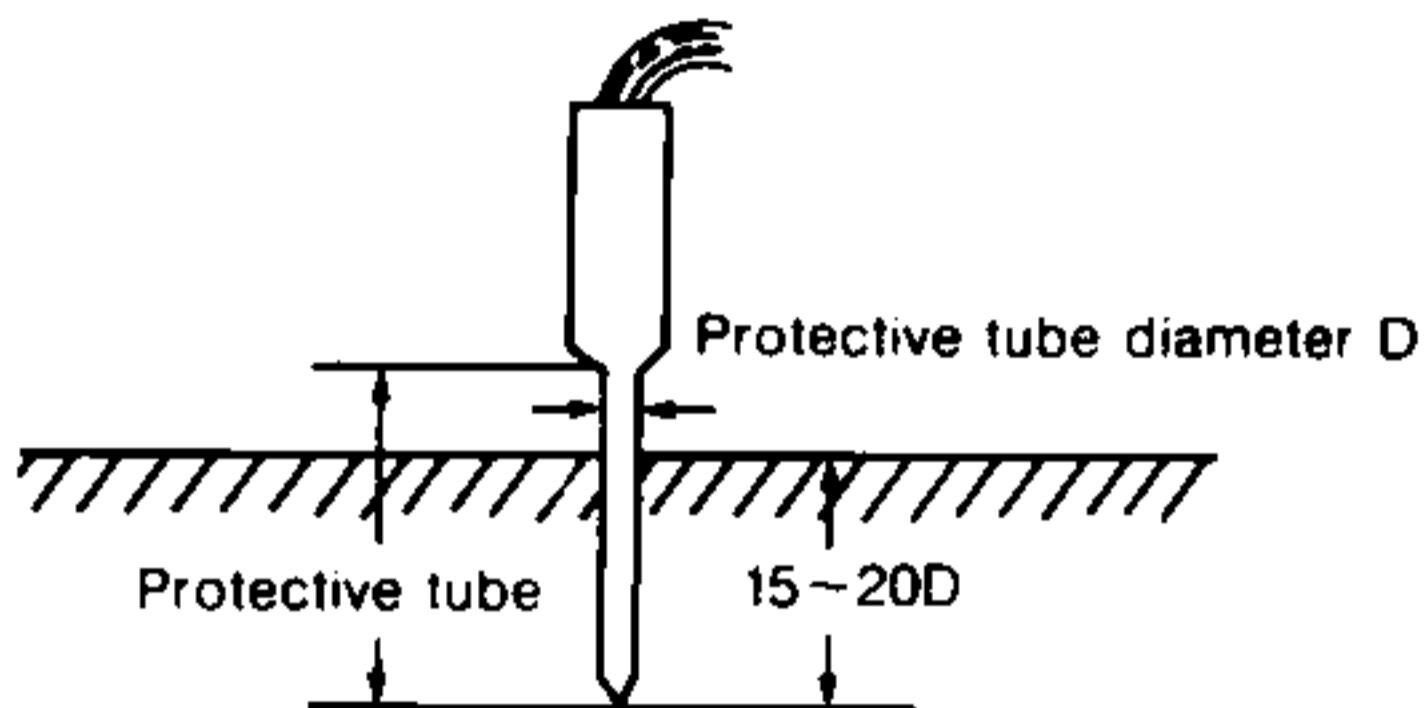
Connect the K-type thermocouple probe to the input terminals. Connect the red test lead to the "V,Ω,←,mA" terminals and the other (black) test lead to the "COM" terminal.

Perform measurements by contacting the object being measured with the probe tip.

It is possible to measure ambient temperature without a sensor by shorting the input terminals.

### Cautions

- To measure the internal temperature of an object, insert the protective tube to a depth of 15~20 times the diameter  $D$ .



