INSTRUCTION MANUAL

FOR

MODEL VT-106

HIGH SENSITIVITY ELECTRONIC VOLTMETER

C O N T E N T S

TRIO

Manufactured by TRIO ELECTRONICS INC., TOKYO, JAPAN.

BEFORE plugging the AC cord into a power outlet, MAKE SURE that your line voltage corresponds to the operating voltage to which this unit is set.

1. GENERAL

TRIO model VT-106 is an electronic voltmeter with a scale calibrated in rms value. It provides means for you to make accurate and stable voltage measurement of an input voltage from a minute voltage of 20 μV up to 300 V within a voltage waveform frequency range from 5 Hz to 500 kHz.

Because of its extremely high sensitivity, this electronic voltmeter can be used even for noise measurement, not to speak of general voltage measurement. It may also be used as an amplifier with high gain.

2. FEATURES

- o All solid state circuitry - small both in warm-up and power consumption.
- o Taut-band used to support the meter unit, a moving coil type high sensitivity DC ammeter, frees the meter unit from abrasion or shocks and allows easy and precise reading of meter indication.
- o Wide voltage measuring range from 20 μV to 300 V within a measuring frequency range from 5 Hz to 500 kHz.
- o Each range measuring circuit provides an input impedance of 1 M Ω and a shunt capacitance of less than 32 pF - almost no adverse effect given to the circuit under measurement.
- o Power supply incorporating a voltage regulator circuit insures stable voltage measurement against variation of source voltage.
- o The dB and dBm scales provided additionally to voltage scale calibrated in rms value. - convenient specifically to make S/N ratio measurement.
- o Provision of output terminals for connection of an oscilloscope - waveform observation available for waveform of the voltage under measurement.

3. RATINGS

- o VOLTMETER

Measuring ranges

Voltage (12 ranges)	;	0.02 mV ~ 300 V (Full scales of 0.001/ 0.003/0.01/0.03/0.1/0.3/1/3/10/30/100/ 300)
dB	;	- 80 ~+ 50 dB (0 dB = 1 V)
dBm	;	- 80 ~+ 52 dB (0 dB = 1 mW, 600 Ω)
Indicating accuracy		± 3 % of full scale (as measured using 1 kHz as standard measuring frequency)

Frequency response (with respect to the response at 1 kHz)

5 Hz ~ 500 kHz	;	± 10 %
10 Hz ~ 250 kHz	;	± 5 %
20 Hz ~ 100 kHz	;	± 3 %

Input impedance	1 M Ω shunted by 32 pF or less.
Power regulation	Within ± 1 % of full scale against ± 10 % variation of power source voltage.
Temperature coefficient	± 0.09 %/ °C
Operating temperature range	- 10 ~ + 50 °C

Maximum input voltage

DC component	;	± 400 V
AC component	;	300 V rms for ranges 0.3 V or lower 500 V rms for ranges 1 V or higher

o AMPLIFIER CHARACTERISTIC

Gain	Approx. 66 dB
Output voltage	More than 2 V without load
Frequency response	Within ± 1 dB from 5 Hz to 500 kHz
Output impedance	Approx. 600 Ω
Distortion factor	Less than 1 % at full scale
S/N ratio	More than 40 dB at full scale

o Power Supply

Input voltage	AC 100, 117 or 230 V ± 10 %, 50 or 60 Hz
Power consumption	2.7 W

o Composition

Front and rear views	Refer to the Fig 2.

Dimentions	158(W) x 195(D) x 215(H) (mm)
Weight	2.7 kg (5.1 LBS)
Accessories	1 One CA-41 cord (BNC)
	2 Three fuses
	3 One copy of instruction manual

4. CIRCUIT DESCRIPTION

When you read the following descriptions, refer to the block diagram in Fig. 1 and the circuit diagram in Fig. 4.

