

## CONTENTS

INTRODUCTION .....	1
1. APPLICATION AND FEATURES .....	1
1-1 Application .....	1
1-2 Features .....	1
2. SAFETY .....	2
2-1 Safety Cap .....	2
2-2 Usage of Safety Cap .....	2
2-3 Observation of Warning Description .....	2
3. NAME OF COMPONENT UNITS .....	4
4. INPUT TERMINAL AND MAXIMUM INPUT VALUE .....	6
5. VARIOUS FUNCTIONS AND USAGE .....	7
6. MEASUREMENT PROCEDURE .....	10
6-1 Voltage Measurement .....	10
6-2 Resistance Measurement .....	11
6-3 Continuity Test and Diode Test .....	12
6-4 Frequency Measurement .....	12
6-5 Current Measurement (40mA) .....	16
6-6 Current Measurement (10A) .....	17
7. MAINTENANCE .....	19
7-1 General Maintenance .....	19
7-2 Calibration .....	19
7-3 Battery and Fuse Replacement .....	19
8. SPECIFICATIONS .....	21
8-1 General Specifications .....	21
8-2 Accuracy .....	23
9. OPTIONAL ACCESSORIES .....	25
9-1 Usage of AC Current Clamp Probe (CL-20D) .....	25
9-2 Usage of AC-DC Current Clamp Probe (CL-22AD) .....	26
10. REPAIR .....	27
10-1 Confirmation before User Requests Us to Repair .....	27
10-2 For Information or Enquiries .....	28

## INTRODUCTION

You are kindly requested to read this Instruction Manual carefully before starting to use Digital Multimeter "DA-50C", so as to ensure its safety. Especially, important items containing in this Manual are 2. SAFETY, 4. INPUT TERMINAL AND MAXIMUM INPUT VALUE, 6. MEASUREMENT PROCEDURE and 7. MAINTENANCE.

## 1. APPLICATION AND FEATURES

### 1-1 Application

This instrument is portable digital multimeter designed for measurement of weak current circuits. It plays an important role in circuitry analysis by using additional functions as well as measurements of small type communication equipment, electrical home appliance, lighting voltage and batteries of various types.

### 1-2 Features

- Maximum display up to 4000 counts
- Bargraph display provided
- Easily visible display of large size
- Fuse built into current input terminal
- Additional functions provided

## △ 2. SAFETY

### 2-1 Safety Cap

If operator measures voltage with 10A terminal, this instrument may be damaged or may cause injury. To protect from such hazard (such as erroneous insertion), safety cap is capped onto 10A input terminal.

### 2-2 Usage of Safety Cap

- Cap this safety cap onto +input terminal, when operator uses 10A input terminal.
- Be sure always to cap the safety cap onto 10A input terminal after 10A measurement.

### 2-3 Observance of Warning Description

Be sure to observe the "warning" description in this Manual. If operator uses it erroneously, it may cause injury.

Note the following symbols used in this instrument.

f Hazardous voltage (be careful not to receive electric shock at the time of voltage measurement.)

≡ Grounding (it shows allowable applied voltage range between input terminal and grounding.)

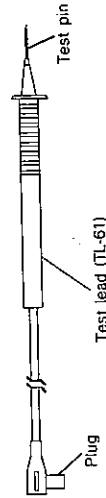
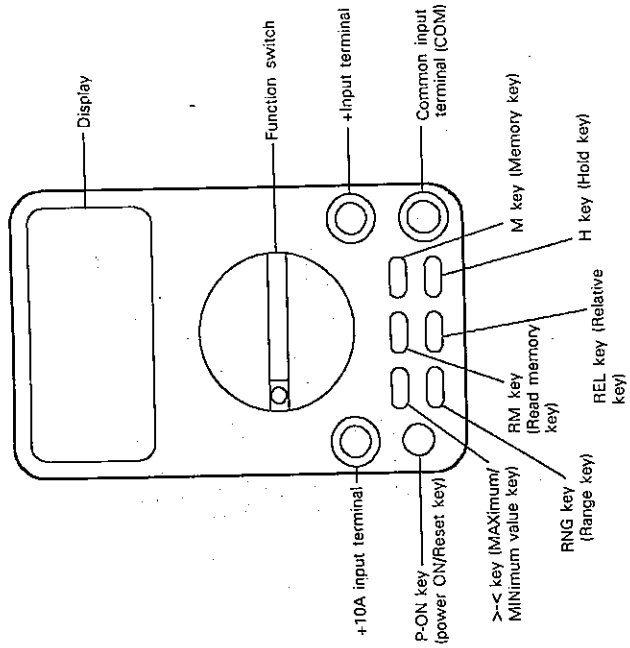
△ Refer to Instruction Manual. (It shows specially important descriptions for safety use.)

