
MODEL **356E**

Digital 10kHz AC m Ω Meter

Instruction Manual

I-01953

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1. Preface

We thank you for your purchase of our product. Please take care that this instruction manual is certainly delivered to the person in charge to operate the product. For proper use of the product, please carefully read this manual prior to the initial operation.

⚠ CAUTION

- To avoid break-down, malfunction or deterioration of life of the product, do not use it in such places where:
 - ◆ exposed to rain, water drops or direct sunlight.
 - ◆ high temperature or humidity, heavy dust or corrosive gas.
 - ◆ affected by external noise, radio waves or static electricity.
 - ◆ Where there is constant vibration or shock.
- Do not use the product dismantling or modifying it.

1.1 ●Preparations prior to use

1.1.1 Inspection

When the meter is delivered, please check whether it conforms to the required specifications and has not been damaged in transit. If there is any damage on the meter or it does not work in conformity with the specifications, please inform us of the model and product name.

1.1.2 Storage

In case of storing the meter for a long time, store it at the place of low humidity and where it is not exposed to the direct sunlight.

1.2 ●Confirmation prior to use

1.2.1 Power supply

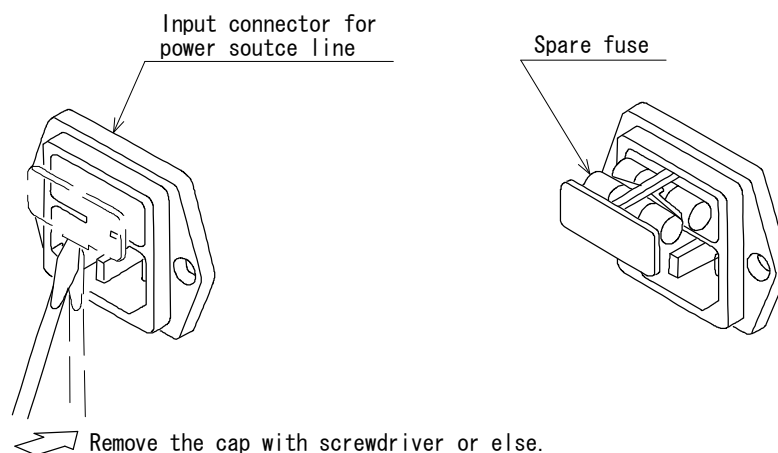
Use the meter with the power source voltage within 90~250VAC and the frequency 50/60Hz. When connecting the power supply cable, confirm that the power supply switch is turned OFF.

1.2.2 Power supply cable

The plug of power supply cable connected to the meter is for 100VAC use. When the meter is used with 200VAC, replace the plug with appropriate one for 200VAC use. Please connect the power supply cable to the power supply connector on the rear panel of the meter. The plug of power supply cable has 3 pins and the round shape pin in the center is for grounding. When connecting the meter to the receptacle with an adapter attached to the plug, be sure to connect the earth wire of the adapter to the external earth line for grounding.

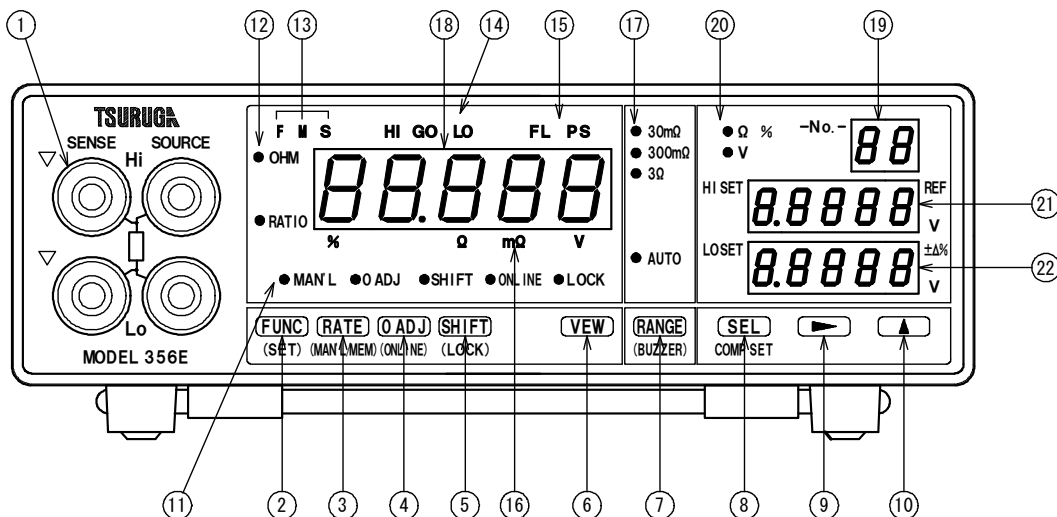
1.2.3 Replacement of fuse

A fuse of 250V/2A for the power source is mounted at the delivery from factory. A socket of the fuse is incorporated in the input connector of the power supply line. In advance to connecting the power supply cable, confirm the rate of the fuse, removing the cap of fuse holder and taking the fuse out. In total two fuses, including a spare one, are put inside the fuse cap. The fuse on this side (spare fuse) can be removed by pushing it toward right or left, and the fuse another side downward.