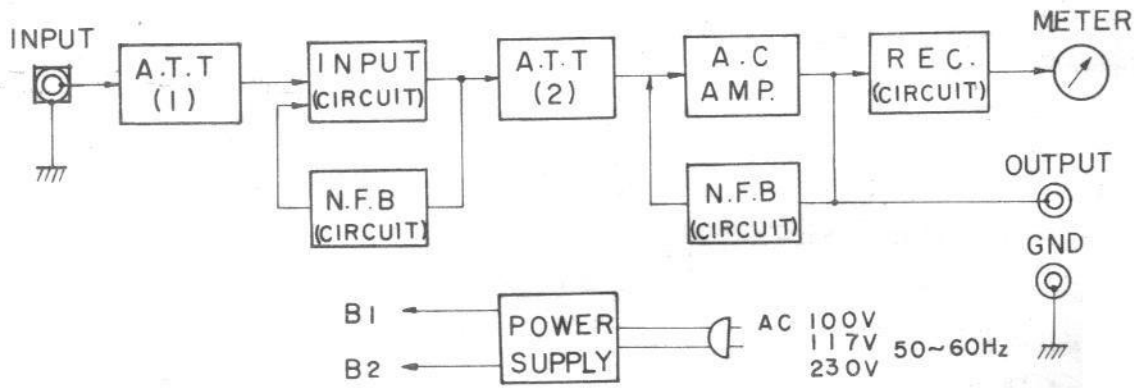


Fig.1 VT-106 BLOCK DIAGRAM

(1) ATTENUATOR (I)

Attenuator (I) is a resistance attenuator with compensating capacitor.

This attenuator provides the same output voltage as the input voltage when its selector switch is set to any of positions of 0.001V to 0.3 V. If the selector switch is in any of positions of 1V to 300 V, the attenuator provides an output voltage which, being voltage divided by resistors R101 and R102, is 60 dB lower than the input voltage.

Trimmer capacitor TC101 is inserted to adjust the performance of this set (pre-set at 100 KHz).

(2) INPUT CIRCUIT

The input circuit is a high input-impedance circuit employing FET (2Sk13-Y).

Transistors Q1 (2SK13Y) and Q3 [2SC458(LG)C] form an amplifier with a gain of 20 dB with a negative feedback of 10 dB applied from the output to the input sides of the circuit.

Transistor Q2 (2SA562-Y) compensates the drift of the transistor Q1 output due to temperature change.

Transistor Q4 [2SC458(LG)C], acting as an emitter follower, connects the output of the input circuit to the second attenuator.

Diodes D1 and D2 [1S1473(K)] form a protection circuit for FET Q1.

(3) ATTENUATOR (II)

This attenuator (II) divides all its input voltage into output voltages below 0.01 V, which are applied to the next amplifier. That is, the attenuator exerts an attenuation of 50 dB to the input voltages from the input circuit for ranges 0.001 V through 0.3 V. When the selector switch is turned to position Range 1 V, the attenuator [2] is switched to the Range 0.001 V circuit, This is because at the position Range 1 V, the input voltage is attenuated by 60 dB through attenuator (I).

(4) AC AMPLIFIER AND FEEDBACK CIRCUIT

The AC amplifier receives its input from attenuator [2] through a Darlington circuit which, comprising transistors Q5 and Q6, turns the input into high impedance, and delivers the output of Darlington circuit through emitter follower Q6 with low output impedance to the succeeding amplifier stage consisting of IC1, Q7 and Q8.

The amplifier provides a gain of approx. 46 dB at 1 kHz with a negative feedback of approx. 20 dB applied from its output to the input sides.

This amplifier operates in conjunction with the input circuit to form an amplifier circuit providing an overall gain of 66 dB.

(5) RECTIFIER CIRCUIT

The rectifier circuit consists of a full-wave rectifier

circuit and a meter (DC 100 μA, internal resistance 850 Ω).

This circuit causes the meter to deflect in proportion to the mean value of the input waveform. But, the meter is provided with a scale graduated in rms value of the sine wave.

(6) METER

This meter is of the taut-band suspension type, which is characterized by small abrasion and high shock-resisting nature, and therefore insures you a stable measurement.

There are three types of scale marked on the meter face. Of these, one type is the voltage scale graduated over full scale ranges of 0 ~ 10 and 0 ~ 3 in rms value of sine wave. The others are the dB and dBm scales graduated on the bases of 10 = 0 dB and 1 mW. 600 Ω = 0 dBm respectively.