⎓ Direct current (DC)

~ Alternating current (AC)

⊞ Fuse

### 3. NAME OF COMPONENT UNITS



4

#### ⚠ WARNINGS

Following description is intended to protect operators from such injury as burn and electric shock. Be sure always to observe it at the time of using this instrument.

1. Take full care not to receive electric shock, if the voltage to be measured exceeds 60V DC or 25V AC RMS.
2. Do not use this instrument to measure the voltage exceeding maximum input value (please refer to item 4. INPUT TERMINAL AND MAXIMUM INPUT VALUE).
3. Do not use the test lead if its lead wire is damaged or core wire is exposed.
4. Be sure always to cap the safety cap onto 10A input terminal when operator does not measure 10A or after 10A measurement.

3

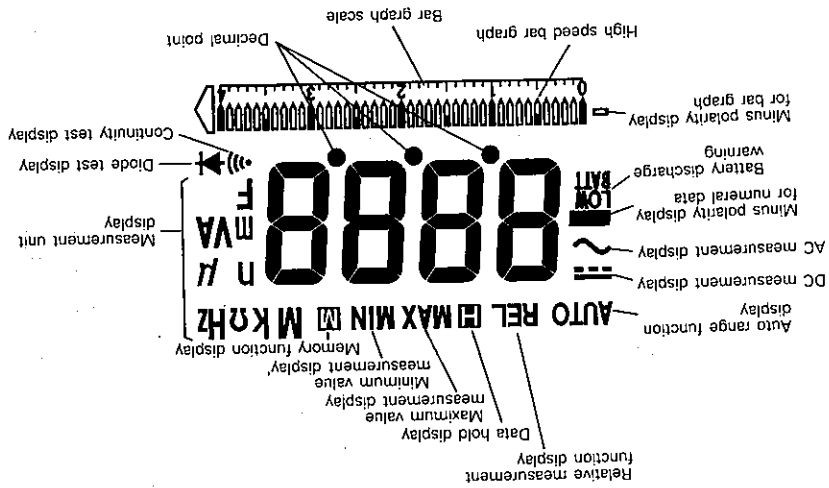
#### 4. INPUT TERMINAL AND MAXIMUM INPUT VALUE

Function	Input terminal	Max. input value	Max. allowable input
DCV	+ .COM	AC+DC 600V	DC 600V AC 600V
ACV		$\Delta$ Voltage-Current input prohibited 250V peak max.	DC 250V AC 250V
$\Omega$ , $\mu$ , $\text{m}$ , $\text{A}$	+ .COM		
Hz		250V peak max.	
DC-AC mA	10A-COM	40mA	250V/0.5A fuse protected
DC-AC 10A		10A (within 1 min.)	250V/10A fuse protected

Note: AC voltage is regulated by RMS value of sinusoidal wave.

#### $\Delta$ WARNING

- Never apply the voltage exceeding 600VDC-AC between input terminals or between input terminal and grounding.
- Do not use this instrument if the instrument or operator's hand is wet.
- Do not use this instrument if its case is opened or the case and other insulated part are damaged.



Liquid Crystal Display

## 5. VARIOUS FUNCTIONS AND USAGE

Function Name	Description	Key to Use
1) Over Display	If input (except for 10A) is beyond over the measurement range, digit of display value at the top place flickers. Buzzer sounds at the same time in case of voltage and current function (40mA).	Function switch, P-ON key
2) Auto Power OFF	Buzzer sounds, power is automatically cut off and all the displays disappear in approx. 30 min. after power is applied. To restart, press P-ON key or reset it after turning OFF the Function switch. If operator does not want Auto Power OFF for measurement for long time, set Function switch from OFF to target function while pressing P-ON key. Then, after approx. 3 sec., reset P-ON key. Auto Power OFF does not function by conducting this operation. <ul style="list-style-type: none"> <li>Set Function switch to OFF if the instrument is kept unused for storage for long period of time.</li> </ul>	
3) Battery Discharge Warning	Replace RO3 (IEC) dry battery if LOW BATT flickers on the display. (Refer to item 7. MAIN-TENANCE.)	
4) Bar Graph Display	This function displays increase/decrease of input signal at such high speed as 20 times/sec. (Bar Graph does not function at the time of frequency measurement.)	