2. Name of parts

2.1 ●Front panel

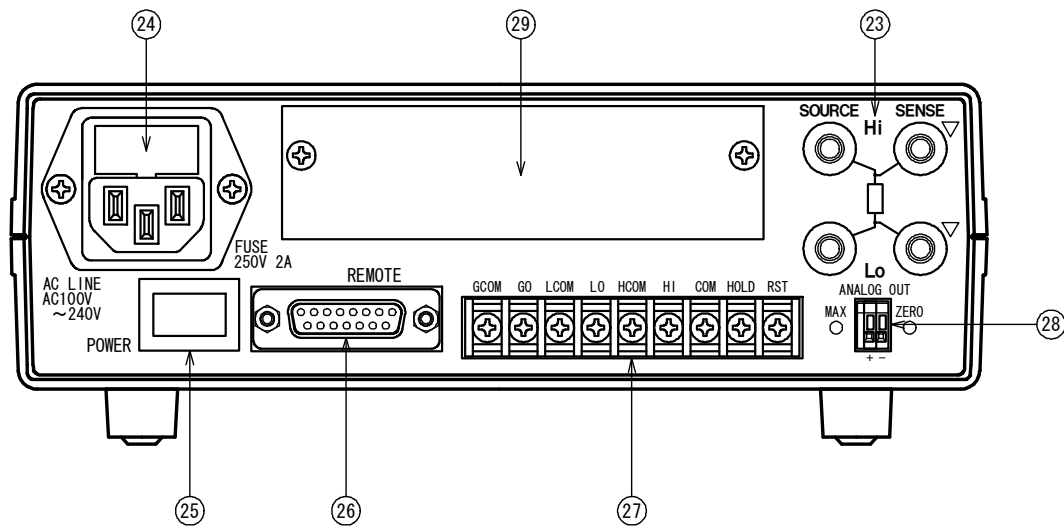


- ① Measuring terminals SENSE Hi : Input terminal of resistance measurement and + terminal of voltage measurement.
 SENSE Lo : Input terminal of resistance measurement and - terminal of voltage measurement.
 SOURCE Hi : Current output terminal.
 SOURCE Lo : Current output terminal
 (Connected to SENSE Lo at the voltage measurement.)
- ② **FUNC** key (SET) Key to changeover the resistance/ratio display in resistance measurement.
 At ratio display : RATIO lamp is lit up.
 At resistance display : OHM lamp is lit up.
 (In manual mode, the power source frequency can be set.)
 (In memory mode, the setting of memory can be done.)
- ③ **RATE** key (MAN'L/MEM) Key to select a sampling rate.
 (Key to changeover the memory/manual mode. MAN'L lamp is lit up in manual mode.)
- ④ **0 ADJ** key (ONLINE) Key to ON/OFF the zero-adjust function.
 0 ADJ lamp is lit up while the zero-adjust function is working.
 (On-line key of the GP-IB, RS-485 and RS-232C.)
- ⑤ **SHIFT** key (LOCK) Blue key becomes effective while the SHIFT lamp is lit up.
 While the SHIFT lamp is lit up, it can be turned off by pressing this key.
 (The key prohibits the key operation on the front panel. The pressing of the key for 3 seconds or more allows prohibition or cancellation. During the prohibition, the LOCK lamp is lit up.)
- ⑥ **VIEW** key Key to select the display mode.
- ⑦ **RANGE** key (BUZZER) Key to select the range of resistance or voltage.
 The resistance range $30\text{m}\Omega \sim 3\Omega$ or AUTO range can be selected.
 The voltage range 5V or 50V can be selected.
 (Key to enter the setting of buzzer mode and sound volume.)
- ⑧ **SEL** key (COMP SET) Key to changeover the setting items.
- ⑨ **▶** key Key used for various setting.
- ⑩ **▲** key Key used for various setting.

⑪	MAN'L lamp 0 ADJ lamp ONLINE lamp LOCK lamp SHIFT lamp	Lit up in manual mode and turned off in memory mode. Lit up while the zero-adjust is in working. Lit up when remote controlled. Lit up while key-locked. Interlocked with SHIFT key. While the lamp is lit up, the key functions change to those of blue letters ().
⑫	OHM lamp RATIO lamp	Lit up in resistance measurement. Lit up in ratio display.
⑬	F lamp M lamp S lamp	Displays in blinking when the sampling rate is FAST. Displays in blinking when the sampling rate is MEDIUM. Displays in blinking when the sampling rate is SLOW. (The lamps become steady light during the hold status.)
⑭	HI lamp GO lamp LO lamp	Red LED is lit up when the measured resistance value is at high limit or above. Green LED is lit up when the resistance measurement is good judgement. Red LED is lit up when the measured resistance value is at low limit or below.
⑮	FL lamp PS lamp	Red LED is lit up when the measured voltage value is at high limit or above or, low limit or below. Green LED is lit up when the voltage measurement is good judgement.
⑯	Unit lamp	The unit of the data being indicated on the main display is lit up. For resistance : Ω , $m\Omega$ For ratio : % For voltage : V
⑰	Range lamp AUTO lamp	In resistance display mode: The measuring range is lit up The comparator range is lit up in blinking. In voltage display mode: Turned off. In resistance voltage display mode: The resistance measuring range is lit up. Lit up in AUTO range measurement.
⑱	Main display section	The measured values and various characters are displayed. In Rr mode : The measured resistance value is displayed. In Vv mode : The measured voltage value is displayed. In RV mode : The measured resistance value is displayed.
⑲	No. display	The memory number is displayed in memory mode. During the setting of buzzer, power source frequency / limit, the characters being set are displayed.
⑳	Ω % lamp V lamp	Lamp to inform the content of HI SET and LO SET display. Ω % lamp is lit up in Rr mode. V lamp is lit up in Vv mode and RV mode.
㉑	HI SET display	The comparator's high limit and various characters are displayed. In Rr mode : The high limit of resistance comparator or the referential resistance value of ratio measurement is displayed. In Vv mode : The voltage comparator's high limit is displayed. In RV mode : The voltage side measurement value is displayed.
㉒	LO SET display	The comparator's low limit and various characters are displayed. In Rr mode : The low limit of resistance comparator or the range of ratio measurement is displayed. In Vv mode : The voltage comparator's low limit is displayed. In RV mode : Turns off.

Note: The (blue letter) keys become effective while the SHIFT lamp is lit up.

2.2 ●Rear panel



⑳ Rear measuring terminals

Respectively common with:

- SENSE Hi : (SENSE Hi) on the front panel.
- SENSE Lo : (SENSE Lo) on the front panel.
- SOURCE Hi : (SOURCE Hi) on the front panel.
- SOURCE Lo : (SOURCE Lo) on the front panel.

㉑ Power supply connector

The attached power supply connector is to be used.
Be sure to use the meter with the specified power source voltage and frequency.
A fuse of 250V 2A must be used.

㉒ Power source switch

ON/OFF switch of the power supply.

㉓ REMOTE connector

Connector for the remote control.

㉔ Input and output terminal blocks

Terminals for input of hold and reset, and for output of resistance comparator.

㉕ Analog output terminals

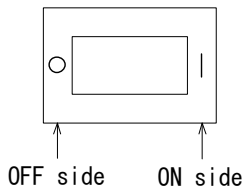
Terminals to output the DC voltage proportional to the measured value.
ZERO : ZERO volume of the analog output
MAX : MAX volume of the analog output

㉖ Inlet for interface board

Section to fit an optional interface board.

3. Operation

3.1 ●Power supply



After confirming that the power supply switch on the rear panel is turned OFF, connect the power supply plug into the receptacle and turn ON the power supply switch. The meter promptly enters into operable condition but it is recommended to have a pre-heating time for 30 minutes or more. The meter is provided with the function to retain the parameters, so it stores the status of the following parameters even when the power supply is turned OFF.

- (1) Measuring function, display mode and measuring range.
- (2) Set values of comparator (30 program memories).
- (3) Key-lock status.
- (4) Buzzer status.
- (3) Zero-adjust condition.

3.2 ●Connection of measuring terminals

When the optional Kelvin clip is used, make a connection as the **Fig. 3.2.1** shows. At this time, accord the red ▼ mark of the tester with the ▼ mark of the red lead, and the black ▼ mark of the tester with ▼ mark of the black lead.