(7) POWER SUPPLY CIRCUIT

The power supply circuit, operating from AC 100/117/230 V, 50 or 60 Hz source, supplies all circuits of this set with the 12 and 23 V voltages as the + B voltage.

This circuit is of the series regulator type, in which the output voltage is regulated as follows:

Error detector Q10 detects any variation of an output voltage, compares it to reference voltage provided by diode D5, and applies an error voltage to controller Q11 (2SC627), thereby restoring the output to the normal voltage.

5. OPERATING INSTRUCTIONS

(refer to Fig. 2.)

(1) PANEL CONTROLS AND THEIR FUNCTIONS

The panel controls and their functions are as follows.

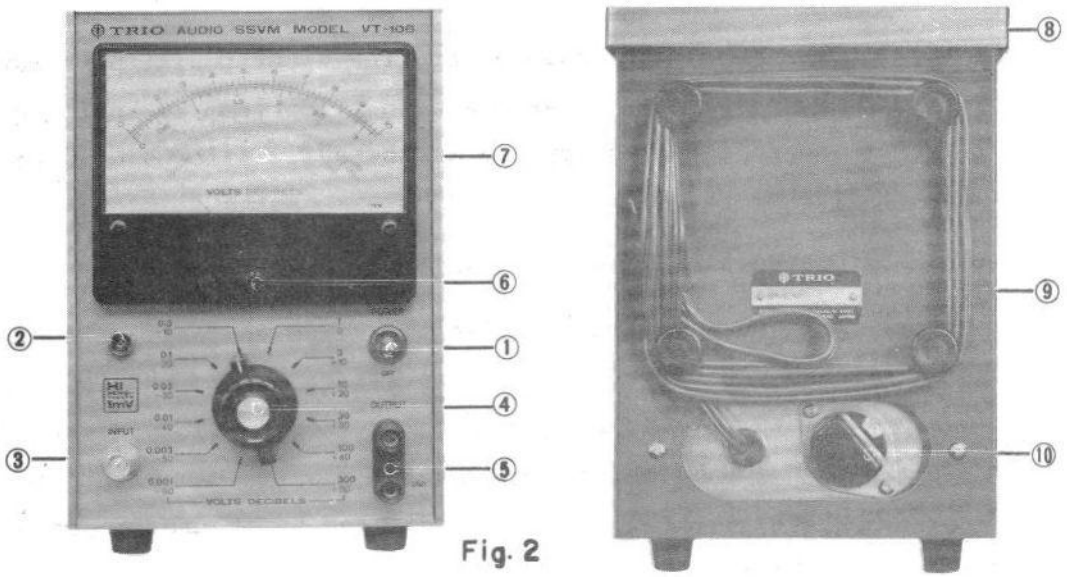


Fig. 2

① POWER : Throwing this switch into the upper position turns on this set and neon pilot lamp glows to indicate that the set is placed in the running condition.

② : Neon pilot lamp which turns on when POWER switch is thrown into ON position.

③ INPUT : Input signal terminal.

④ VOLTS
DECIBELS : 12-positions meter range selector switch for selecting a voltage measuring range in 10 dB steps.

⑤ OUTPUT : Output terminal provided for connection of an oscilloscope to observe waveform.

⑥ : Zero-set adjustment for meter.

⑦ : Taut-band meter having high resisting nature to abrasion and shocks. Indicates the rms value of real voltage measured.

⑧ : Handle

⑨ : Power cord

⑩ : Input power selector switch with positions 100;

117 and 230 V for 50 or 60 Hz.

(2) OPERATIONS

(2)-1 Throw the POWER switch into the upper position to turn on the set. This glows the neon pilot lamp to indicate that the AC power is applied to the set. Allow 3 minutes for the set to warm up.

(2)-2 Connect the measuring cable to INPUT terminal.

(2)-3 Set the meter range selector switch to position 300. When measuring an AC input voltage superposed on DC voltage, however, never fail to set the range selector switch at position 300 before connecting the measuring cable to the circuit. Otherwise, the set may be damaged by the surge due to the DC voltage.

