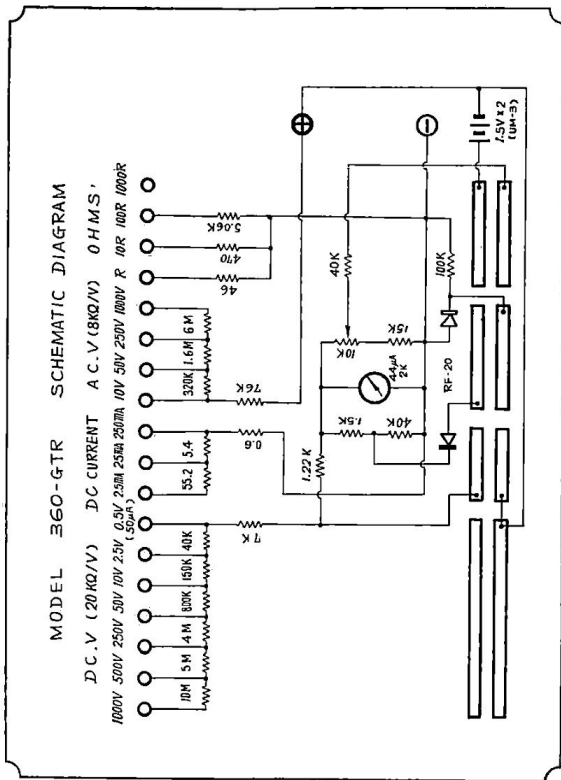
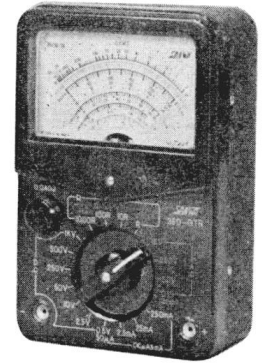




SANWA ELECTRIC INSTRUMENT WORKS, LTD.
 TOKYO JAPAN

SANWA

MULTI-TESTER



MODEL 360-G TR

INSTRUCTION MANUAL

- General Instructions.**
- At each measurement, confirm the range to use.
 - When measuring an unknown voltage or current, always start from the highest range to know the approximate value. Then switch it down to the appropriate range to check accurate value.
 - By no means, voltage should be measured on current or ohm range.
 - When zero ohm adjustment is ineffective on RX1 range, the internal batteries are required to be replaced with fresh ones.
 - When the meter is not in use, set the selector switch on DCmA range.
 - Do not expose the meter in high temperature or humidity.
- Features**
- High sensitivity: Fitted with 50μA meter movement in sensitivity, the meter works at 20KΩ/V for measurement of DC voltage and at 8KΩ/V for measurement of AC voltage.
 - Wide Range of Measurement: Through the internal batteries (1.5V X 2), the meter measures resistance of up to 50MΩ at maximum, while DC voltage ranges measure from 0.5V to 1000V at full scale.
 - Versatility: Provided with LI scale, the meter is available for checking all kinds of electronic instruments, television and radio sets as well as semi-conductors.
 - High Voltage: High sensitivity of the meter (50μA-20KΩ/V) uses 25KV high voltage probe embodying 480MΩ resistor.
 - Model 360-GTR, though built handy, with its 50μA meter movement just as a large-size multi-tester, to be classified as a Sanwa's TR Series Multi-Tester.

Range of Measurement.

DC/V:	0.5V 2.5V 10V 50V 250V 500V 1000V (20KΩ/V)
AC/V:	10V 50V 250V 1000V (8KΩ/V)
DC/μA:	50μA (150mV)
DC/mA:	2.5mA 25mA 250mA (150mV)
dB:	0dB ~ +22dB (at AC/10V range)
Resistance: Range	RX1000 RX100 RX10 RX1
Center	46KΩ 4.6KΩ 460Ω 46Ω
LI	65μA 650μA 6.5mA 65mA
LV	3V ~ 0V (at full ranges)
Battery:	Internal 1.5V (UM-3) X 2

Instructions for Use.