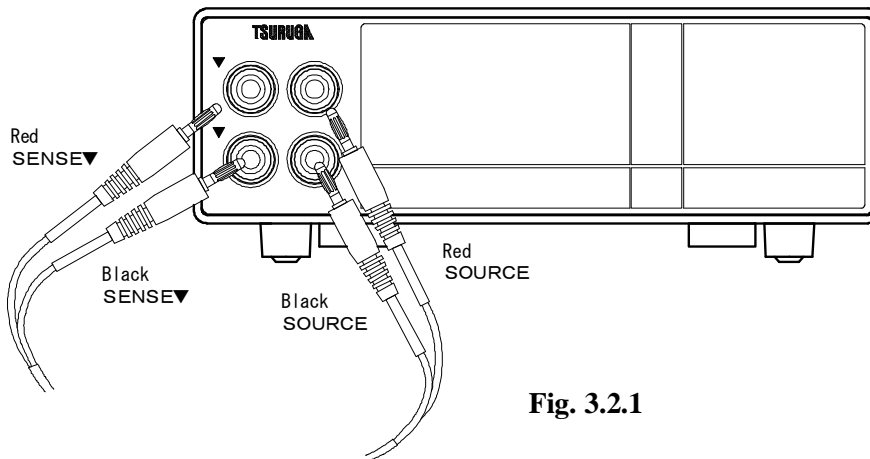


Fig. 3.2.1

In case that the cables are connected to the measuring terminals on the front panel (or rear panel).

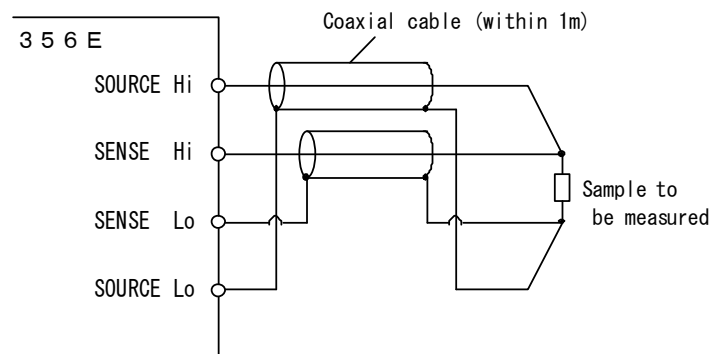


Fig. 3.2.2

Note: If the noise penetrates into the measuring terminals, it may widely fluctuate the display or destabilize the auto-range action. Ensure to use the coaxial cable.

3.3 ●Cautions for measurement

3.3.1 When overlaying the DC voltage

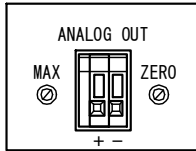
Apply the voltage 60VDC or less.

After the measurement, the capacitor inside the meter is charged with voltage, so let the probe short-circuit for a few seconds to discharge it.

3.3.2 Others

- (1) A big error may occur when the samples with inductance or capacitance is measured. If the tester is used near the source of noise (high frequency furnace, high noise power line, inverter power source etc.), such noise may enter the input line and affect the measurement. Avoid the use in such a site or keep the sufficient distance from the source of noise.
- (2) Effect of eddy current
This tester is the resistance meter to measure with AC current, so if there is a metallic plate neat the tester, it may cause the measurement error due to the effect of eddy current. To avoid this effect, do not get the measuring part at the tip of measuring lead to come closer to the metallic plate or else.

3.4 ●Connection of analog output

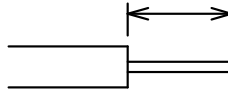


The analog output proportional to the measured resistance value is output. (The analog data proportional to the resistance value is output even during the ratio display.)

Make a connection of the cable to the analog output terminal, applying the cable end treatment as the Fig. 3.4.1 shows.

Push down the release knob with a screwdriver or else and insert the cable to the terminal.

Length to cut = 9~10mm



Applicable cable: AWG28~AWG32

Fig. 3.4.1

Data output	: 0~3VDC 0 display = 0V, 30000 display = 3.000V
Conversion system	: D/A conversion system
Resolution	: 1mV
Accuracy	: Accuracy of resistance measurement + 0.2% F.S.
Output terminal	: Screw-less terminal

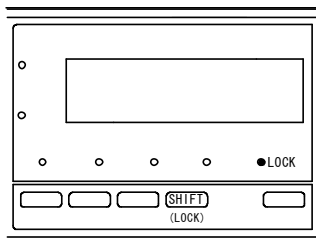
3.5 ●Key-lock

The key-lock is the function to prohibit the key operation on the front panel so that the measuring condition is not altered.

While the key-lock is in operation, the LOCK lamp is lit up.

To operate the other keys, cancel the key-lock first.

It is not operable in the ONLINE or HOLD status.



How to key-lock

While the LOCK lamp is turned off, press **SHIFT** (LOCK) key for 3 seconds or more.

Reset of key-lock

While the LOCK lamp is lit up, press **SHIFT** (LOCK) key for 3 seconds or more.

3.6 ● Changeover of display

The content of display of main display section, HI SET and LOW set can be changed. The changeover is allowed in the measuring condition. It is not operable in the memory mode, ONLINE or HOLD status.

The changeover to the ratio display is done with **FUNC** key.

3.6.1 Selection of display mode

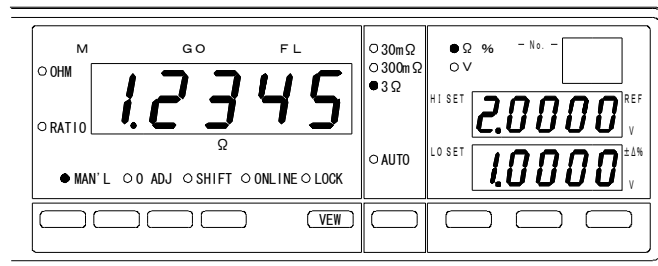
Changeover of function

Every time the **FUNC** key is pressed, the resistance measurement and the ratio display alternate with each other. Select the resistance measurement. (No changeover is possible in the Vv mode.)

Changeover of VEW

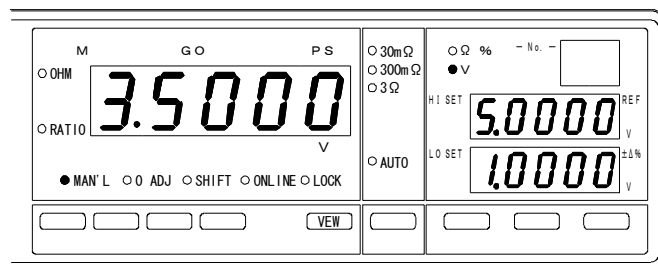
Every time the **VEW** key is pressed, the display changes over.

- ① To display the resistance value and resistance comparator (Rr mode). Select the Rr display with **VEW** key.



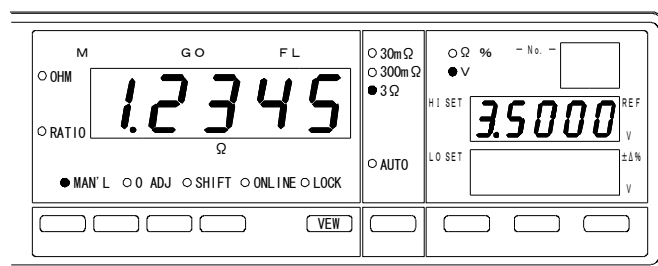
Rr mode

- ② To display the voltage value and voltage comparator (Vv mode). Select the Vv display with **VEW** key.