- When moving the 4050 to a location which would subject it to a temperature difference or when connecting the probe plug to the 4050's jack, allow 30 minutes or more before measurements are made to allow the input jack reference junction compensation to stabilize.
- The temperature measurement probe molded section and lead wires (compensating wires) can withstand  $100^{\circ}\text{C}$  and  $80^{\circ}\text{C}$ , respectively. Care should be taken that these parts are not subjected to higher temperatures than these.

### (7) Measurement Using Optional Accessories

A variety of optional accessories are available for this instrument. These enables, in addition to the basic functions, the measurement of large currents (using a clamp-on accessory), capacitance and transistor  $h_{FE}$ , thus greatly expanding the measurement functions of the instrument. When using these adaptors, set the function switch to "ADP", mount the adaptor as shown in the figure below, connect the required sensor and/or circuit device to be measured and perform the measurement. At this function setting, no decimal point or units are displayed. Refer to the adaptor's instruction manual for instructions on reading the display.

In this mode, the input signal is DC only and older

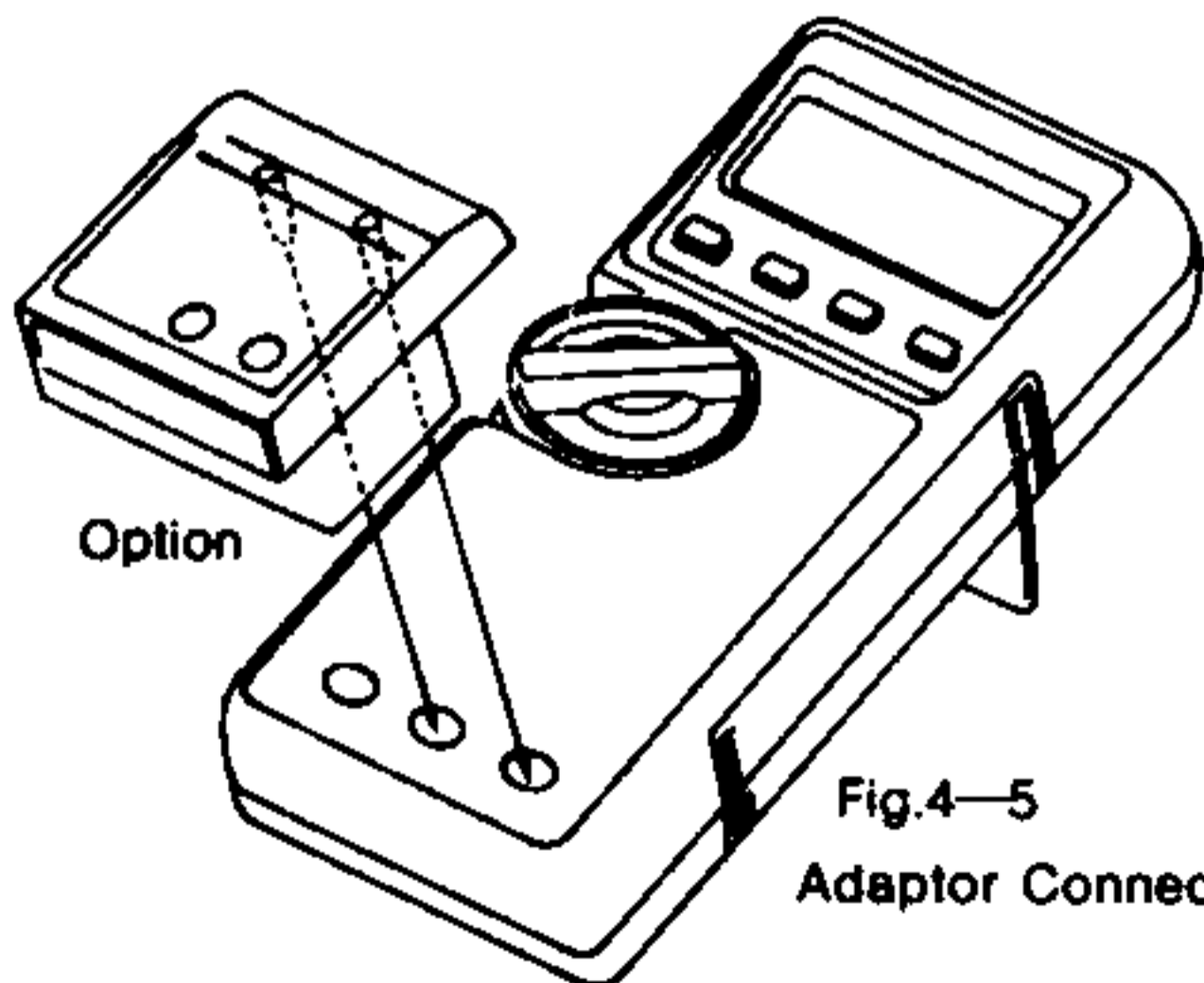


Fig.4—5  
Adaptor Connection

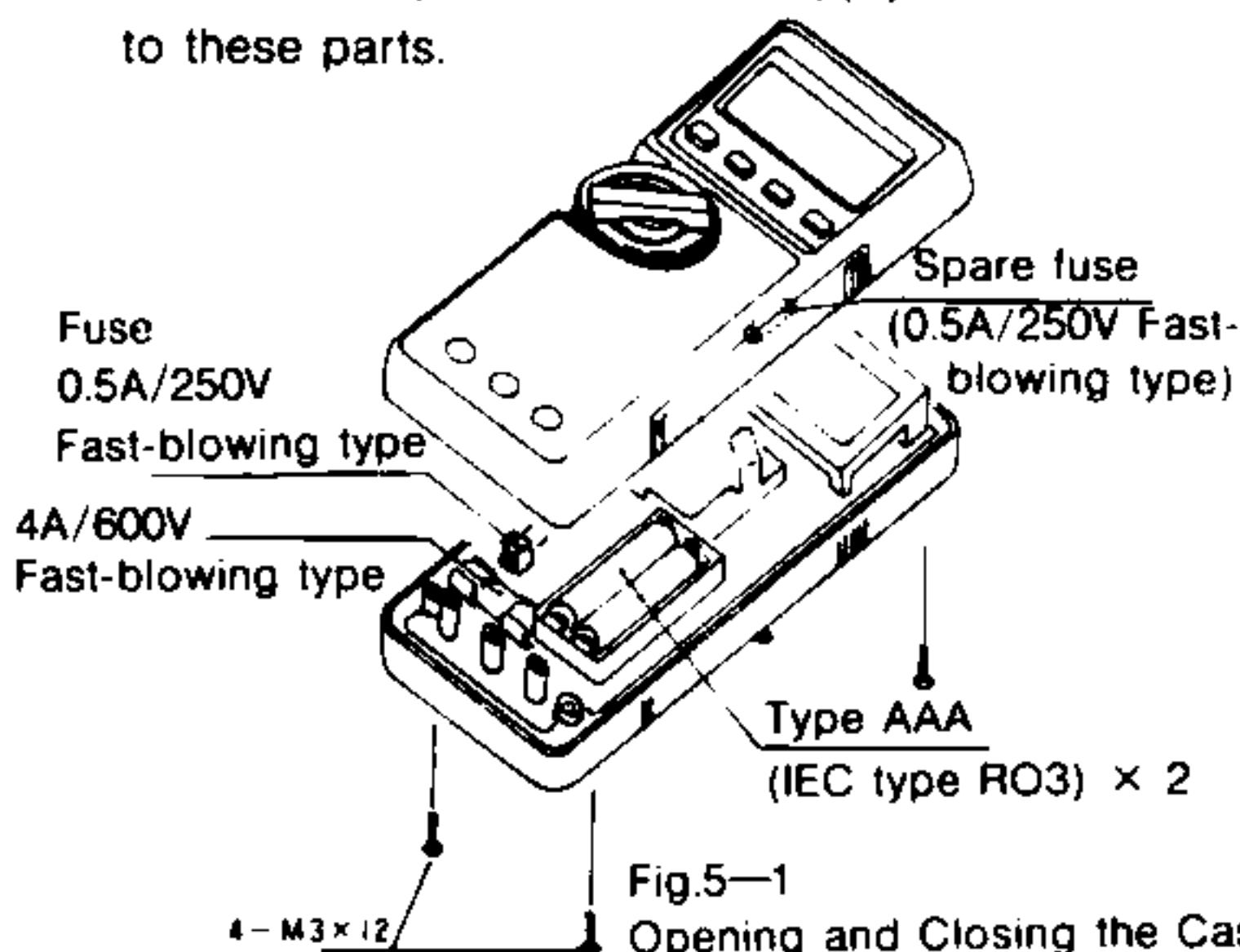
**type adaptors (older 9300 series) are not capable of AC measurements. When using this series of adaptors, the display may read negative, in which case the polarity should be ignored and data only read.**

