sanwa

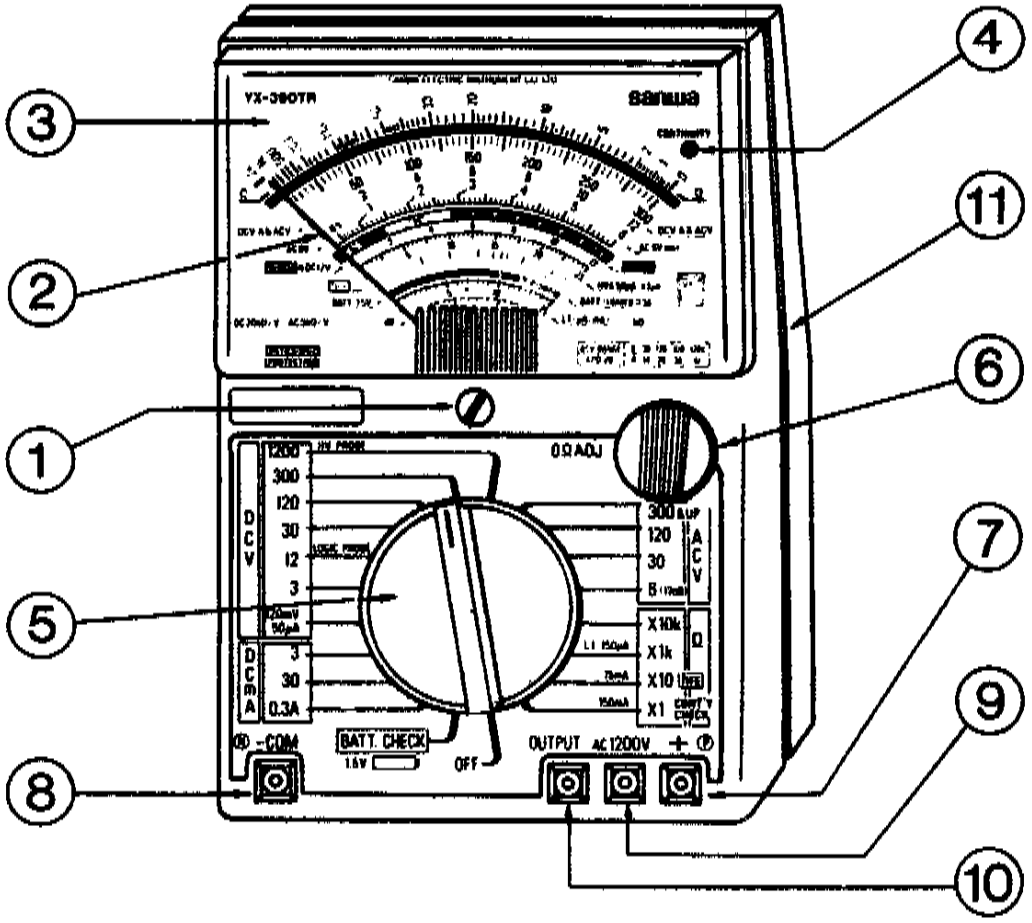
YX-390TR
MULTITESTER

INSTRUCTION MANUAL

FEATURES

1. A 20-position range selector switch and a core magnet type taut-band indicator are used. The sensitivity is 20kΩ/VDC and 9kΩ/VAC with the 3–12 system scale divisions.
2. The optical check of continuity on the R X 1 range by an LED.
3. A high performance fuse is contained in addition to the diode protection for safety.
4. The logic H and L divisions are provided. By jointly using with the logic probe LG-2, the YX-390TR performs as a logic analyzer for pulse detection. The LG-2 is an optional accessory sold separately.
5. The transistor amplitude factor h_{FE} (0 ~ 1000) is checked by using an optional h_{FE} connector.
6. The BATT. CHECK range is provided to judge good-bad of 1.5V cell by the color zone.
7. Also provided is an output terminal with a capacitor in series for signal detection of such an electronic circuit in television receivers, audio equipments, etc.
8. The indicator is mounted inclined about 3° for the convenience of taking the reading.

FRONTAL PARTS



1 Meter-0 adjuster
2 Meter needle
3 Scale dial
4 LED continuity indicator
5 Range control switch
6 0Ω adjuster
7 + terminal
8 – COM terminal
9 AC 1200V terminal
10 OUTPUT terminal (capacitor in series)
11 Rear case

MEASUREMENT RANGE AND PERFORMANCE

Meas. items	Measurement ranges	Accuracy	Remarks
DCV	0-120mV-3V-12V-30V-120V-300V-1200V (25kV w/HV probe)	±2.5% fs (below 1200V)	Input impedance 20kΩ/V
DCmA	0-50μA-3mA-30mA-0.3A (50μA common with DC 120mV)	±2.5% fs	Voltage drop 300mV
ACV	0-6V-30V-120V-300V-1200V 30Hz ~ 100kHz ±1dB 40Hz ~ 30kHz ±3%	±3% fs	Input impedance 9kΩ/V
dB	−10dB ~ +17dB (AC 6V range) ~ +63dB 0dB = 0.775V (1mW) through 600Ω	±3% fs	Same as ACV
Ω	Range − X1 X10 X1k X10k Maximum − 2k 20k 2M 20M(Ω) Midscale − 20 200 20k 200k(Ω) Minimum − 0.2 2 200 2k(Ω) Led continuity indicator at the X 1 range (below 10Ω)	±3% of arc	Internal batteries 1.5V (SUM-3 or R6) X2 9V (006P) X1
BATT	0 ~ 1.5V by GOOD-BAD color zone	±2.5% fs	0.3A load