Vv mode

- ③ To display the resistance and voltage value (RV mode). Select the RV display with **VEW** key.



RV mode

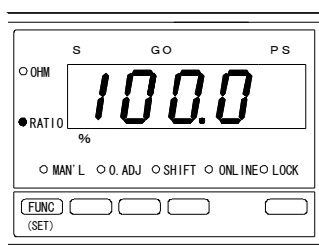
For the content of each display mode, refer to the **Table 3.6.1** below.

Display mode	Main display	HI SET display	LO SET display	Ω % lamp	V lamp
r mode	Resistance measurement value	Resistance comparator High limit value	Resistance comparator Low limit value	Lit up	Turn off
(Ratio display)	Ratio display	Referential resistor	Deviation $\pm \Delta\%$		
Vv mode	Voltage measurement value	Voltage comparator High limit value	Voltage comparator Low limit value	Turn off	Lit up
RV mode	Resistance measurement value	Voltage measurement value	Turn off	Turn off	Lit up

Table 3.6.1

3.6.2 Selection of ratio display

To changeover the ratio display and the resistance display.



Ratio display

Changeover of function

Every time the **FUNC** key is pressed, the resistance measurement and the ratio display alternate with each other. In the resistance measurement, OHM lamp is lit up and the unit of resistance is lit up (one of Ω or $m\Omega$). In the ratio display, RATIO lamp is lit up and % is lit up.

3.7 ● Changeover of resistance range

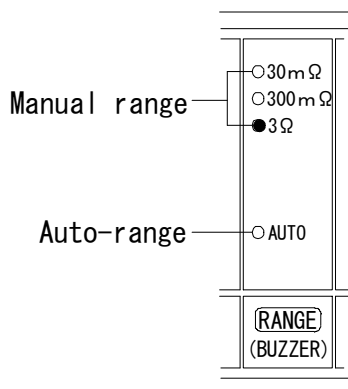
The measuring range (auto-range or manual range) of the resistance measurement is selected.

The operation is not allowed in the memory mode, ONLINE or HOLD status.

Selection of resistance measurement

Press the **VIEW** key and select the Rr or RV mode.

Changeover of resistance range



(1) Auto-range

- When the measured resistance value is 35000 (3500) or above, the range goes up, and when the value is 3000 (300) or less, the range goes down.

- The AUTO lamp and the lamp of detected range are lit up.

Note: Figures in the brackets are at F sampling rate.

Selection of auto-range

When pressed the **RANGE** key, the measuring range changes. Next to the 3 Ω range, the AUTO lamp is lit up and the range changes to the auto-range.

Note: When the auto-range is set, both resistance and voltage measurement change into auto-range action.

(2) Manual range

- The range is fixed range in between 30mΩ and 3 Ω.
- The lamp of selected range is lit up.

Selection of manual-range

Every time the **RANGE** key is pressed, the range lamp changes. Selected the required range.

3.8 ● Changeover of voltage range

The measuring range of the voltage measurement is selected.

The operation is not allowed in the memory mode, ONLINE or HOLD status.

Selection of voltage measurement

Press the **VIEW** key and select the Vv mode.

Selection of voltage range

(1) Auto-range

- Make the setting of auto-range in the resistance measurement.

The measuring range goes up when the measured voltage value is 50000 (5000) or more, and goes down when the measured value is 1000 (100) or less.

Note: Figures in the brackets are at F sampling rate.

(2) Manual range

- The range is fixed range 5V or 50V.

Selection of range

Every time the **RANGE** key is pressed, the measuring changes, and the lit up position of the decimal point changes.

(It can not be changed in the auto-range.)

12345 5V range

12345 50V range

3.9 ●Zero adjustment

This is the function to suppress the resistance of the tool and so on used in the resistance measurement.

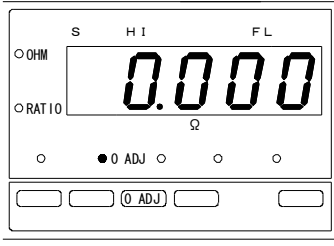
The data currently measured is memorized in the non-volatile memory as “zero set value”, and afterwards, the value obtained by deducting the “zero set value” from the measured value is displayed.

$$\boxed{\text{Display value}} = \boxed{\text{Measured value}} - \boxed{\text{Zero set value}}$$

- It works in the resistance display and the resistance voltage display.
- The zero set value works in every range. (It is memorized as the resistance value.)
- When the zero set is made in the higher range, it may cause the over-range in the lower range.
- Remote operation is possible.
- External control by the interface of GP-IB, RS-232C or RS-485 is possible.

Note: This function is not operable during the HOLD status or setting.

3.9.1 Key operation



While the 0 ADJ lamp is turned off, press the **0 ADJ** key, the 0 ADJ lamp is then lit up and enters into the zero adjustment condition.

Cancellation of it can be done by pressing the **0 ADJ** key again.

3.9.2 Remote operation

While the 0 ADJ pin and COM of the REMOTE connector on the rear panel is short-circuited, the 0 ADJ lamp is lit up and the zero adjustment is in operable condition.

The measured resistance data at the moment when the 0 ADJ pin is short-circuited is memorized as zero set.

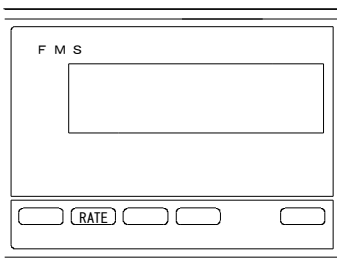
When released the 0 ADJ pin, its working is cancelled.

Note: The zero adjustment action set by the key operation can be cancelled by making this pin OFF.

3.10 ●Selection of sampling rate

Selection of the sampling range is made by the key operation on the front panel. The external control by the interface of GP-IB, RS-232C or RS-485 is possible

Note: This function is not operable during the HOLD status or setting.



Key operation

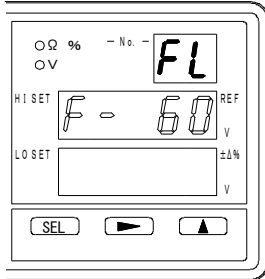
Press the **RATE** key and the sampling rate changes.

S→M→F→S...

Sampling rate	Sampling LED	Sampling rate	
		50Hz	60Hz
S	S	1.56 times/sec.	1.88 times/sec.
M	M	6.25 times/sec.	7.52 times/sec.
F	F	50 times/sec.	60 times/sec.

3.11 ● Setting of power source frequency

In order to eliminate the affect of inductive voltage to invade the measurement line, the power source frequency is set.
 The operation is not allowed in the memory mode, ONLINE or HOLD status.
 When no key operation is made for 5 minutes during the setting, the meter returns to the measurement.



Press the **SHIFT** key, and the SHIFT lamp is lit up.
 (Enters into the setting of power source frequency and voltage limit.)
 Press (SET) key and the HI SET lamp blinks.
 Adjust the power source frequency, pressing the **▲** key.
 When the **SEL** key is pressed twice, the meter returns to the measurement.

