

# sanwa®

## M53

DIGITAL INSULATION METER  
WITH VOLTAGE & SPEED RANGE

INSTRUCTION MANUAL

## [1] Safety Precautions – Be sure to read before use. –

Be sure to read carefully the information under “⚠ WARNING” and “⚠ CAUTION” in this manual in order to prevent human injuries, electric shock and damage to the instrument as well as other equipment.

### 1-1 Warning Markings and Other Symbols

The symbols and their meanings used with the instrument and in this manual are as described below.



The information under this marking must be observed strictly to prevent human injuries, including burns and electric shock.



The handling information under this marking should be observed carefully to prevent damage to the instrument and associated equipment.

#### ■ Other symbols used with the instrument and in this manual

	Indicates a risk of shock due to a high voltage generated or applied at a measuring terminal.
E	Insulation resistance measurement terminal (Earth=GND)
L	Insulation resistance measurement terminal (Line)
ACV	AC voltage
DCV	DC voltage
MΩ	Insulation resistance
V. SPEED	Voltage and speed measurement terminal
	Voltage polarity DCV:+positive terminal, ACV:~(No polarity)
	Voltage polarity DCV:-negative terminal, ACV:~(No polarity)
SPEED m/min	Speed measurement range (DCV 0~20 V range)
INSUL.	} Insulation test voltage ON indication
TEST VOLT	
ON	
POWER	Measuring power switch

## 1-2 Warning Messages for Safety

### WARNING

1. Check the measurement type (insulation resistance, DC or AC voltage) before measurement and select the appropriate function for it.
2. Do not apply a voltage or signal exceeding the specified maximum allowable input. (For the maximum allowable input voltage value, see section 1-3 on the next page.)
3. Do not open the case or battery cover unless replacing the batteries as described in this manual.
4. Always use the test leads specified in the manual.
5. If the insulation coating of a test lead is damaged or its conductor wire is exposed, do not attempt to repair it. Instead, replace with a new test lead.
6. Do not switch the measuring function during measurement.
7. Do not use the instrument when it is moistened, when your hand is wet or when the ambient humidity is high (85 %RH or more).
8. Do not touch the metallic parts of the test leads during measurement.
9. Do not use the instrument if it is defective and incapable of making the specified measurements.
10. Do not use the instrument using high-power or higher voltage circuitry than the maximum allowable input.
11. Be sure to conduct annual inspections.

### 1-3 Maximum Allowance Input Value

Function	Input terminal	Max allowance input value
Insulation resistance (500 V, 15 V)	E ____ MΩ ____ L	⚠ Voltage or Current Input prohibited
ACV, DCV	~ ____ V. SPEED ____ ~	AC 750 V, DC 750 V

## [2] Overview and Features

### 2-1 Overview

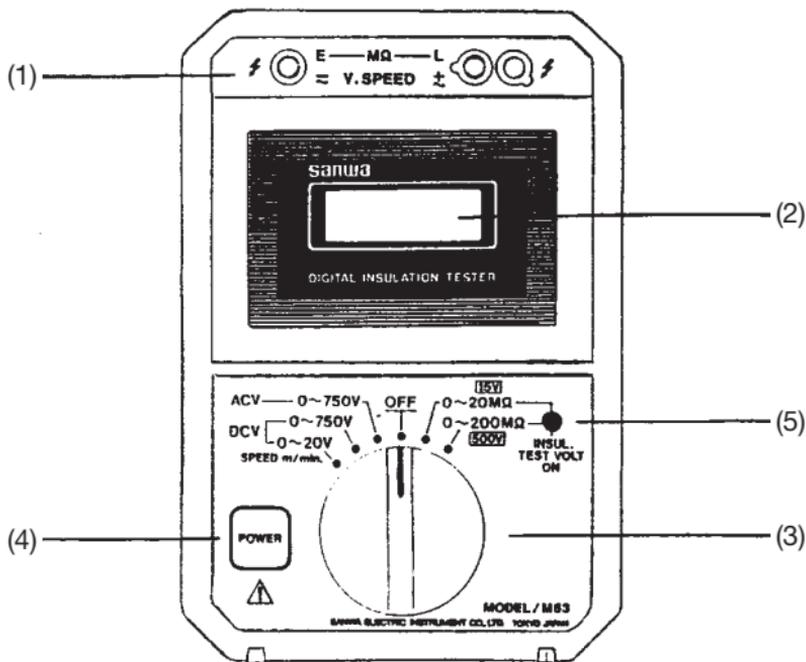
This device is a digital insulation resistance tester, with DCV & ACV measurement functions.