7

5) Display Hold	Press H key and the data at the pressed time is held to display. (H on the display lights.) Then the display does not change even if measurement input changes. Press H key again, the hold status is reset and the status returns to measurement operation. (H on the display disappears.)	H key
6) Relative Measurement (Measurement of Relative value)	Press REL key, the value at the pressed time turns to X1 and X-X1 value is displayed to subsequent actual input value X. X1 value is renewed at each time operator presses REL key. To reset this function, keep on pressing REL key until REL lighting on the display disappears. <ul style="list-style-type: none"> <li>Relative measurement cannot be made for bar graph. Here, input value is displayed as itself.</li> <li>If operator selects the relative measurement mode during auto range operation, AUTO on the display disappears and it turns to manual range operation.</li> </ul>	REL key
7) Memory Function, Read Memory Function	Press M key and M lights on the display and the displayed data is memorized in the instrument. Only one data can be memorized and the memorized data is renewed at each time operator presses M key. Press RM key and M lights on the display and the lighting turns to flickering and the memorized data is read on the display.	M key RM key

8

<p>Memory Function, Read Memory Function</p>	<p>Press H key at the read memory status, only H disappears and the status returns to measurement operation.</p> <ul style="list-style-type: none"> <li>■ The memorized data is retained even at Auto Power Off. However, apply the power again by pressing P-ON key for the memory. The memorized data is deleted if operator reapplies the power by Function key.</li> <li>■ The data read on the display by Read Memory function when M does not light means the reset value of internal memory.</li> </ul>	<p>H key</p>
<p>8) Range Control</p>	<p>Press RNG key once to make measurement by fixing the range as desired. Then, AUTO on the display disappears and the range is fixed at Manual range. At manual range, the range moves at each time operator presses RNG key. Therefore, operator should select desirable range by confirming the position of unit and decimal point on the display. To return to Auto range, keep on pressing RNG key until AUTO lights on the display.</p>	<p>RNG key</p>
<p>9) Max./Min. Value Measurement</p>	<p>Press &gt;-&lt; key and minimum value during measurement is displayed. (H MIN lights.) Press &gt;-&lt; key again, then, maximum value during measurement is displayed. (H MAX lights.) If operator presses &gt;-&lt; key again, this function is reset.</p>	<p>&gt;-&lt; key</p>

<p>Max./Min. Value Measurement</p>	<ul style="list-style-type: none"> <li>■ Maximum/minimum value measurement cannot be made for the bar graph. In this case, input value is displayed as itself.</li> <li>■ If operator selects maximum/minimum value measurement during Auto range operation, AUTO on the display disappears and the status turns to Manual range automatically.</li> </ul>
------------------------------------	--

## 6. MEASUREMENT PROCEDURE

### 6-1 Voltage Measurement

#### ⚠ WARNING

1. At the time of voltage measurement, do not apply the voltage exceeding 600V DC, AC between the input terminals or input terminal and grounding so as to protect from hazard.
2. The voltage exceeding 60VDC or 25VAC RMS is hazardous to human body. Take full care not to receive electric shock at the time of measurement.
3. Do not use this instrument to measure the voltage and current exceeding maximum allowable voltage and current. (Refer to item 4. INPUT TERMINAL AND MAXIMUM INPUT VALUE.)

Select DC voltage (—) or AC voltage (∩) with Function switch. Use +input terminal and common input terminal as measurement terminal.

- The display value changes at the time of open measurement terminal in 400mV range. But, this is not trouble.