(2)-4 Connect the measuring cable across the measuring points.

(2)-5 Adjust the meter range selector switch to the position at which the meter deflects over one-third of full scale.

(2)-6 Take reading on the meter using an appropriate scale in connection with the position of meter range selector switch.

6. HOW TO READ METER SCALE INDICATION

(refer to Fig. 3.)

(1) Voltage scale

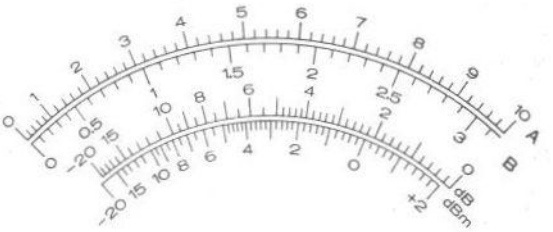


Fig.3

The voltage scale is calibrated with black double graduations marked, together with their respective figures, over ranges 0 ~ 10 Ⓐ and 0 ~ 3 ~ Ⓑ .

When the meter range selector switch is set to range 1 V, the full scale setting 10 of the 1 ~ 10 Ⓐ scale indicates 1 V. If the switch is set to range 300 mV, the full scale setting 3 of the 1 ~ 3 Ⓑ scale indicates 300 mV.

The above similarly applies to the other range selected by the meter range selector switch only if the reading is taken from the scale having the same full scale setting as the range selected.

The 0 ~ 3 range of the 0 ~ 10 Ⓐ scale is overlapped with the 0 ~ 3 Ⓑ scale. This is intended to enlarge the range between graduations 0 and 3 of the 0 ~ 10 Ⓐ scale, since it is rather difficult to take meter reading over said range because of too narrow intervals between the graduations. If the meter gives an indication smaller than 3 on the 0 ~ 10 Ⓐ scale, therefore, turn the meter range selector switch to range 3 and you can take the reading more minutely from the 0 ~ 3 Ⓑ scale.

(2) dB scale

The dB scale is a voltage ratio scale calibrated with red graduations over a range of 0 to -20 dB with graduation 0 dB corresponding to graduation 10 of the 0 ~ 10 Ⓐ scale.

While, the meter range selector switch is so designed that it selects the input voltage with 10 dB step for 12 input voltage ranges from 1 mV to 300 V. This means that the switch provides an attenuation ratio of 110 dB for the input voltages 1 mV and 300 V.

Accordingly, if 1V is regarded to be equal to 0 dB as read on the dB scale, or 10 as read on the 0 ~ 10 Ⓐ scale, with the range selector switch set at position 1, the input voltage may be read in dB down to - 80 dB continuously for the voltage range from 1 V to 0.1 mV and up to + 50 dB continuously for a voltage range from 1 V to 300V.

(3) dBm scale

It is a general practice for a voltmeter indicating a mean value to set the level, at which a voltage of 0.775 V is built up across a 600 Ω resistance load (i.e. 1 mW as its power), as the reference level (i.e. 0 dBm). Therefore, if the measuring circuit offers an impedance of pure 600 Ω resistance, its power level to the reference level may be measured using this dBm scale.

7. CAUTIONS ON HANDLING THE SET

(1) This set is ready immediately after switching on it. In order to make a specifically precise measurement, however, allow about 3 minutes for the set to warm up after switching on and then proceed to the measurement.

(2) When installing this set, refrain from placing it in a place where especially strong magnetic or electric field prevails.