LOGIC PULSE INDI-CATOR	Led display (Pat. pend.) Above 0.8Vp-p Min. pulse width 0.1μsec. Max. freq. 30MHz		Using an optional logic probe
LI (ICEO)	0 ~ 150μA on X 1kΩ range 0 ~ 15mA on X 10Ω range 0 ~ 150mA on X 1Ω range	±5% of arc	Current across + & − COM in resistance measurement
hFE	0 ~ 1000 on X 10Ω range Pat. No. 1306641 (Japan) No. 1482137 (U.K.)	±3% of arc	Using an optional connector

Dimensions/weight : 151 X 100 X 42mm/300g
Attached accessories : Instruction manual, test leads (pair) & spair fuse (250V/1A).
Optional accessories : Carrying case, logic probe, HV probe & hFE connector.

SCALE READING (scale order from top)

Order	Scale mark	Meas. items	Description
1	Ω (black)	Resistance	0.2Ω ~ 2kΩ read direct for X 1 range. For X 10, X 1k & X 10k, values read are multiplied by each magnifying factor.
2	(mirror)	Common	For accurate reading, visual point, needle and its image in the mirror must agree.
3	DC & ACV·A (black)	DC voltage DC current AC voltage	Scale arcs: 0–300, 0–12, 0–6. Unit: mV & V for voltage; mA & A for current. Read them direct for 6V, 12V & 300V, and converted for the other ranges.
4	AC6V (black)	AC6V	Exclusive for AC6V. 0–6 arc above is used.
5	LOGIC DC12V (red)	Logic circuit DCV H & L	Exclusive for positive logic output check. DC12V range is used. H output in logic "1": 2V ~ 5V. L output in logic "0": below 0.8V. As logic analyzer, use LG-2 logic probe.
6	HV & 50μA (black)	DCV 25kV DCA 50μA	Use 0–25 divisions. For high voltage measurement using a HV probe, read the indicated value directly. For 50μA measurement, multiply the indicated value by 2.
7	h_{FE} (blue)	Tr. current amplitude degree	$h_{FE} = \frac{I_C}{I_B}$ 0 ~ 1000 directly read. Optional connector used.
8	BATT (color zone)	1.5V cell check	GOOD-BAD discrimination by color at 0.3A load.
9	LI (black)	Current across terminals	Current read across + & –COM terminals while measuring resistance. 0 ~ 15 arc used for X 10 range in mA. 0 ~ 150μA for X 1k & 0 ~ 150mA for X 1.
10	dB (red)	AF output	–10 ~ +17dB corresponds to AC6V. $20 \log_{10} \frac{\text{ACV scale}}{0.775V}$ = dB (0dB = 0.775V) 0dB corresponds to 1mW through 600Ω.

PRECAUTIONS IN OPERATION

1. 0-correction of the indicator.
   Whenever the meter needle is found off 0 of the scale left, turn the meter-0 adjuster to have the needle stay on 0.

2. Connection of the test leads.
   As a rule, the red lead goes to the + and the black lead to −COM. Voltage, current and resistance are measured through these terminals.

3. Confirmation of the range to use.
   Before applying the test leads to a load, be sure to identify if the range control switch is placed correctly in the prescribed range. The meter circuit resistor or resistors can be burnt if high power voltage is applied to the meter with the range control switch erroneously placed in a current or a resistance range.
   Although the internal components are protected by the built-in fuse and diodes, if AC power voltage is impressed to one of mA or Ω ranges by mistake, the internal fuse is blown.

NOTE: Replacement of the fuse.
When the fuse is blown by misuse, the multitester does not function at all. For replacement of the fuse, take off the screws on the rear case and mount a good fuse of 250V/1A.

4. Indicator cover.
   Do not rub the cover hard with dry cloth. It is treated with antistatic coating. If the coating effect has fallen in long use, wipe it with some diluted antistatic washing solvent as a temporary measure.

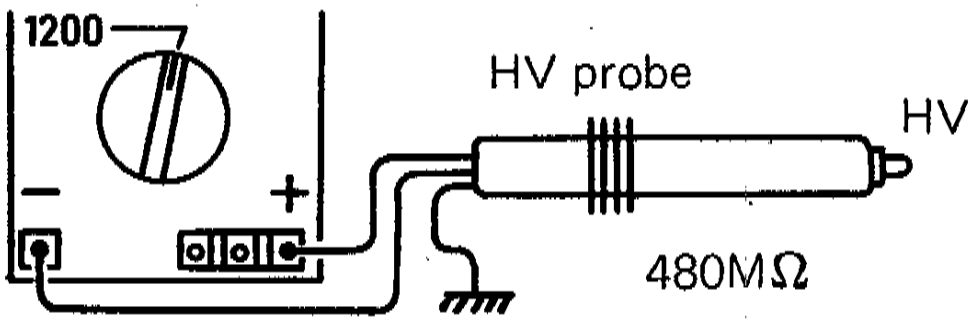
5. Maintenance care.
   A multitester is an elaborately constructed instrument. It must not be exposed long in the direct sunlight or in high temperature or humidity. Also do not give it severe mechanical shock nor vibration.