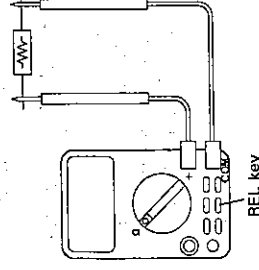
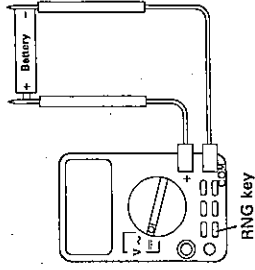
- Auto range operation cannot be made only for AC voltage measurement in 400mV range. To use this range for measurement, select Manual range with RNG key.

- Since this instrument employs the mean value system for its AC voltage measurement circuit, AC waveform other than sinusoidal wave may cause error.

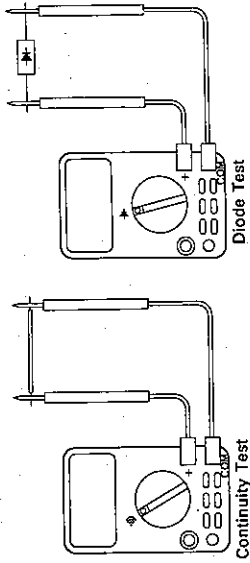
### 6-2 Resistance Measurement

Set Function switch to Ω position. Use +input terminal and common input terminal as measurement terminal.

- To measure 400Ω range, short the test pins and set display to zero with REL key. Then, operator can measure the resistance quite accurately. Indication may not be stabilized due to ambient noise when operator measures high resistance. For solution, connect the resistor to terminal not through the test lead or shield it with potential of common input terminal. Then, operator can make stabilized measurement.



### 6-3 Continuity Test and Diode Test



#### • Continuity Test

Set Function switch to (diode with sound waves) position. Use +input terminal and common input terminal as measurement terminal. In the continuity test, buzzer sounds at approx. 40Ω or less.

#### • Diode Test

Set Function switch to (+) position. Use +input terminal and common input terminal as measurement terminal. In diode test, the fall voltage is displayed in forward direction if diodes are connected in forward direction. If they are connected in reverse direction, it is almost open voltage of measurement terminal. (In case that the diodes are normal.)

### 6-4 Frequency Measurement

#### ▲ WARNING

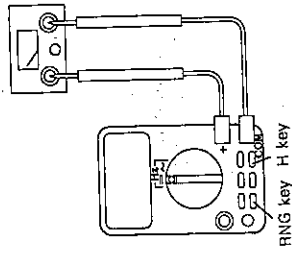
250V peak max. is maximum measurement voltage at the time of frequency measurement. Do not absolutely apply the voltage exceeding this voltage. Otherwise, it may damage this instrument or cause injury.

- **DC Coupled Input**  
Set Function switch to (—) position of Hz. Use +input terminal and common input terminal as measurement terminal.

- **AC Coupled Input**  
Set Function switch to (~) position of Hz. Use +input terminal and common input terminal as measurement terminal.

Operator can change the input sensitivity in 3 steps by pressing RNG key. The sensitivity is displayed for approx. 0.5 sec. after key operation.

- Measurement is available only at Auto range, but not at Manual range.
- If input terminal is open, display may cause over or numeral value fluctuates but not be fixed. It is not trouble.



- Only 3 digits in upper place are effective figure in case of 40.0kHz~99.9kHz in 99.9kHz range and 400kHz~999kHz in 999kHz range.
- Bar graph does not function for frequency measurement. Bar graph may be displayed on the display. But, it is not trouble. Press H (Hold) key twice to delete bar graph.

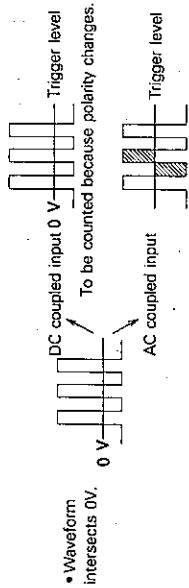
### Input Sensitivity Table for Frequency Measurement (RMS sinusoidal wave)

Input Sensitivity Indication	10Hz — 40kHz	— 300kHz	— 1MHz
10mV	30mV	0.8V	2.4V
0.1V	0.2V	1.2V	3.6V
1 V	2 V	2.6V	4.4V
			10V

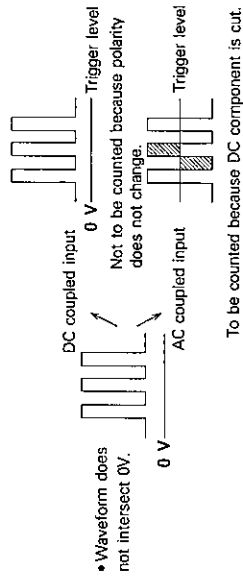
- Input sensitivity changes dependently on the frequency and waveform. Please take the above Input Sensitivity Table as reference of sensitivity.