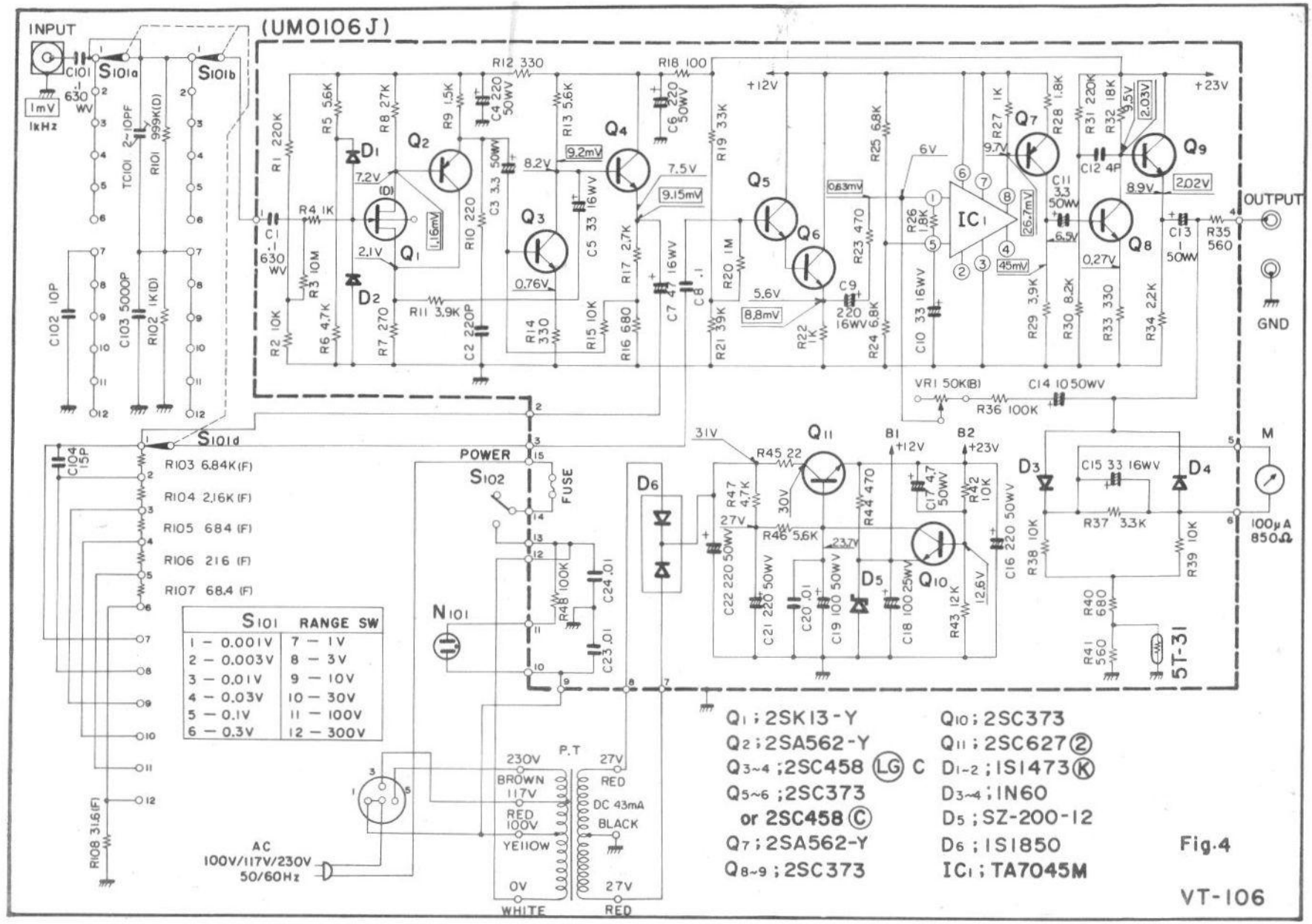
(3) If you attempt to use the cord other than that supplied with the set as an input cord, employ single-conductor cord or shielded single-conductor cord with small capacitance between the conductor and the shield.

(4) This voltmeter is of the high-sensitivity type, so it should be operated with sufficient care to the line and other minute noises.

(5) Be careful not to leave this set for long time at a place where high temperature and humidity prevail.

(6) With 230-volt power supply, use 0.2A fuse; with 117-volt power supply, use 0.5A fuse. Be sure to use the fuse of correct ampare rating.

Note: The ratings and circuit diagram of this set may be changed without notice owing to improvement of the set.



S101	RANGE SW
1 — 0.001V	7 — 1V
2 — 0.003V	8 — 3V
3 — 0.01V	9 — 10V
4 — 0.03V	10 — 30V
5 — 0.1V	11 — 100V
6 — 0.3V	12 — 300V