OPERATION I Circuit Tester.

■ DC voltage (DCV) measurement.

1. Measurement range: DC 120mV ~ 1200V in 7 ranges.
2. Terminals to use: +, −COM.
3. Set the range control switch to a proper DCV range. For an unknown voltage, check it first on the 1200V range. The switch can be reset to a proper lower range.
4. For measurement of a high voltage in a TV receiver, use the high voltage probe (HV-1) sold separately to measure up to 25kV as per Fig. 1.

Fig. 1



■ AC voltage (ACV) measurement.

1. Measurement range: AC 6V ~ 1200V in 5 ranges.

2. Terminals to use: +, −COM (between 6V and 300V ranges)
   For measurement of 1200V, set the range selector switch to 300 & UP range. The test lead plugged into the + is replugged into the AC 1200V terminal. In other words, use the AC 1200V and −COM terminals.

3. Set the range control switch to the prescribed ACV range. For an unknown voltage, first check it on the 1200V range. The switch can be moved down to a proper lower range.

4. Note on measuring a high voltage above 200V.
   a. Identify if the range control switch is correctly placed in the AC300V range and the test leads are inserted as described in the article 2 above.
   b. Before connecting the tester to a load, switch off the power supply to the circuit to be checked. The power switch is set to ON to proceed to measurement.
   c. Do not touch the circuit wiring nor the YX-390TR while measuring. Before disconnecting the YX-390TR from the load, be sure to switch off the power supply.

■ AF output (dB) measurement.

1. Measurement range: −10 ~ +17 ~ +63dB in 5 ranges.
2. Method of measurement is quite the same as in ACV measurement.
3. The dB scale is graduated corresponding to AC 6V range, and the output value is read directly in dB based on 0dB = 1mW only for 600Ω circuit impedance.
4. For measurement on ranges over 30V, add the value given in the ADD dB value table to know the real value. For instance, when +10dB is read on the 30V range, add +14dB by the table to know the real value to be +24dB.
5. In case the impedance in the measured circuit is unknown, the measured value is merely an AC voltage value converted to the corresponding dB divisions.

■ ACV measurement (including AF output) through the OUTPUT terminal.

1. The measuring method is the same as for ACV measurement. The + test lead is connected to the OUTPUT terminal. In other words, the OUTPUT and −COM terminals are used.
2. It can take out an AC signal only from a circuit where DC and AC elements are mixed as in a TV receiver or audio equipments, etc. It also checks various signals in a TV circuit as detection of a horizontal signal in the horizontal circuit, or detection of an input signal in the synchronizing separation and synchronizing signal amplitude circuits.
3. The OUTPUT terminal has a 0.047μF capacitor connected in series.

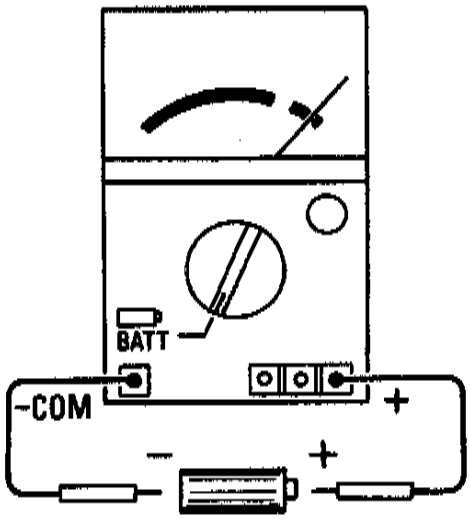
■ DC current (DCmA) measurement.

1. Measurement range: DC 50μA ~ 0.3A in 4 ranges.
2. Terminals to use: +, −COM.
3. The switch position at 50μA measurement is in common with DC 120mV range. For ranges other than 50μA, set to a prescribed range.
4. While using any one of DCmA ranges, be very careful not to impress voltage to the meter.

■ Use as a battery checker. (Testing of various 1.5V cells)

The BATT range is provided with a load resistance that consumes about 300mA which usual appliance consumes in operation. The good-bad is judged by color-zone scale by connecting a cell as per Fig. 2.

Fig. 2



DRY CELL (1.5V)

Examples of judgement by indication.

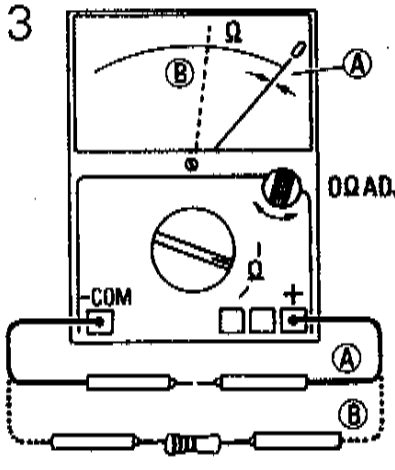
- ○ GOOD (blue) . . . The more the pointer swings rightwards, the better.
- ○ ? . . . . . For a small transistor radio, it is still workable.
- ○ BAD (red) . . . . . Completely worn out.