## 5. BATTERY AND FUSE REPLACEMENT METHOD


Battery and fuse replacement is done by separating the top and bottom parts of the multimeter case. When opening and closing it, take care not to touch any other components and perform the replacement in a location which would not subject the instrument to dust.

### 5—1 Opening and Closing the Case

Use a screwdriver to loosen the screws at the four corners of the bottom of the multimeter case and carefully lift off the top part of the case. The board and bottom part of the case are connected and cannot be separated. Do not apply excessive force to these parts.



## **5—2 Battery Replacement**

While using the instrument, if the remaining battery life drops below operating voltage, the warning mark "" will appear in the display. Also, it is an indication that the batteries have worn down. Such cases, replace with new batteries.

Replace both batteries at one time and do not mix battery types or mix old batteries with new batteries when doing this. Be sure to insert with the correct polarity, following the marks inside the battery compartment.


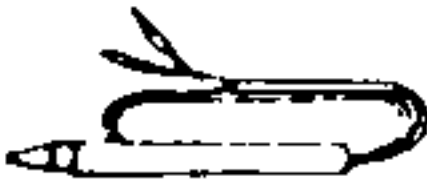

## **5—3 Fuse Replacement**




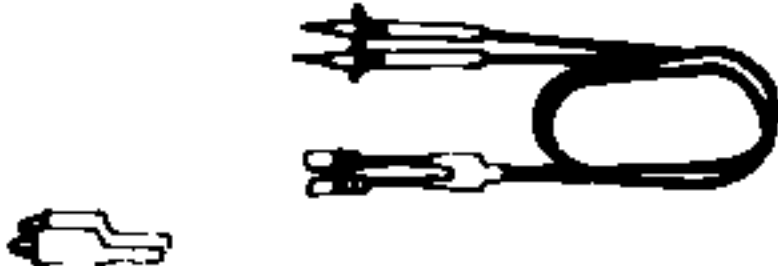
If the protective fuse blows by virtue of an excessive current in any of the current ranges except 10A, further current measurements will not be possible. If this occurs, replace the blown fuse with a fuse of the proper rating. The 0.5A spare fuse is located inside the top part of the case. When inserting a new fuse, use a 5 dia. x 20mm, 0.5A/250V fast-blowing fuse. If the 4A fuse blows, severe damage can be suspected. If this occurs, refer to the section on service and contact your service representative. As a safety measure, never use a fuse other than one of the specified rating and never perform measurements with the case opened.