HI SET display	Action
<i>F - 50</i>	Set to the power source frequency 50Hz
<i>F - 60</i>	Set to the power source frequency 60Hz

Note: Make sure to set the power source frequency. Otherwise, the accurate measurement can not be performed.

3.12 ● Comparator action

The comparator has two functions – one is the resistance comparator to compare the resistance values and the other is the voltage comparator to compare the voltage values.

The comparator compares the measured value and high/low limit, and output the judgement result.

A 30 pairs of the memory high and low limit values per pair can be memorized (No.1~No.30).

The judgement is output by open collector, simultaneously announcing by buzzer and lamp. (For the resistance comparator, a relay output can be provided at option.)

The memory can be selected by key operation or through remote connector.

The selection is also possible by the interface of GP-IB, BCD, RS-232C or RS-485.

Note: During the setting of high or low limit value, or calling of the memory, the sampling is stopped and the output is retained.

3.12.1 Condition of comparison

Resistance comparator

Display value \geq High limit value (HI SET)	HI output
High limit value (HI SET) $>$ Display value $>$ Low limit value (LO SET)	GO output
Display value \leq Low limit value (LO SET)	LO output

Note: The comparator makes the comparison including the range.

Example:

In case that the high limit value is set to 100.00m Ω (300m Ω range), and when 1.000 Ω is displayed in the measuring range is 3 Ω , the HI output is given.

Voltage comparator

Display value \geq High limit value (HI SET) or	
Display value \leq Low limit value (LO SET)	FL output
High limit value (HI SET) $>$ Display value $>$ Low limit value (LO SET)	PS output

3.12.2 Comparator output

Resistance comparator

Open collector output or relay contact output is output at the input/output terminals on the rear panel.

(Refer to the article 4.2)

Display: HI and LO: Red, GO: Green

Voltage comparator

Open collector output is output at the REMOTE connector on the rear panel.
(Refer to the article 4.1)

Display: FL: Red, PS: Green

3.12.3 Setting method

No setting is possible during the ONLINE, when externally controlled by the BCD data output interface or in the HOLD status.

When no key operation is made for 5 minutes during the setting, the meter returns to the measurement.

Adjustable range: High limit Resistance : 0~35000
 Voltage : -50000~50000
 Low limit Resistance : 0~35000
 Voltage : -50000~50000

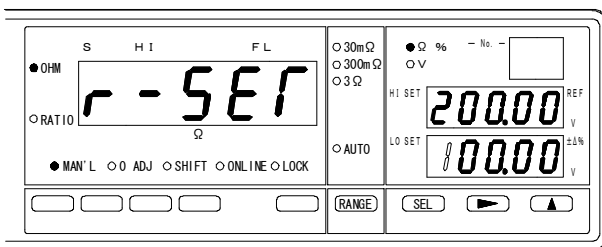
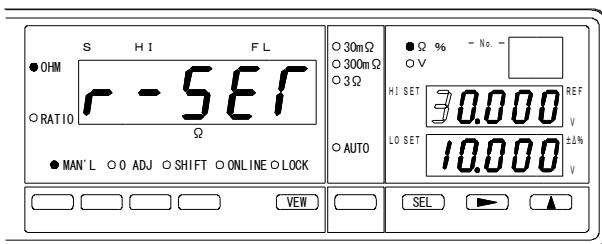
The unit and the decimal point are set with the **[RANGE]** key.

The content of the comparator setting is different depending upon the display mode.

Display mode	Setting items
Rr mode	Resistance comparator, high and low limit
Vv mode	Voltage comparator, high and low limit
RV mode	Resistance comparator, high and low limit Voltage comparator, high and low limit

Note: When the setting is for the resistance comparator, in the ratio display mode, the items to set are deviation ($\pm \Delta\%$).

Setting of resistance comparator (Rr mode)



Changeover to manual mode

- ① (Refer to the article 3.14)

Changeover to resistance display

- ② Changeover to Rr mode with the **[VIEW]** key.
(Refer to the article 3.6)

Setting of high limit value

- ③ Press the **[SEL]** key.
The highest digit of HI SET display blinks.
Set the numeral with the **[▶]** or **[▲]** key.
The selected digit blinks with the **[▶]** key.

Setting of low limit value

- ④ Press the **[SEL]** key.
The highest digit of LO SET display blinks.
Set the numeral with the **[▶]** or **[▲]** key.
The selected digit blinks with the **[▶]** key.

Setting of comparator range

- ⑤ Set with the **[RANGE]** key
The selected range lamp blinks.

Note: The decimal point automatically changes depending upon the range.

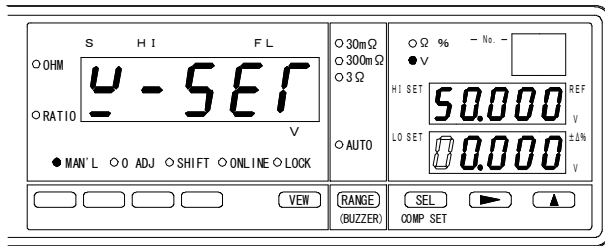
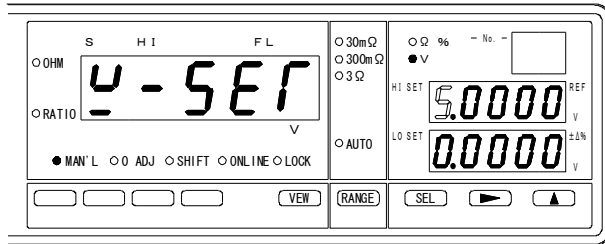
Finish of the setting

- ⑥ The setting can be finished by pressing the **[SEL]** key during the setting of low limit.

Note-1: When returned to the measurement and, the measuring range and comparator range are different, the range lamp of the comparator range is lit up.

Note-2: When the setting of high or low limit is out of the range, Err is displayed for a while at the setting item in question, and then returns to the setting of high or low limit.

Setting of voltage comparator (Vv mode)



Changeover to voltage display

- ① Changeover to Vv mode with the **VIEW** key.
(Refer to the article 3.6)

Setting of high limit value

- ② Press the **SEL** key.
The highest digit of HI SET display blinks.
Set the numeral with the **▶** or **▲** key.
The selected digit blinks with the **▶** key.

Setting of low limit value

- ③ Press the **SEL** key.
The highest digit of LO SET display blinks.
Set the numeral with the **▶** or **▲** key.
The selected digit blinks with the **▶** key.

Setting of comparator range

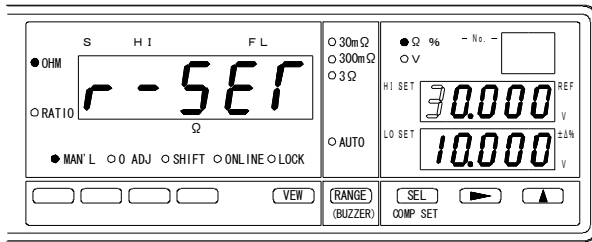
- ④ Set with the **RANGE** key
The selected range is known by the position of decimal point being lit up.
5V range : Decimal point at 10^4 is lit up.
50V range : Decimal point at 10^3 is lit up.
Note: The decimal point automatically changes depending upon the range.