NOTE: Measurement of button cells.
For measurement of such thin miniature cells, do not use the BATT range but measure on the 3V range using the + and – terminals. If the voltage is much dropped, it is judged defective.

■ Resistance (Ω, kΩ & MΩ) measurement.

1. Measurement range: 0.2Ω min. ~ 20MΩ max. in 4 ranges (X1, X10, X1k, X10k).
2. Terminals to use: +, −COM.
3. The range selector switch is set to a prescribed Ω range.
4. Zero ohm adjustment (0ΩADJ).
   Each time the range is moved, short together the terminals and adjust the meter needle to 0Ω turning the 0Ω adjuster as per Fig. 3.
5. Continuity check by LED.
   When measuring on the X 1 range, the LED continuity indicator emits light on the upper right corner of the indicator against a measured subject below 10Ω. In this case, the luminosity varies according to the resistance value. Continuity or disconnection of a wire is quickly judged as it responds faster than the needle movement.
6. When measuring a circuit resistance, be sure to switch off power. Pay special caution not to impress voltage particularly to the X 1 and X 10 ranges.

Fig. 3



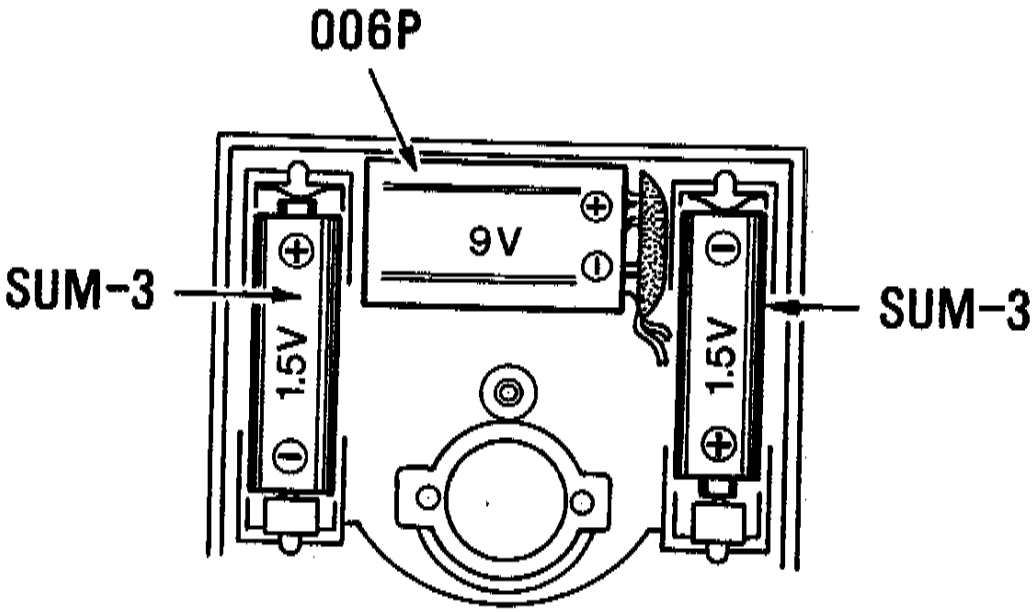
0Ω ADJ

Resistor measurement.

■ Replacement of batteries.

1. If 0Ω adjustment is impossible for the X 1 range, the internal batteries (UM3 X 2) have worn out needing replacement.
2. If it is for the X 10k range, the 9V (006P) needs replacement.
3. Remove the rear case and mount the batteries as illustrated in Fig. 4 taking note of their polarities.

Fig. 4

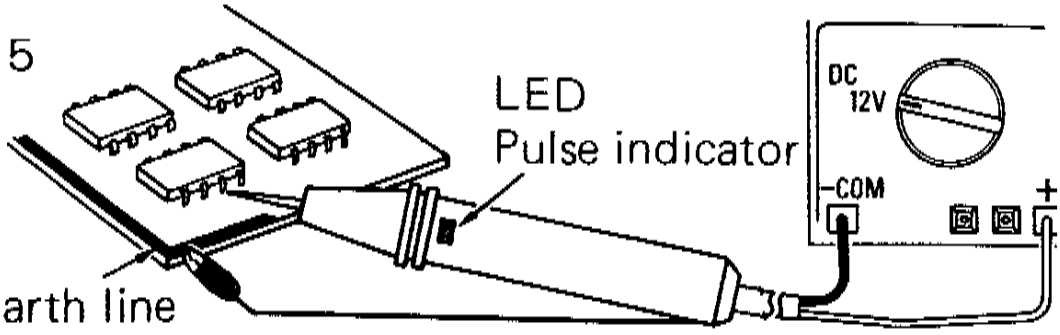


OPERATION II Expanded Functions Using Optional Accessories.