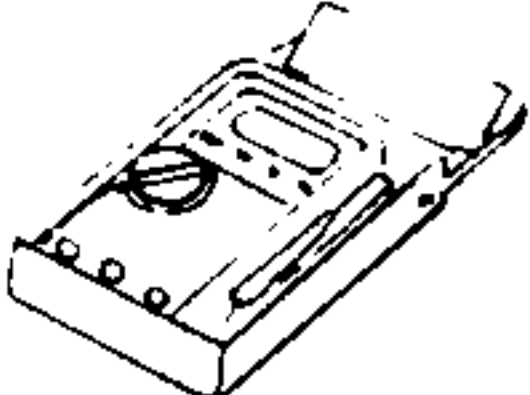
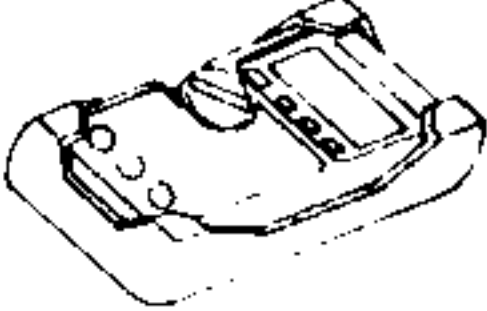


## 6. OPTIONAL ACCESSORIES

Optional accessories are shown in the following table.

Model	Remarks
<b>Temperature Probe</b> <b>TX—K10B</b>  <b>TX—K11B</b>  <b>TX—K12B</b>	Type K(CA)  <ul style="list-style-type: none"> <li>• - 50 ~ + 300°C ,JIS-class 0.4, Sheath type.</li> <li>• - 50 ~ + 800°C ,JIS-class 0.4, Sheath type.</li> <li>• - 50 ~ + 200°C ,JIS-class 0.4, Sheath type</li> </ul> 
<b>TX—K20B</b>  <b>TX—K21B</b>	<ul style="list-style-type: none"> <li>• - 20 ~ + 600°C ,JIS-class 0.75, Surface temp. measurement</li> <li>• 20 ~ + 200°C ,JIS-class 0.75, Surface temp. measurement</li> </ul> 
<b>Current Adaptor</b> <b>9320A</b>	<ul style="list-style-type: none"> <li>• 0 ~ 200A(DC)</li> <li>• 0 ~ 150A(AC)</li> </ul> 

Model	Remarks
<b>Clamp Probe 9321</b>	<ul style="list-style-type: none"> <li>• Jaw opening capability: Approx 9mm</li> </ul> 
<b>Capacitance Adaptor 9330A</b>	<ul style="list-style-type: none"> <li>• 4nF ~ 400<math>\mu</math>F (6 ranges)</li> <li>• Resolution: 1pF ~ 0.1<math>\mu</math>F</li> </ul> 
<b>TR Adaptor 9340A</b>	<ul style="list-style-type: none"> <li>• <math>h_{FE}</math> 0 ~ 4000</li> <li>• <math>I_{DSS}</math> 0 ~ 40mA</li> </ul> 
<b>Shielded Test Lead TL-4</b>	<ul style="list-style-type: none"> <li>• Small-signal, high-resistance measurement.</li> <li>• With alligator clips.</li> </ul> 

Model	Remarks
<b>10A Measuring Cable</b> <b>TL-8</b>	<ul style="list-style-type: none"> <li>• Terminated in banana plugs and alligator clips.</li> </ul> 
<b>Carrying Case</b> <b>CC-4000</b>	
<b>Protection Case</b> <b>PC-4000</b>	