In addition to that, it also has optional speed measurement function (Sanwa speed meter SE-9000 is necessary to use this function), that enables to read output voltage value directly as a speed value.

### 2-2 Features

1. Two test voltage ranges DC 500 V and DC 15 V
2. Auto range
3. Auto power off after one minute from power-on.
4. Low battery indication function.
5. With optional tachometer SE-9000, remote speed measurement can be made.

### [3] Appearance and Appellation



- |  |   |
|--|---|
| (1) Measurement terminal (Insulation resistance, ACV, DCV) | (5) Insulation resistance measurement voltage input indication lamp (red LED) |
| (2) LCD  | (6) Red test lead (L, $\pm$ side)   |
| (3) Function switch  | (7) Black test lead (E, $\sim$ side)  |
| (4) Power switch   | (8) Clip lead for connecting pin  |

## [4] Measuring Methods

### 4-1 Preparations

 **WARNING**

For safe use of the instrument, check its appearance and associated accessories carefully before use.

1. Check for damage due to dropping, etc.
2. There is a risk of electric shock if the insulation coating of a test lead or its conductor wire is exposed. Check the test leads carefully before use.

#### **NOTE: Operation of the POWER Switch and Auto Power OFF**

The POWER switch of the instrument toggles, or alternates operation, so that each successive press switches the selected measuring function from ON to OFF, and vice versa. The auto power OFF feature provided turns power OFF automatically in about 1 minute, as a safeguard for when you forget to set the POWER switch to OFF after use. Still, we recommend pressing the POWER switch to OFF after measurement to save the power of the built-in batteries.

### 4-2 Checking the Built-in Batteries

1. Do not connect any leads to the measuring terminals.
2. Set the function switch to 500 V or 15 V.
3. Press the POWER switch.
4. The built-in batteries are normal if the INSUL. TEST VOLT ON indicator (red LED) lights up and the LCD looks as shown in Fig. 1.

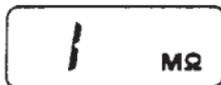


Fig 1

5. If the INSUL. TEST VOLT ON indicator does not light and the LCD shows nothing even when the POWER switch is pressed to ON, the batteries may be exhausted completely, or no battery has been loaded. In this case, remove the battery cover on the rear case and insert new batteries as described in section 4-3, “Replacing the Built-in Batteries” on the next page.
6. If the INSUL. TEST VOLT ON indicator does not light and the LCD shows nothing, although unexhausted batteries are loaded, it is possible that the battery terminal contacts have failed. In this case, remove the battery cover on the rear case and check the contacts between the batteries and terminals.
7. If the INSUL. TEST VOLT ON indicator lights up but the LCD shows the “B” marking as shown in Fig. 2 when the POWER switch is pressed to ON, the built-in batteries are nearly exhausted. In this case, replace them with new batteries.

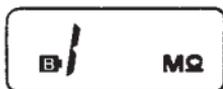


Fig 2

### 4-3 Replacing the Built-in Batteries

1. Set the function switch to OFF on the center position.

⚠ **WARNING**

Make sure that the function switch is set to OFF before proceeding to the battery replacement operation.

2. Refer to Fig. 3 below for the battery replacement.
3. Remove the lock screw on the battery cover on the rear case, then remove the battery cover by sliding it down while pushing the square projection on the top center (Fig. 3[A]) with your finger, and insert batteries in correct polarity positions as shown by Fig. 3[B].
4. After checking that the batteries have been inserted correctly, place the battery cover in the original position on the rear case and fasten with the lock screw.

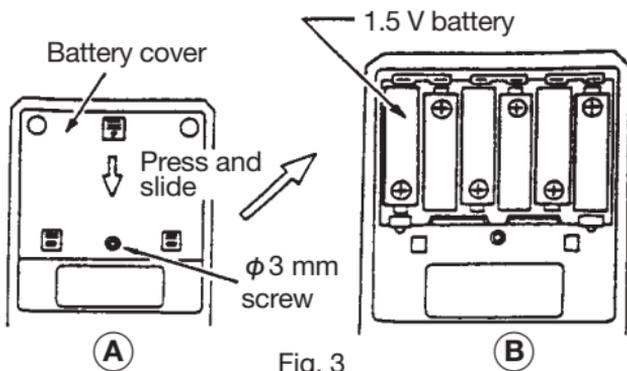


Fig. 3

**⚠ CAUTION**

1. Always use the specified batteries (LR6 batteries).
2. To prevent performance degradation, replace all six batteries with six brand-new ones when the time comes to replace batteries.