Finish of the setting

- ⑤ The setting can be finished by pressing the **SEL** key during the setting of low limit.
Note: When the setting of high or low limit is out of the range, Err is displayed for a while at the setting item in question, and then returns to the setting of high or low limit.

Setting of resistance voltage comparator (RV mode)

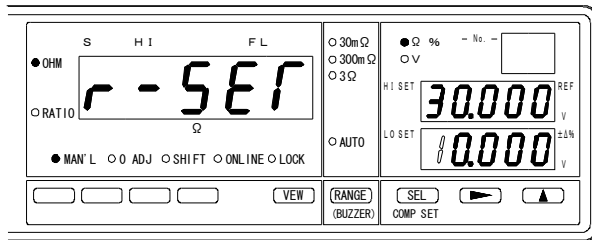
In case of the RV mode, the setting is made sequentially for the resistance comparator and the voltage comparator.



Setting of resistance comparator

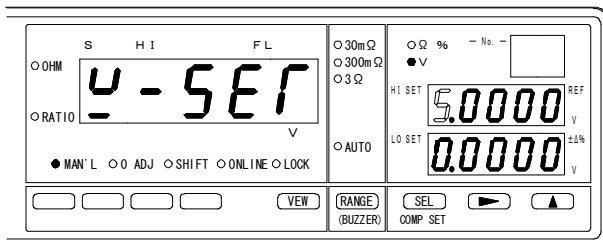
Setting of HI SET

SET key.



Setting of LO SET

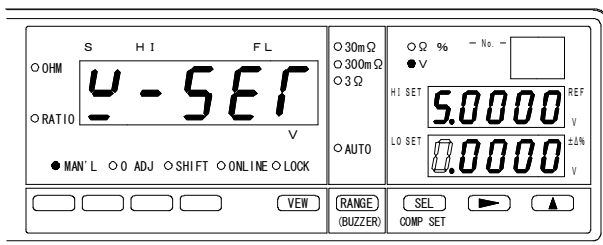
SET key.



Setting of voltage comparator

Setting of HI SET

SET key.

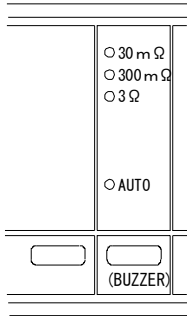


Setting of LO SET

3.13 ● Buzzer

The setting of the buzzer is made with the (BUZZER) key on the front panel.
 During the setting of buzzer, the sampling is stopped and the comparator output is held.
 The setting is not allowed in the memory mode, ONLINE or HOLD status.
 When no key operation is made for 5 minutes during the setting, the meter returns to the measurement.

3.13.1 Setting method

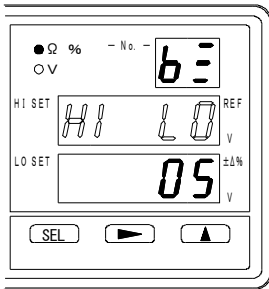


Setting of buzzer action

Press the **[SHIFT]** key.
 The SHIFT lamp will then light up.
 Press the (BUZZER) key.
 It changes to the buzzer setting and **bE** is displayed on the No display, making HI SET blink.
 The buzzer action is displayed on the HI SET, and the buzzer sound on the LO SET.

Selection of buzzer action

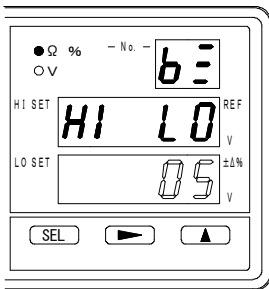
Select the buzzer action with the **[▲]** key.



Display	Action
<i>oFF</i>	Buzzer OFF (buzzer does not sound).
<i>Go</i>	Buzzer sounds when the resistance judgement is GO.
<i>HI nG</i>	Buzzer sounds when the resistance judgement is HI.
<i>Lo nG</i>	Buzzer sounds when the resistance judgement is LO.
<i>HI Lo</i>	Buzzer sounds when the resistance judgement is HI or LO.
<i>PASS</i>	Buzzer sounds when the voltage judgement is PS.
<i>FAIL</i>	Buzzer sounds when the voltage judgement is FL.
<i>Good</i>	Buzzer sounds when the resistance judgement is GO and the voltage measurement is PS.
<i>nG</i>	Buzzer sounds when the resistance judgement is HI or LO, and the voltage judgement is FL.

Adjustment of sound volume

When the **[SEL]** key is pressed during the setting of buzzer action, it becomes the setting of buzzer sound level and the buzzer sounds.
 By pressing the **[▲]** key, the sound level and its indication change.
 The buzzer sound level is adjustable in 10 steps.

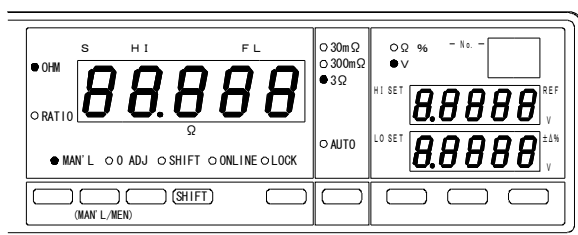


Finish

By pressing the **[SEL]** key in the buzzer sound level setting, the buzzer setting can be finished and the meter returns to the measurement.

3.14 ● Manual mode

In this mode, the changeover of function, measuring range or display mode is possible. It can not be changed over to the manual mode when the meter is remote controlled and while the ONLINE is lit up.



Operation

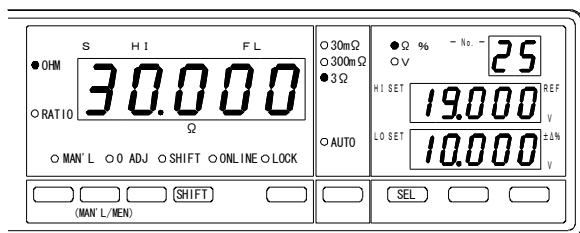
Press the **SHIFT** key and while the SHIFT lamp is lit up, changeover the manual mode / memory mode with the (MAN'L/MEM) key. During the manual mode, MAN'L lamp is lit up and the No. display (indication of memory number) turns off.

3.15 ● Memory mode

In this mode, it is possible to select a memory of the measuring conditions from among 30 memories stored in the meter and to perform the measurement according to the conditions of the selected memory. The sampling rate is common setting.

3.15.1 Selection of memory

● Procedures on the front panel



Enter the memory mode

- ① Press the **SHIFT** key. The SHIFT lamp is lit up.
- ② Press the (MAN'L/MEM) key, and the mode changes to the memory mode, displaying the memory number. The MAN'L lamp turns off.