### Difference Between AC Coupled Input and DC Coupled Input



Shaded areas between trigger level become equal.



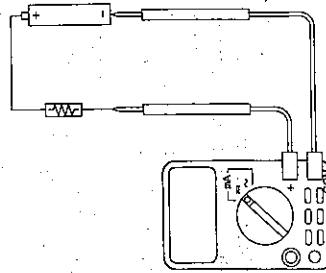
To be counted because DC component is cut.

- Input impedance
- DC coupled input: approx.  $10\text{M}\Omega \approx 100\text{pF}$
- AC coupled input: approx.  $1.8\text{M}\Omega \approx 100\text{pF}$

### 6-5 Current Measurement (40mA)

#### ⚠ WARNING

1. Current measurement is protected by 250V rated fuse. Do not use the instrument with circuitry net exceeding 250V. It is quite hazardous.
2. Be sure to use it only with weak current circuits. Even in case of weak current circuits, if the voltage exceeds 60VDC or 25VAC RMS, it is hazardous to human body. So, proceeds measurement with full care.
3. Do not apply the voltage, since input impedance is low and hazardous if operator does it.



Select DC (—) or AC (—) with Function switch in 40mA range.  
Use +input terminal and common input terminal as measurement terminal.

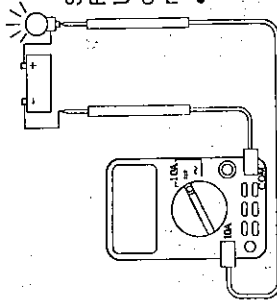
- In AC current measurement, AC waveform other than sinusoidal wave may cause error.

## 6-6 Current Measurement (10A)

### ⚠ WARNING

1. 10A input terminal is protected by 250V rated fuse. Do not use the instrument with circuitry net exceeding 250V. It is quite hazardous.
2. 10A measurements causes heating. Be sure to complete its measurement within one minute.
3. 10A input terminal is connected to common input terminal with approx. 0.01Ω. Consequently, if operator applies directly the large capacity power erroneously, it is short-circuited and large current flows to the test lead wire. This may damage the test lead wire and cause injury such as burn. Take full care not to try it.
4. Be sure to use the instrument only with weak current circuits. Even in case of weak current circuits, if the voltage exceeds 60VDC or 25VAC RMS, it is hazardous to human body. So, proceed measurement with full care.
5. Do not apply the voltage, since input impedance is low and hazardous if operator does it.
6. Use the test lead wire as extended. If operator uses it as bound, it causes heating partially and may be hazardous to human body. Use it after full confirmation.

7. Before starting 10A measurement, be sure always to uncap the safety cap from 10A input terminal and cap it +input terminal.  
Be sure always to cap the safety cap onto 10A input terminal after 10A measurement or when operator does not make 10A measurement. (Refer to item 2-2 Safety Cap.)



Select DC (—) or AC (—) with Function switch in 10A range. Use 10A input terminal and common input terminal as measurement terminal.

- In AC current measurement, AC waveform other than sinusoidal wave may cause error.

## 7. MAINTENANCE

### 7-1 General Maintenance

Keep the panel and case away from volatile solvent or heating element. Do not store the instrument at the place with high temperature, low temperature or high humidity. If the instrument is wet with water, do not use it but request your nearest distributor for its inspection and repair.

### 7-2 Calibration

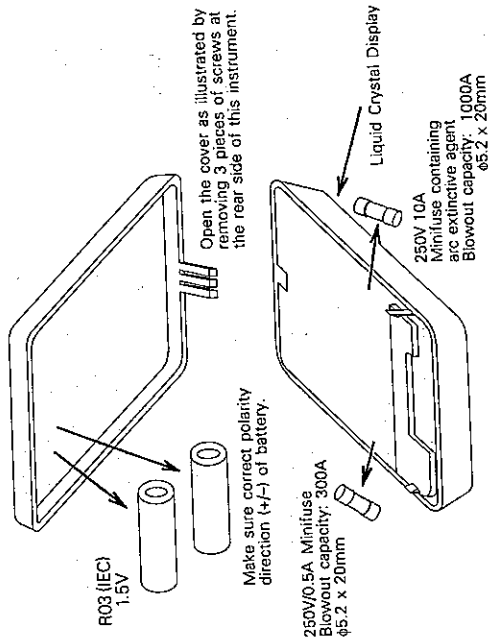
Calibration and inspection is required once in a year so as to ensure accuracy and safety. Contact your nearest distributor for calibration and inspection.