#### 4-4 Measurement of insulation resistance (MΩ)

**⚠ WARNING**

1. When the power is ON with the insulation resistance measuring function selected (when the INSUL. TEST VOLT ON indicator is lit), a high voltage for insulation resistance measurement is applied across the E-L terminals. To avoid the risk of electric shock, do not touch the metallic parts of the test leads connected to the measuring terminals.
2. Make sure that the object to be measured is not subjected to voltage before proceeding to measurement.
3. Certain measurement objects (capacitive objects, for example) may retain the voltage applied from this instrument for some time after the completion of the measurement.

1. Set the function switch according to the measurement object, to 500 V or 15 V.
2. Connect the black plug of the black test lead to the E terminal on the left and the amber plug of the red test lead to the L terminal on the right as shown in Fig. 4.

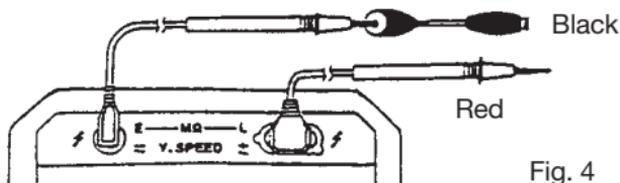


Fig. 4

3. Connect the black clip to a measuring point on the measurement object and the tip of the red test rod to the other point, and press the POWER switch. The INSUL. TEST VOLT ON switch will light up and the resistance measurement value will be shown on the LCD.
4. When the measurement object has resistance of more than 200 M $\Omega$  at 500 V or 20 M $\Omega$  at 15 V, the LCD shows the same over-input display as that displayed when the measuring terminals are open, as shown in Fig. 1 under section [4]4-2, “Checking the Built-in Batteries” on page 5.
5. After measurement, press the POWER switch again to OFF or set the function switch to OFF.

#### **NOTE: Distinction Between E and L Terminals**

When one of the measuring points is grounded, connect it to the E terminal of the instrument.

This is specified in consideration of safe use, because the resistance measurement value reading in the insulation testing can be reduced in this way. In other measurement operations, consideration of the polarity of measurement points is not necessary.

### NOTE: In Case the “B” Marking is Displayed During Measurement

When the resistance measurement value in an insulation test is extremely small, the LCD sometimes shows the “B” marking which is usually used as the battery alarm indicator. In the present case, the “B” marking is displayed because an extremely small resistance measurement value means consumption of large battery current and the drop in capacity due to exhaustion of the batteries causes the internal operating voltage to fall below the specified level.

### 4-5 Measuring the AC Voltage (ACV)

#### ⚠ WARNING

1. The maximum allowable input voltage of the ACV range is 750 V. Never apply a higher voltage than this.
2. Voltages higher than 25 Vrms AC are hazardous to the human body. Be very careful during measurement.
3. Never attempt to change the function switch position during measurement.
4. Never touch the device with a wet hand.

1. Set the function switch to ACV.
2. Connect the amber plug of the red test lead to the  $\pm$  terminal on the right and the black plug of the black test lead to the  $\approx$  terminal on the left as shown in Fig. 5.

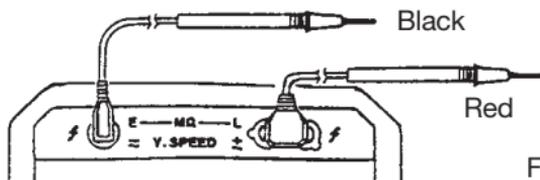


Fig. 5

3. Press the POWER switch to ON, connect the black clip to a measuring point on the measurement object, and apply the tip of the red test rod to another measuring point. The LCD will show the measurement voltage value.
4. After measurement, press the POWER switch again to OFF or set the function switch to OFF.

#### 4-6 Measuring the DC Voltage (DCV)

 **WARNING**

1. The maximum allowable input voltage of the DCV range is 750 V. Never apply a higher voltage than this.
  2. DC Voltages higher than 60 V are hazardous to the human body. Be very careful during measurement.
  3. Never attempt to change the function switch position during measurement.
  4. Never touch the device with a wet hand.
- 
1. Set the function switch to appropriate range, but if the voltage to be measured is uncertain, set it to DCV 0-750 V range.
  2. Same as the ACV measurement, connect both black & red plugs to measurement terminals.
  3. Press the POWER switch to ON, connect the black clip to the earth line (lower voltage side) and red point on the measurement object (higher voltage side), the LCD will show the measurement voltage value.
  4. If the measured value is less than 20 V, then turn off the device, and make measurement again by setting the function switch to DCV 0-20 V range.
  5. After measurement, press the POWER switch again to OFF or set the function switch to OFF.