Call up of memory

- ③ Press the **SEL** key, then the memory number changes and the content of the selected memory is called up. The measurement and judgement are carried out under the measurement conditions of the memory called up.

Finish of the memory mode

- ④ Press the **SHIFT** key. The SHIFT lamp is lit up.
- ⑤ Press the (MAN'L/MEM) key and the mode changes to the manual mode, lighting the MAN'L lamp up.

● Procedures by remote operation

Refer to the remote operation of memory mode (article 4.1.2)

3.16 ● Setting of memory

The setting of memory is made, moving to the memory mode with key operation. When the memory is selected through the REMOTE connector, the setting is not allowed. Make the setting of memory with key operation after canceling it.

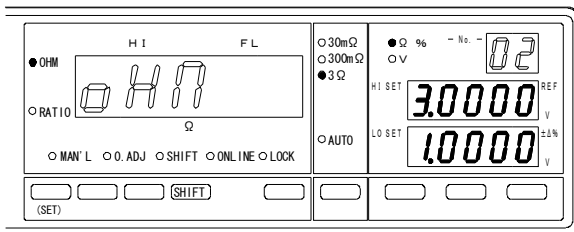
The items of the memory setting are following 4 items.

- Setting of comparator (resistance/voltage comparator (high and low limit value))
- Display mode (resistance display, voltage display, resistance voltage display)
- Function of resistance measurement (resistance measurement, ratio display)
- Measuring range (resistance measuring range, voltage measuring range)

- Note:**
- No setting is possible in the hold status.
 - No setting is possible while the ONLINE is lit up by the remote operation.
 - During the setting, the sampling is stopped and the comparator output is held.
 - When no key operation is made for 5 minutes during the setting, the meter returns to the measurement of the memory mode.

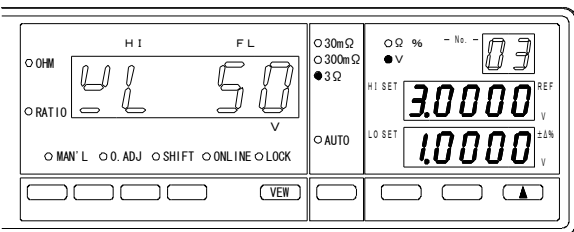
Enter the memory mode

Enter the memory mode with the **[SHIFT]** and (MAN'L/MEM) key. (Refer to the article 3.15)



Setting of memory

Press the **[SHIFT]** key, and the SHIFT lamp is lit up. Press the (SET) key, then the display mode blinks on the measurement display and the memory number blinks.



Selection of memory No.

Select the memory No. pressing the **[▲]** key.

[4.77] Rr display

[4.77 · 50] Vv display (50V range)

[4.77 · 5] Vv display (5V range)

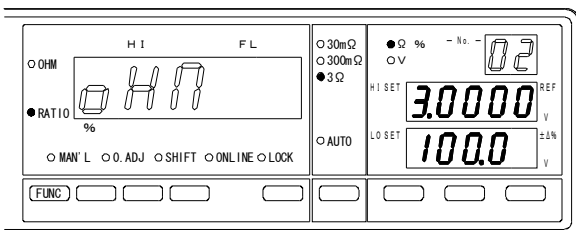
[4.77-4.77] RV display

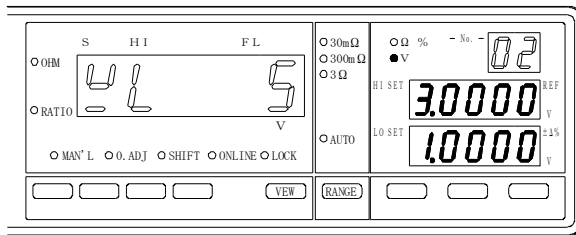
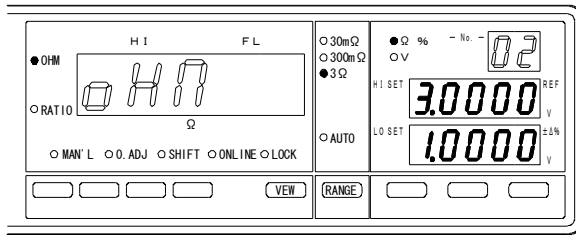
Selection of display mode

Select the display mode setting with the **[VIEW]** key. The display mode is indicated on the main display section. The measuring range is displayed together in the Vv mode.

Setting of ratio display

Make the display to Rr. Select the ratio display with the **[FUNC]** key. When the ratio display is selected, the RATIO lamp is lit up.





Setting of measuring range

- Setting of resistance measuring range
Changeover the display to Rr or RV with the **VIEW** key.
Select the resistance measuring range with the **RANGE** key. The lamp of the selected range is lit up.
Note: In case that the resistance measuring range and the comparator range are different, the comparator range is displayed in blinking.
AUTO lamp is lit up on AUTO range.

- Setting of voltage measuring range
Select the Vv display with the **VIEW** key.
Select the measuring range with the **RANGE** key. The selected range is indicated on the main display section.
(AUTO range can not be set.)

Setting of comparator

Press the **SEL** key, and the highest digit of the HI SET blinks to make the comparator setting.
(Refer to the article 3.12.3)

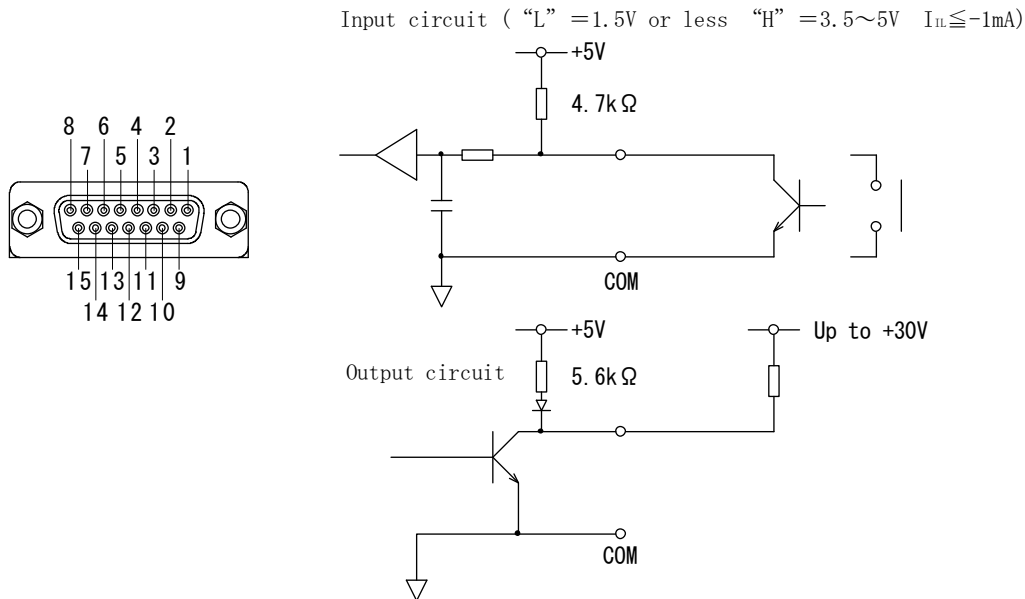
Finish

Press sequentially the **SHIFT** key and the (SET) key, then the memory setting finishes and the meter returned to the measurement under memory mode.