### 7-3 Battery and Fuse Replacement

#### ⚠ WARNING

1. This item is very important for safety. Accordingly, only the qualified person who knows well the detail and handling of the instrument should be selected to make their replacement.
2. Do not absolutely remove the rear case of the instrument or make its adjustment, except in case of replacing the installed battery and fuse just according to the work procedure described in this Manual.
3. If operator removes the rear case with input to input terminal, charging portion is exposed and operator may receive electric shock. Start their replacement work after unplugging the plug of input terminal.
4. Use same rating fuse for replacement. Do not absolutely use substitute fuse or not try to short-circuit.

### Battery and Fuse Replacement



## 8. SPECIFICATIONS

### 8-1 General Specifications

Operation System Display	Integral system Counter: 3999 counts (9999 counts for frequency measurement) max. Bar graph: 40 segments max. Auto and Manual ranges (partially Manual range or Auto range only)
Range Selection	Manual range or Auto range only
Over Display	Flickering the digit at top place (except for 10A)
Polarity Display	Automatic selection (only "-" is displayed)
Battery Discharge Display	Display by flickering at approx. $2.4 \pm 0.2V$ or less
Sampling Rate	2 times/sec. (numeral display except for frequency measurement) 2~4 times/sec (frequency measurement) 20 times/sec. (bar graph display)
Accuracy Assurance Temperature/Humidity Range	Temperature/ Humidity Range 18~28°C 80% RH max. No condensation
Operating Temperature/Humidity Range	5~40°C 80% RH max. No condensation
Storage Temperature/Humidity Range	-10~55°C 70% RH max. No condensation
Power Supply	RO3 (IEC) dry battery, 2 pieces

21

### Power Consumption

Approx. 3mW Typ (at VDC)  
Approx. 0.01mW Typ (at Auto Power OFF)

(Internally memorized data is held by Memory function, and, accordingly, the power is consumed even at Auto Power OFF. So, be sure always to turn OFF the Function switch at the end of each measurement.)

### Battery Life

Alkali manganese battery  
400 hours or longer at VDC continuous

### Dimension and Weight

145 x 82 x 30mm, approx. 200 g.  
Accessories  
Test lead (TL-61) 1 set  
Instruction manual 1 copy

Specifications and external appearance of the product described above may be revised for modification without prior notice.

22

### 8-2 Accuracy

(Accuracy assurance range: 18~28°C 80% RH max. No condensations)

Function	Range	Accuracy	Input Resistance	Remarks
DCV	400.0mV	± (0.6%rdg + 2 dgt)	Approx. 100MΩ	
	4.000V	± (0.9%rdg + 2 dgt)	Approx. 11MΩ	
	40.00V	"	Approx. 10MΩ	
	400.0V	"	"	
	600V	"	"	
ACV	400.0mV	± (1.4%rdg + 5 dgt)	Approx. 100MΩ	45~100Hz
	4.000V	"	Approx. 11MΩ	
	40.00V	"	Approx. 10MΩ	
	400.0V	"	"	
	600V	± (3.0%rdg + 5 dgt)	"	45~500Hz
Ω	400.0Ω	± (0.8%rdg + 2 dgt)		Open voltage: 0.4V
	4.000kΩ	"		For 400Ω, the accuracy shows the measurement by using REL function after cancelling the resistance for test lead.
	40.00kΩ	"		
	400.0kΩ	"		
	4000kΩ	± (1.0%rdg + 2 dgt)		
Auto range and Manual range	40.00MΩ	± (2.0%rdg + 2 dgt)		
	40.00mA	± (1.4%rdg + 2 dgt)	Approx. 10Ω	
	10.00A	± (2.0%rdg + 2 dgt)	Approx. 0.01Ω	
ACA (direct Current) Manual range	40.00mA	± (1.8%rdg + 5 dgt)	Approx. 10Ω	
	10.00A	± (2.5%rdg + 5 dgt)	Approx. 0.01Ω	45~1kHz