1. LOGIC ANALYZER.

By using a logic analyzer LG-2, the YX-390TR perfc as a logic analyzer. It serves to analyze the behavior electronic appliances containing logic circuits compo of TTL, CMOS, etc. like that of a microcomputer.

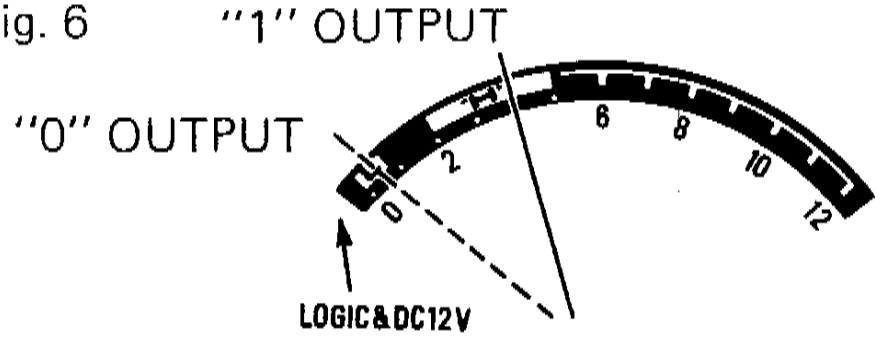
Fig. 5



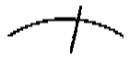
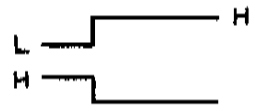
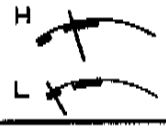
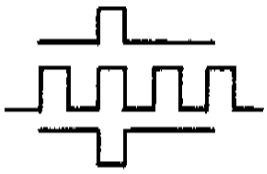
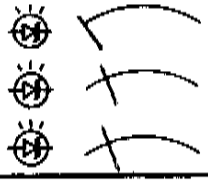
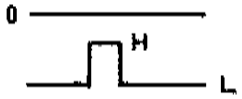
■ Measurement of logic circuits.

1. The range selector switch is set to DC 12V.
2. The logic probe LG-2 is connected to the YX-390T as per Fig. 5.
3. The grounding clip of the probe is connected to t ground and apply the probe tip to the check poi The logic output is checked by the LED pulse indicat on the probe using the H and L scales.

Fig. 6



4. The logic output and results of measurement are illustrated below.

	Logic circuit Output waveform	Detector	Indication of tester for DC 12V range	Polarity
Power source voltage Vcc		Meter		DC
VH VL		Meter		DC
Single and successive pulse (positive logic)		Meter & LED		AC AC & DC DC & AC
Pulse (negative pulse)		Meter & LED		– DC & AC

NOTE:

1. The H output, L output and power source voltage are measured on the exclusive 0～12V logic scale. The moment the DC voltage is impressed, charging effect causes the pulse indicator to emit itself. It is about 0.3 sec at below 3V and about 2 sec at below 12V.
2. The DC output of a negative logic circuit is also negative, where the meter needle deflects in reverse direction across 0.

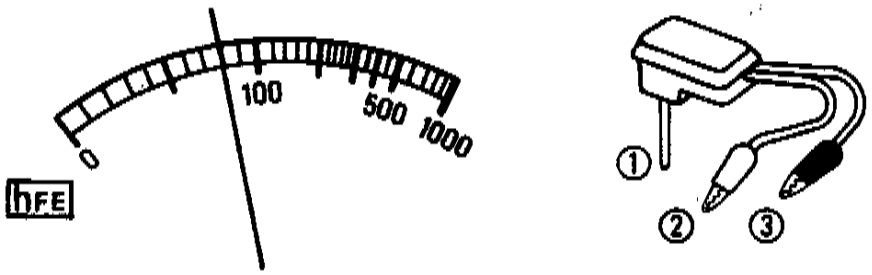
■ Pulse signal captured in DC voltage measurement (simultaneous measurement of DC and AC signals).

1. In measurement on a range between 120mV ~ 300V, DCV element is indicated by the indicator and AC pulse element on the pulse indicator of the probe. The analysis of function is thus carried out easily.
2. In this measurement, 500V is the maximum analyzed voltage.
3. Where the earth potential in the circuit is unstable against the ground as with a TV receiver, the LED emits light just by connecting the earth clip of the logic probe to an earth point of the receiver set. However, if the earth line is completely grounded to the earth, the LED does not emit light.

2. TRANSISTOR TEST.

By using an hFE connector (hFE-1), it performs as a transistor checker enabling measurement of the transistor DC current amplitude factor hFE (IC/IB) from 0 to 1000.