#### 4-7 Speed(m/min) measurement

1. The measurement method is the same as DCV measurement, but set the function switch to DCV 0-20 V.
2. As shown in Figure 6, connect optional cable of SE-9000 (speed meter), positive red plug to the right side of L terminal, and negative black plug to E terminal.
3. Press power switch, and then analog output value from speed meter will be shown on the display as mV value. Read that value directly as m/min.

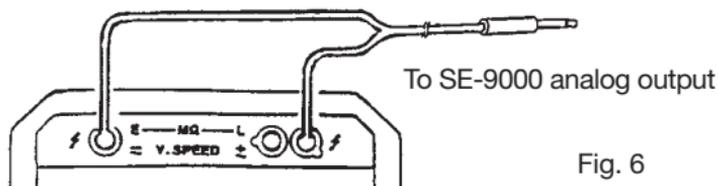


Fig. 6

### [5] Maintenance & Management

#### ⚠ WARNING

This section contains important information for maintenance. The maintenance of the instrument should be performed by managing personnel who understand the instrument and this manual in detail, and who are well-acquainted with handling the instrument.

#### 5-1 Maintenance & Inspections

#### ⚠ WARNING

Be sure to maintain and inspect to ensure safe, long-lasting optimum-performance use of the instrument.

1. Check that the external finish of the instrument is not damaged due to dropping etc.
2. Check the test leads to ensure that
  - a plug is not loose when it is inserted into a terminal;
  - the test lead coating is not damaged;
  - the conductor wires are not exposed from any part of the test leads.
3. Check that the function switch is not subject to strong pressure from above. (This could lead to a contact failure of the switch.)  
If the instrument cannot comply with any of the above checks, do not use it as it is. Service the defective part or replace it with a new part.

## 5-2 Calibration

### **WARNING**

To maintain safety and accuracy, conduct inspections and calibration at least every year. For inspection and calibration, please consult a dealer in your area or the local sales representative for the instrument.

## 5-3 Storage

### **WARNING**

1. The panel and rear case are not resistant to volatile solvents or heat. Do not attempt to clean them with lacquer thinner or alcohol, or place the instrument near a source of heat. To clean the instrument, wipe lightly with a soft, dry cloth.
2. Do not store the instrument in a place subject to vibration, or where the instrument may drop.
3. Do not store the instrument under direct sunlight, under extremely high or low temperatures, or in a place where toxic gas is generated.
4. When the instrument is not used, be sure to set the function switch to OFF.
5. When the instrument is not to be used for a long period of time, be sure to remove the built-in batteries before storing it.

## **[6] After-Sales Service**

### **6-1 Warranty and Provision**

Sanwa offers comprehensive warranty services to its end-users and to its product resellers. Under Sanwa's general warranty policy, each instrument is warranted to be free from defects in workmanship or material under normal use for the period of one (1) year from the date of purchase.

This warranty policy is valid within the country of purchase only, and applied only to the product purchased from Sanwa authorized agent or distributor.

Sanwa reserves the right to inspect all warranty claims to determine the extent to which the warranty policy shall apply. This warranty shall not apply to fuses, disposables batteries, or any product or parts, which have been subject to one of the following causes:

1. A failure due to improper handling or use that deviates from the instruction manual.
2. A failure due to inadequate repair or modification by people other than Sanwa service personnel.
3. A failure due to causes not attributable to this product such as fire, flood and other natural disaster.
4. Non-operation due to a discharged battery.
5. A failure or damage due to transportation, relocation or dropping after the purchase.

### **6-2 Repair**

Customers are asked to provide the following information when requesting services;

1. Customer name, address, and contact information
2. Description of problem
3. Description of product configuration
4. Model Number
5. Product Serial Number
6. Proof of Date-of-Purchase
7. Where you purchased the product

Please contact Sanwa authorized agent / distributor / service provider, listed in our website, in your country with above information. An instrument sent to Sanwa / agent / distributor without those information will be returned to the customer.