Hz (frequency)	99.99Hz	± (0.3%rdg + 3 dgt)	Approx. 10MΩ	Measurement range:
DC coupled input: Auto range	999.9Hz	"	≤100pF	10kHz~999kHz
	9.999kHz	"		Only 3 digits at upper place for effective figures are effective.
	99.9kHz	"		400Hz~99.9kHz
	999kHz	"		in 99.9kHz range and/or
	99.99Hz	"	Approx. 1.8MΩ	400kHz~999kHz in 999kHz range.
AC coupled input: Auto range	999.9Hz	"	≤100pF	
	9.999kHz	"		
	99.9kHz	"		
	999kHz	"		
	999kHz	"		
*) (Continuity test)	Buzzer sounds at approx. 40Ω max. Open voltage: approx. 0.4V			
† (Diode test)	Open voltage: approx. 2.2~3.3V			

rdg: reading.

dgt: digits

## 9. OPTIONAL ACCESSORIES

- Carrying Case C-DA
- Thermistor Temperature Probe T-130 (measurement range: -20~130°C)
- AC Current Clamp Probe CL-20D
- DC-AC Current Clamp Probe CL-22AD

### 9-1 Usage of AC Current Clamp Probe (CL-20D)

1. Set Function switch to AC voltage (V~).
2. Set to 4VAC with RING key.
3. Insert the black plug into common input terminal and red plug into +input terminal.
4. Set the range knob of CL-20D to 20A or 200A range.

Read the displayed value as measurement value by multiplying the following multiplying factor. Here, the display indicates V. Accordingly, read it in unit A.

Range	20A	200A
Read	Displayed value x 10 times	Displayed value x 100 times
ACA		

- Be careful of the indication, since it becomes inaccurate if the value exceeds 20A or 200A.

(Ex. for 20A)

Displayed value → 1.900V  
Reading → 1.900(V) x 10, namely, it is 19A.

(Ex. for 200A)

Displayed value → 1.900V  
Reading → 1.900(V) x 100, namely, it is 190A.

### 9-2 Usage of AC-DC Current Clamp Probe (CL-22AD)

1. Set Function switch DC (V=) or AC (V~) of V... measurements.
  2. Operate RING key to set to 400mV for both DCA and ACA measurements.
  3. Insert the black plug into common input terminal and red plug into +input terminal.
  4. Set the range knob of CL-22AD to 20A or 200A range.
- Read the displayed value as measurement value by multiplying the following multiplying factor. Here, the display indicates mV. Accordingly, read it in unit A.

Range	20A	200A
Read	Displayed value x $\frac{1}{10}$ times	Displayed value x 100 times
DCA		
ACA		

(Ex. for 20A)

Displayed value → 190.0mV  
Reading → 190.0 (mV) x 1/10, namely, it is 19A.

(Ex. for 200A)

Displayed value → 190.0mV  
Reading → 190.0 (mV) x 1, namely, it is 190A.

## 10. REPAIR

### 10-1 Confirmation before User Requests Us to Repair

Faulty Phenomenon	Checkpoint
It does not display at all despite the power is supplied.	Are the batteries not exhausted? Are the batteries placed in correct polarity?
It displays normally. But the display does not change even by inputting the data, or the display changes abnormally. Or, the display is kept as over even by setting to resistance measurement and by short-circuiting the test lead wire.	Protective fuse should have been blown out. Replace it with the rated fuse as specified. Test lead wire should have been disconnected. Check the continuity of test lead wire.

### 10-2 For Information or Enquiries

Ask the shop where you bought the products for any detailed information on repair, how to purchase replacing parts (such as fuse) or optionally sold accessories, as well as questions and complaints, etc. on our products.

**sanwa**



# **DA-50C**

DIGITAL MULTIMETER

**sanwa**  
SANWA ELECTRIC  
INSTRUMENT CO., LTD.  
Dempa Bldg, Sotokanda 2-Chome  
Chiyoda-Ku, Tokyo, Japan

INSTRUCTION MANUAL