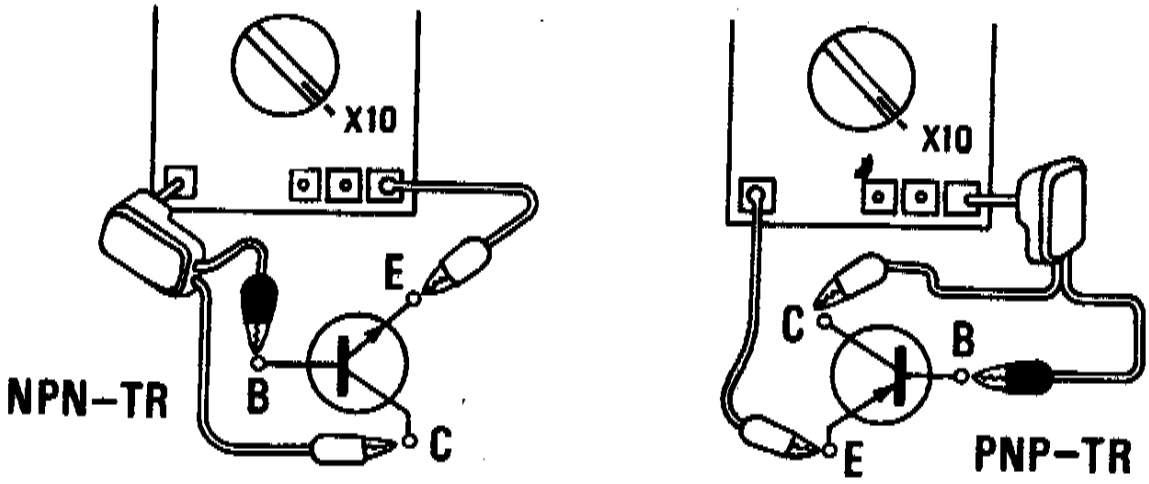
Fig. 7



1 Connecting pin 2mmϕ to the YX-390TR.
2 Connecting clip to the Tr. collector.
3 Connecting clip to the Tr. base.

1. Preliminaries.
   The X 10 resistance range is used for transistor test, and before measurement, the meter needle must be adjusted to 0Ω shorting together the + and −COM terminals and turning the 0Ω adjuster.
2. Connection of a transistor to the YX-390TR.

Fig. 8



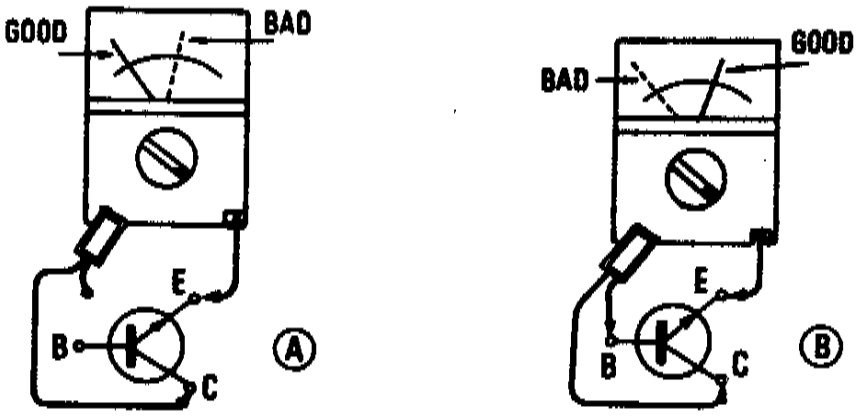
According to the polarity of the transistor being tested, use the –COM terminal for NPN and the + terminal for PNP types, per Fig. 8.

3. Of the 2 alligator clips on the connector, the black lead goes to the base and the red lead to the collector of the transistor.

4. As the tester terminal left open (+ for NPN and –COM for PNP) is connected to the emitter, the meter needle responds to indicate the h_{FE} value (I_B) on the blue h_{FE} scale.

5. Judging the quality of a transistor taking NPN type as sample. If the indicator reads high when the collector and emitter are connected with the base open, the transistor is judged defective: ICEO is in excess, or C and E shorted.

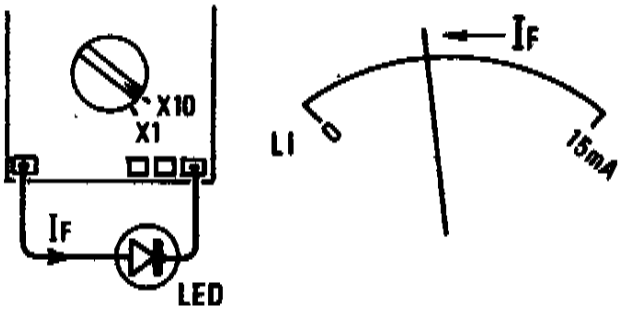
Fig. 9



In the above test Ⓐ, if anything abnormal is not recognized between C and E, connect the base test lead to the base and see the indication to change. Normally it should increase as shown in Ⓑ, but if it remains unchanged the transistor is judged defective.