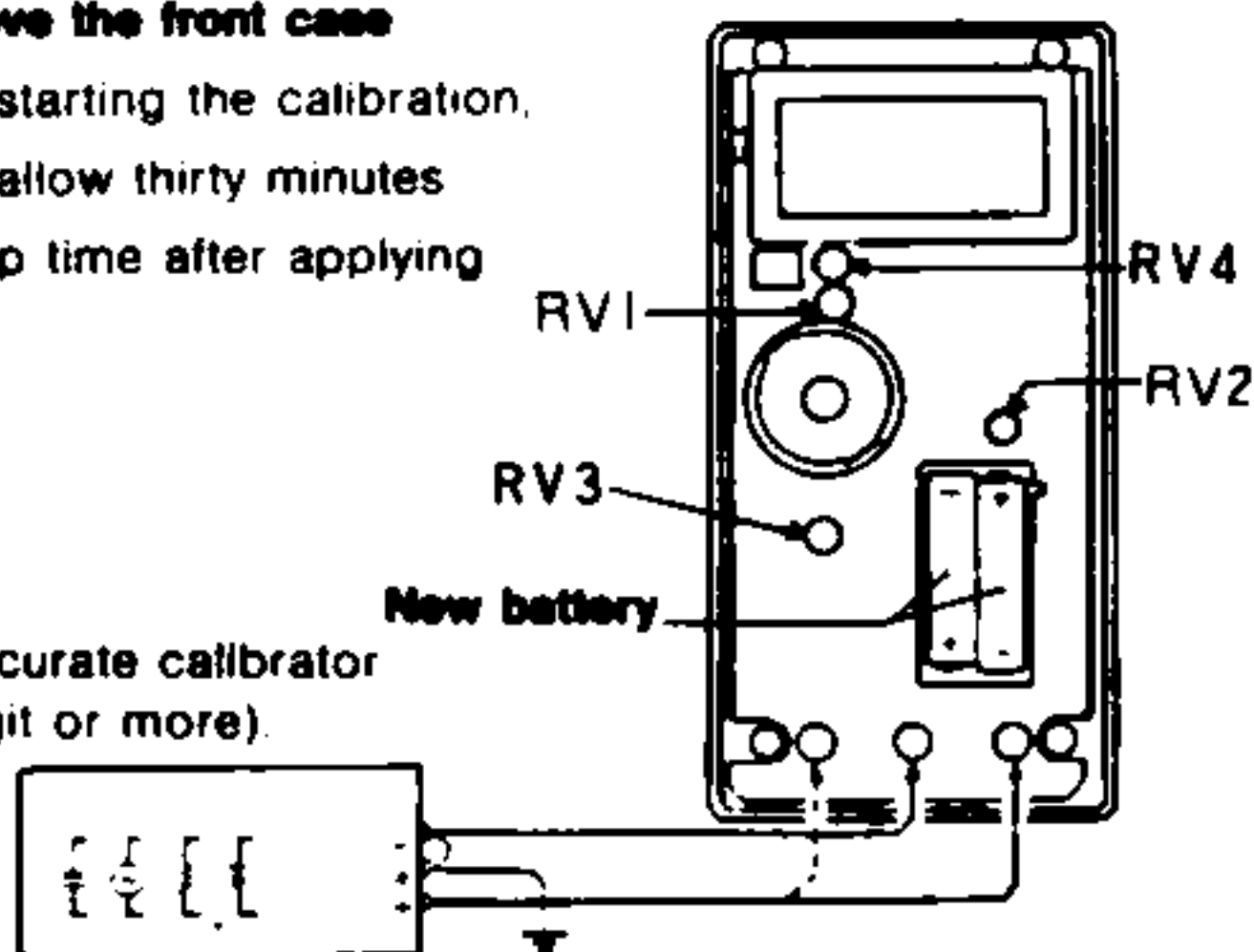
## 7. CALIBRATION

Fig.7—1

### Remove the front case

Before starting the calibration, always allow thirty minutes warm-up time after applying power.

Use accurate calibrator (4.5 digit or more).