**Note:**

1. Prior to requesting repair, please check the following:  
Capacity of the built-in battery, polarity of installation and discontinuity of the test leads.
2. Repair during the warranty period:  
The failed meter will be repaired in accordance with the conditions stipulated in 6-1 Warranty and Provision.
3. Repair after the warranty period has expired:  
In some cases, repair and transportation cost may become higher than the price of the product. Please contact Sanwa authorized agent / service provider in advance.  
The minimum retention period of service functional parts is 6 years after the discontinuation of manufacture. This retention period is the repair warranty period. Please note, however, if such functional parts become unavailable for reasons of discontinuation of manufacture, etc., the retention period may become shorter accordingly.
4. Precautions when sending the product to be repaired  
To ensure the safety of the product during transportation, place the product in a box that is larger than the product 5 times or more in volume and fill cushion materials fully and then clearly mark "Repair Product Enclosed" on the box surface. The cost of sending and returning the product shall be borne by the customer.

**6-3 SANWA web site**

<http://www.sanwa-meter.co.jp>

E-mail: [exp\\_sales@sanwa-meter.co.jp](mailto:exp_sales@sanwa-meter.co.jp)

## [7] Specifications

### 7-1 Insulation Resistance Measuring Block

1. Rated voltage DC 500 V, DC 15 V, 2 ranges
2. Measuring voltage/current characteristics DC 500 V range  
When measuring terminals are open 600 V (+20 % max.)  
When measuring terminals are shorted Approx. 1.6 mA max.  
DC 15 V range : 15 V $\pm$ 10 % at 1 M $\Omega$
3. Measurement range  
DC 500 V range : 0 to 2 M $\Omega$ /1 M to 20 M $\Omega$ /10 M to 200 M $\Omega$ , 3 auto range switching  
DC 15 V range : 0 to 2 M $\Omega$ /1 M to 20 M $\Omega$ , 2 auto range switching
4. Measuring accuracy : Within  $\pm$ (2 % reading + 2 digit)
5. Applied voltage indication : Red LED with 5 mm dia.

### 7-2 AC Voltage Measuring Block

1. Measuring range  
0 to 750 V max.  
0 to 200 V/10 to 750 V, 2 auto range switching
2. Measuring accuracy :  
Within  $\pm$  (1 % of reading + 0.5 % of range + 1 digit)  
Frequency : 50 to 400 Hz
3. Input resistance 10 M $\Omega$

### 7-3 DC Voltage Measuring Block

1. Measuring range : 0 to 20 V, 0 to 750 V max, 2 range.  
0 to 20 V 0 to 2000 mV/1 V to 20 V, 2 auto range switching  
0 to 750 V 0 to 200 V/10 V to 750 V, 2 auto range switching  
\*Speed measurement (m/min) : 0 to 2000 mV range  
1 m/min = 1 mV (Refer to the instruction manual for SE-9000)
2. Measuring accuracy :  
Within  $\pm$  (0.5 % of reading + 0.5 % of range + 1 digit)
3. Input resistance 10 M $\Omega$

## 7-4 Common specifications

- |  |   |
|--|---|
| 1. A/D converter   | Operating system: Double integration<br>Sampling rate: Approx. 2.5 samplings/sec.   |
| 2. Display   | LCD, max. 1999  |
| 3. Over-input indication   | Only the highest digit shows "1".   |
| 4. Polarity indication   | "-" when measuring DCV  |
| 5. Measuring terminals   | Insulation resistance M $\Omega$ : E, L.<br>Voltage: ACV & DCV (V. SPEED) : $\pm$ , $\approx$   |
| 6. Operating temperature/humidity                                  | 0 to 40 °C, 85 %RH (without condensation)   |
| 7. Accuracy guaranteed temperature/humidity                        | 15 to 30 °C, 80 %RH (without condensation)  |
| 8. Built-in batteries  | LR06(IEC)(x6)   |
| 9. Built-in battery life (time until battery voltage drops to 7 V) | When power is switched between ON and OFF every minute in succession<br>Insulation resistance measurement (measuring terminals open): Approx. 50 hours<br>AC voltage measurement: Approx. 300 hours |
| 10. Battery alarm  | LCD shows "B" mark when battery voltage drops below 7 V   |
| 11. Auto power OFF time  | Approx. 1 minute after power ON   |
| 12. Dimensions & mass  | 175(H) x 115 (W)x 55(D) mm, approx. 600 g   |

## 7-5 Accessories

1. Red test lead with amber plug (L,  $\pm$  terminal) x 1
2. Black test lead with black plug (B,  $\approx$  terminal) x 1
3. Alligator clip adapter x 1  
Set of the above 3 test leads: TL-M54
4. Instruction manual x 1
5. Carrying case C-M53 (with cord case) x 1

The specifications in this manual may be subject to change for performance improvement without notice.

## MEMO

## MEMO

# sanwa®

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