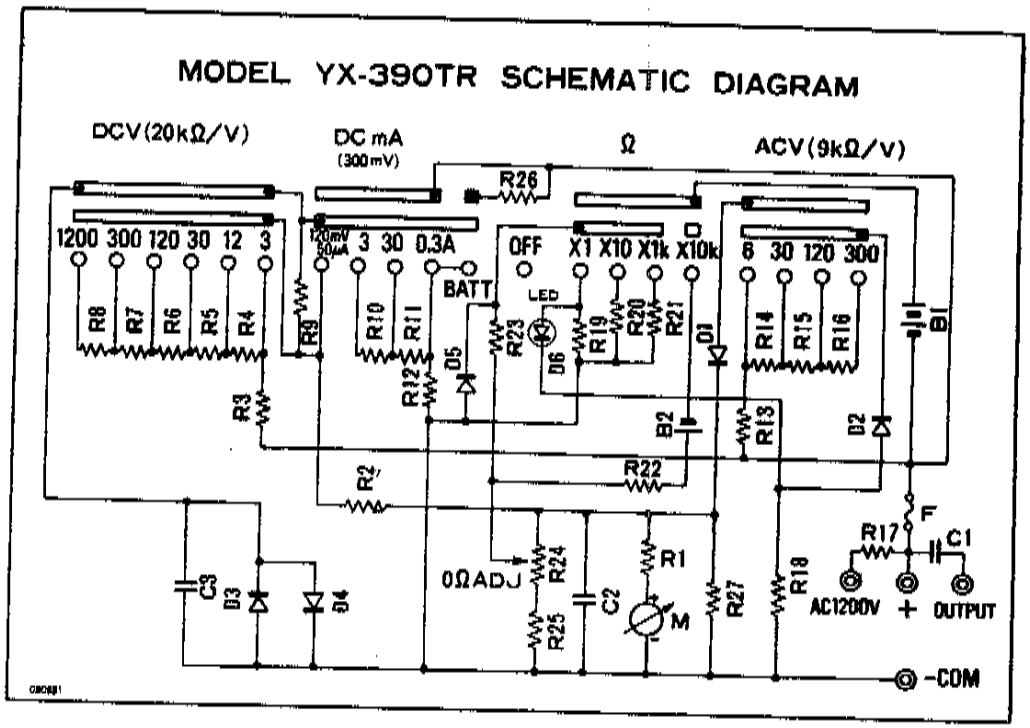
LED test (Application of Ω ranges).

Fig. 10

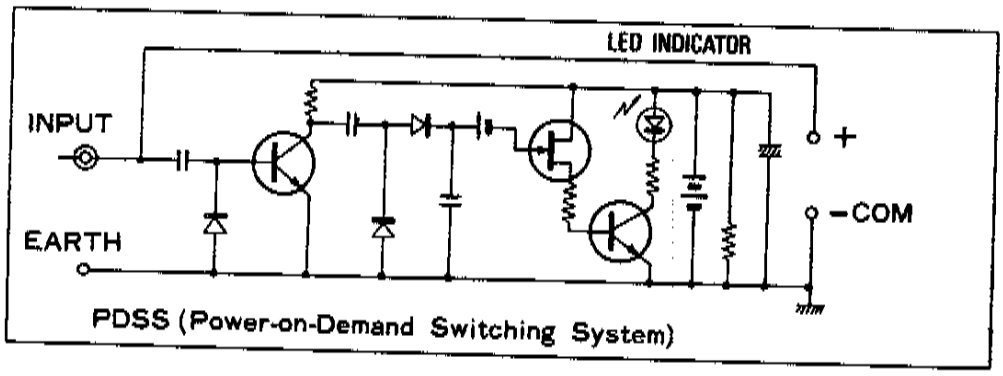


Connecting LED as shown in Fig. 10, check it on the X 1 and X 10 ranges. If the LED conducts, it emits light. The value of the current (IF) is simultaneously read on the LI scale.

CIRCUIT DIAGRAM I Tester.



CIRCUIT DIAGRAM II
Logic probe (LED pulse indicator).