**(1) DC Voltage**

Step	Range	Input	Adjustment	Tolerance
1	400mV	Short	—	-0.1 ~ 0.1mV
		380.00mV	RV1	-379.6 ~ 380.4mV
		-380.00mV	—	-379.6 ~ -380.4mV
2	4V	3.8000V	RV2	3.796 ~ 3.804V
3	40V	38.000V	—	37.96 ~ 38.04V
4	400V	380.00V	—	379.6 ~ 380.4V
5	1000V	1000.0V	—	997 ~ 1003V

**(2) AC Voltage**

Step	Range	Input	Adjustment	Tolerance
1	400mV	Short	—	0 ~ 0.2mV
		380.00mV 100Hz	RV3	377.2 ~ 382.8mV
2	4V	3.8000V 100Hz	—	3.772 ~ 3.828V
3	40V	38.000V 100Hz	—	37.72 ~ 38.28V
4	400V	380.00V 100Hz	—	377.2 ~ 382.8V
5	750V	750.00V 100Hz	—	745 ~ 755V

**(3) DC Current**

Step	Range	Input	Adjustment	Tolerance
1	40mA	Short	—	-0.02 ~ 0.02
		38.000mV	—	37.62 ~ 38.38
2	400mA	380.00mA	—	375.5 ~ 384.5
3	10A	10.000A	—	9.88 ~ 10.12

**(4) AC Current**

Step	Range	Input	Adjustment	Tolerance
1	40mA	Short	—	0.00~0.05
		38.000mA 100Hz	—	37.24~38.76
2	400mA	380.00mA 100Hz	—	372.4~387.6
3	10A	10.000A 100Hz	—	9.78~10.22

**(5) Resistance**

Step	Range	Input	Adjustment	Tolerance
1	400Ω	Short	—	0.0~0.2Ω
		380.00Ω	—	378.9~381.1Ω
2	4kΩ	3.8000kΩ	—	3.789~3.811kΩ
3	40kΩ	38.000kΩ	—	37.89~38.11kΩ
4	400kΩ	380.00kΩ	—	378.9~381.1kΩ
5	4MΩ	3.8000MΩ	—	3.781~3.819MΩ
6	40MΩ	38.000MΩ	—	37.62~38.38MΩ

**(6) Frequency**

Step	Range	Input	Adjustment	Tolerance
1	4	Short	—	0~1
		9000Hz 1V	—	8998~9002Hz

**(7) Temperature test**

Step	Range	Input	Adjustment	Tolerance
※ 1	-20~700℃	short	RV4	Room Temperature ±2℃

※ Before starting calibration, allow thirty minutes for multimeter stabilization to room temperature.

**(8) Continuity check**

Step	Range	Input	Adjustment	Tolerance
1	400Ω	0~100Ω	—	40Ω or less

**(9) Diode Test**

Step	Range	Input	Adjustment	Tolerance
1	0~2.000V	Open	—	"OL" mark
		Diode (forward voltage)	—	0.400~0.700mV (Silicon diode)

**(10) ADP**

Step	Range	Input	Adjustment	Tolerance
1	0~4000	Short	—	--2~2
		DC 380.00mV	—	3789~3811

## 8. MAINTENANCE

Please check the inspection items mentioned below before requesting repair.

Trouble	Cause of trouble and check point
No indication on LCD when power is turned ON	<ul style="list-style-type: none"><li>● Battery voltage has dropped</li><li>● Replace the battery according to Section 5.</li></ul>
Indication is unstable	<ul style="list-style-type: none"><li>● Sudden drop in battery voltage or noise-related error.</li><li>● Replace the battery according to Section 5.</li><li>● Turn off power switch and turn it on again.</li></ul>
Various numerals are indicated in the display even when the input is disconnected in adaptor range	<ul style="list-style-type: none"><li>● This is caused by induction noise due to the high input impedance of the D. M.M. and is not abnormal.</li></ul>
Measurement in current range is impossible	<ul style="list-style-type: none"><li>● Fuse is broken.</li><li>● Replace fuse according to Section 5.</li></ul>



When making requests for repair service, please bring the instrument directly to the dealer. If this is impossible, however, send the instrument directly to our sales office.

When mailing this instrument, always pack it in its original or equivalent packing material and pack together with name, address, telephone number and the warranty documentation.

- To ensure speedy and reliable repair, always include information as to the type of failure and cause.
- If required, always return accessories with the instrument.
- When contacting us, provide the model number and serial number of your instrument.



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