1. Range of measurement is divided into DCV, ACV, OHM, DC μ A and DCmA, all of which are switched over by means of the selector knob in the center of the panel face.
2. The red test prod is connected to + jack and the black one to - jack, respectively.
3. Measurement of DC Voltage.
 - a. The range selector switch is set at an appropriate DCV range connecting the test prods to their respective jacks.
 - b. When checking ordinary radio and TV sets and communication apparatuses, the black test lead is connected to the chassis, which is - potential, and the red test lead is applied to + potential to measure.
 - c. In case of special circuits such as oscillating circuit where negative potential is generated, the connection of the prods is reversed; the red one to the chassis and the voltage is checked by applying the black lead.
 - d. To measure transistor circuit of P-N-P type, the prods are connected as indicated in (c) above. With N-P-N type transistor circuit, the connection is as indicated in (b).
 - e. Generally, when measuring DCV circuit loaded with high resistance, indication will be a little lower than the actual value affected by the serial internal resistance of the meter movement. However, the very high internal resistance of 360-GTR makes such indication error less compared with other testers.
 - f. To know current by measuring voltage. Voltage is checked by applying the prods to both ends of the resistance to know the value dropped by the current. The value thus obtained is divided by the value of the resistance. For instance:

$$\text{In case of the load to be } 10K\Omega \text{ and the value indicated is } 50V: \frac{50V}{10K\Omega} = 1mA$$

High DCV internal resistance and small current consumption of this model enables measurement of current without disconnecting the circuit, if the value of the current is known by measuring the voltage value dropped.

- g. Use of High Voltage Probe for Checking TV Sets. The selector switch is set at DCV 1KV range. The leads of the probe are connected to + and - jacks of the meter, and the earth cord of the probe is clipped to the chassis. The probe is applied to the high voltage to measure. The black DCV-A scale third from top is read.

DCV-A	0-50-100-150-200-250.....	Use 2.5V, 250V & 25KV
	0-10-20-30-40-50.....	Use 0.5V, 50V & 500V
	0-2-4-6-8-10.....	Use 10V & 1KV

4. Measurement of DC μ A-mA.
 - a. The center selector switch is set at an appropriate DC μ A-mA range.
 - b. The circuit to measure is disconnected. To measure, the red prod is applied to plus potential and the black prod to minus potential, of the circuit.

DCV-A	0-50-100-150-200-250.....	Use 2.5mA, 25mA & 250mA
	0-10-20-30-40-50.....	Use 50 μ A only
	0-2-4-6-8-10.....	Not used.

5. Measurement of Resistance.
 - a. The selector switch is set at an appropriate ohm range.
 - b. The prods are shorted and the pointer of the meter movement is adjusted by means of Ω ADJ knob to rest on zero position on the right extremity.
 - c. The resistance value is known by applying the red and the black prods each to both ends of the resistance to measure.
 - d. The ohm value read on the scale indicates the resistance measured on RX1 range. On the other ranges, the values indicated are multiplied by 10, 100 and 1000, respectively.
 - e. Use of LI and LV scales. As is with the measurement of resistance, the pointer is adjusted at each time of measurement on different ranges as is indicated in (b) above. Apply the prods to the base (B) and collector (C) or emitter (E) and collector (C), of a transistor, or to + and - side in case of a diode, and the pointer will indicate a certain value on the ohm scale. It is the resistance of the transistor or the diode measured.

At the same time, the value read on LI scale indicates Ico of the transistor between B and C or E and C. It also indicates the reverse or linear current of a diode; the same relation exists between E and B of a transistor.

Also the value read on LV scale is the voltage actually loaded on the semi-conductor. LV scale is read on its full range, 0-3V in reverse. With a zener diode, therefore, of 0.8V, LV value will read approximately 0.8V on any ohm range.

Note: Model 360-GTR is an ideal tester for measurement of resistance of unlinear change in the relation of resistance between voltage and current.

LI value is read direct on X1000 range. X100, X10 and X1 are read in reverse order multiplied by 10, 100 and 1000 to obtain it.

6. Measurement of AC Voltage.
 - a. The selector switch is set at an appropriate range. Test prods are used irrespective of polarity.
 - b. Red ACV scale second from top is used. The voltage value is obtained just in the same way as with measurement of DC voltage.
 - c. Frequency ranges used are approximately from 40c/s to 5k/c.
 - d. The meter being of half-wave rectification, indication error will be big in case of the wave form other than sine and symmetry waves. Especially in case of asymmetry wave, it is known by inverting the polarity of the test prods, when the indication will change. DCV ranges may be used in this case.
 - e. db scales. db scale is calibrated so that 0db of each value indicated on AC 10V range will be 0.775V. Therefore, the method of measurement is same as that of ACV reading the value on the db scale.

$$20\log_{10} \frac{\text{ACV ind.}}{0.775V} = \text{db value} \quad \text{Therefore, when AC} = 7.75V \quad 20\log_{10} \frac{7.75}{0.775} = 20\log_{10} 10 = 20\text{db}$$

To know db value on the ranges other than AC-10V, i.e. on 50V, 250V or 1000V, first read the value on 22db scale, and then add the figures indicated in table on the bottom right of the scale face to the value obtained on each range. For instance, when the value read on AC-250V range is 16db,

$$\text{Actual value} = 16 + 28 = 44\text{db}$$