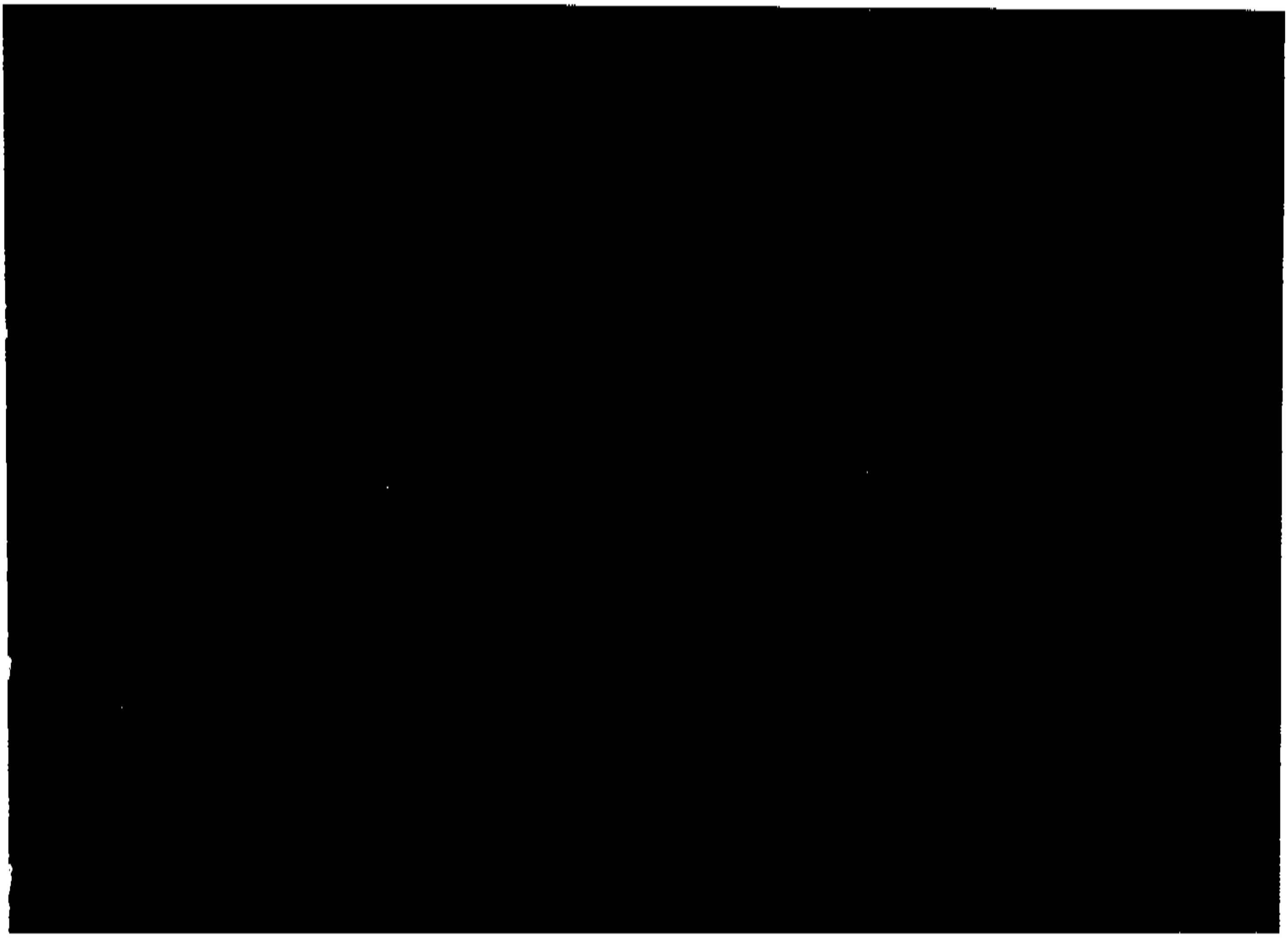
LIST OF MAJOR PARTS

Part No.	Description	R. S.
9YR01	Resistor (750Ω) mV calibration	R1
9YR02	Resistor (640Ω) Series	R2
9YR03	Resistor (57.6kΩ) 3V DC multiplier	R3
9YR04	Resistor (180kΩ) 12V DC multiplier	R4
9YR05	Resistor (360kΩ) 30V DC multiplier	R5
9YR06	Resistor (1.8MΩ) 120V DC multiplier	R6
9YR07	Resistor (3.6MΩ) 300V DC multiplier	R7
9YR08	Resistor (18MΩ) 1200V DC multiplier	R8
9YR09	Resistor (3.6kΩ) Series	R9
9YR10	Resistor (92Ω) 3mA DC shunt	R10
9YR11	Resistor (9Ω) 30mA DC shunt	R11
9YR12	Resistor (1Ω) 0.3A DC shunt	R12
9YR13	Resistor (47.5kΩ) 6V AC multiplier	R13
9YR14	Resistor (216kΩ) 30V AC multiplier	R14
9YR15	Resistor (810kΩ) 120V AC multiplier	R15
9YR16	Resistor (1.62MΩ) 300V AC multiplier	R16
9YR17	Resistor (8.1MΩ) 1200V AC multiplier	R17
9YR18	Resistor (500Ω) Diode series	R18
9YR19	Resistor (19Ω) Ω X 1 shunt	R19
9YR20	Resistor (200Ω) Ω X 10 shunt	R20
9YR21	Resistor (33kΩ) Ω X 1k shunt	R21
9YR22	Resistor (194kΩ) Ω X 10k series	R22
9YR23	Resistor (44kΩ) Ω series	R23
9YR24	Potentiometer (10kΩ) 0Ω adjuster	R24
9YR25	Resistor (16kΩ) Shunt	R25
9YR26	Resistor (4Ω) BATT CHECK series	R26
9YR27	Resistor (35kΩ) Shunt	R27

Part No.	Description	R. S.
RF05	Silicon diode for ACV	D1, D2
RF07	Silicon diode for protection	D3, D4 D5
RF08	LED for continuity check	D6
B001	Dry cell (SUM-3) 1.5V x2	B1
B005	Dry cell (006P) 9V x 1	B2
C049	Capacitor 0.047μF	C1
C050	Capacitor 0.047μF	C2, C3
F001	Fuse (250V/1A)	F
	Meter movement (44μA/2kΩ)	M
C016	Movement cover	
BA05	Movement base	
P021	YX-390TR panel	
P022	YX-390TR panel dial	
X020	XY-390TR rear case	
T001	Terminal jack (2φ) x 4	
K021	Range selector switch knob	
SW21	Range selector switch	
K011	0Ω ADJ knob	
L002	Test lead, pair (2φ)	

R. S. -- Reference Symbol

86.11−1,000 Ⓜ



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