4. Remote control

4.1 Remote connector

4.1.1 Pin operation



(D-sub 15 pin)

Pin No.	Signal	Function
1	0 ADJ input	By making it ON, the zero adjustment is done. (Refer to the article 3.9)
2	NC	Vacant pin
3	MEM input	By making it ON, the memory mode is selected.
4	TRIG input	By making it ON once during the hold status, one sampling is made and the judgement result is output. Min. ON time: 5ms
5	NC	Vacant pin
6	EOC output	Transistor output becomes ON when the AD conversion is finished.
7	NC	Vacant pin
8	COM	Common for input and output.
9 10 11 12 13	M-SEL0 M-SEL1 M-SEL2 M-SEL3 M-SEL4	Memory No. is input in the memory mode to call up the memory.
14	V-FAIL	FL output of voltage comparator, makes the transistor output ON.
15	V-PASS	PS output of voltage comparator, makes the transistor output ON.

4.1.2 Remote operation of memory mode

- ① While the MEM signal is made ON, the mode is memory mode.
 - Moves to the memory mode and the ONLINE lamp is lit up.
 - The selected memory No is displayed.

Note: When the memory No out of the code is selected, it is not allowed to enter the memory mode. Make an input of the code 1~30.
- ② Input the code of memory No and call up the memory.

Table of memory code

Signal	Weight	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
M-SEL0	1		○		○		○		○		○		○		○		○
M-SEL1	2			○	○			○	○			○	○			○	○
M-SEL2	4					○	○	○	○					○	○	○	○
M-SEL3	8									○	○	○	○	○	○	○	○
M-SEL4	16																

Signal	Weight	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
M-SEL0	1		○		○		○		○		○		○		○		○
M-SEL1	2			○	○			○	○			○	○			○	○
M-SEL2	4					○	○	○	○					○	○	○	○
M-SEL3	8									○	○	○	○	○	○	○	○
M-SEL4	16	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○

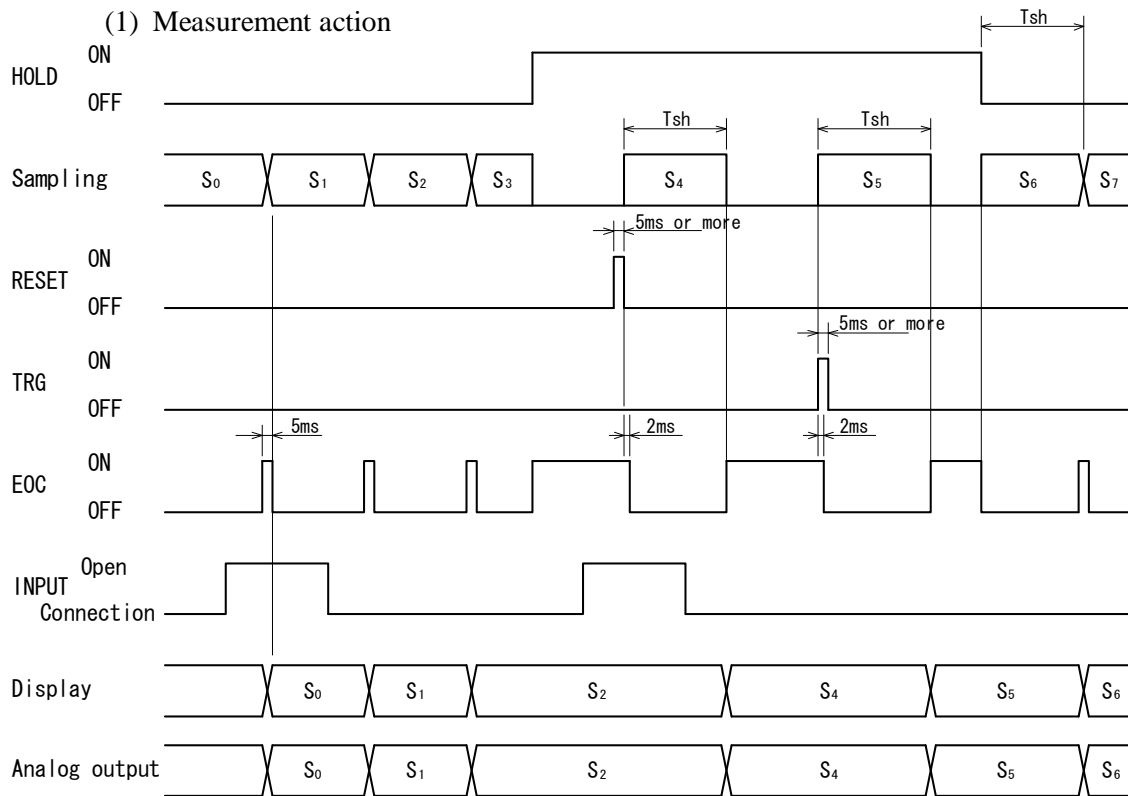
○ : Makes ON.

Blank : Turns OFF.

Note: The input of 0 or 31 makes no change.

- ③ Turn the MEM signal OFF.
 - Moves to the manual mode and the ONLINE lamp is turned off.
 - Finish the memory mode.

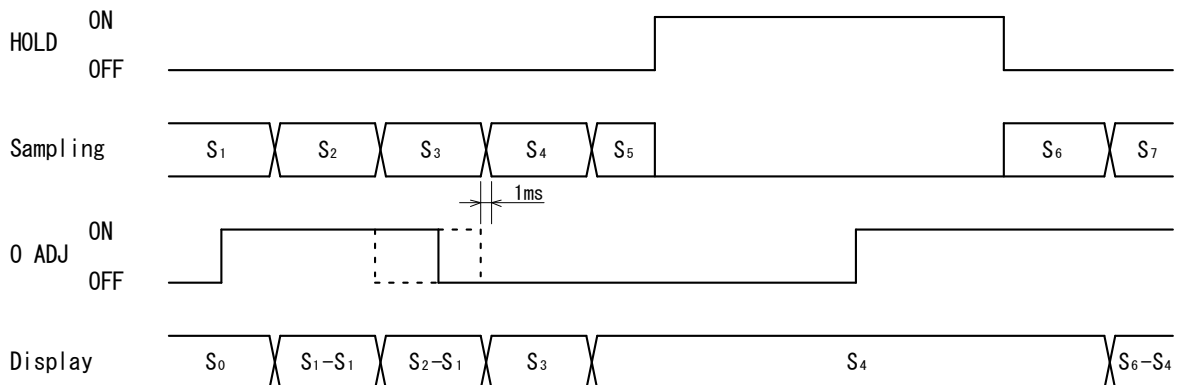
4.1.3 Timing chart of remote control



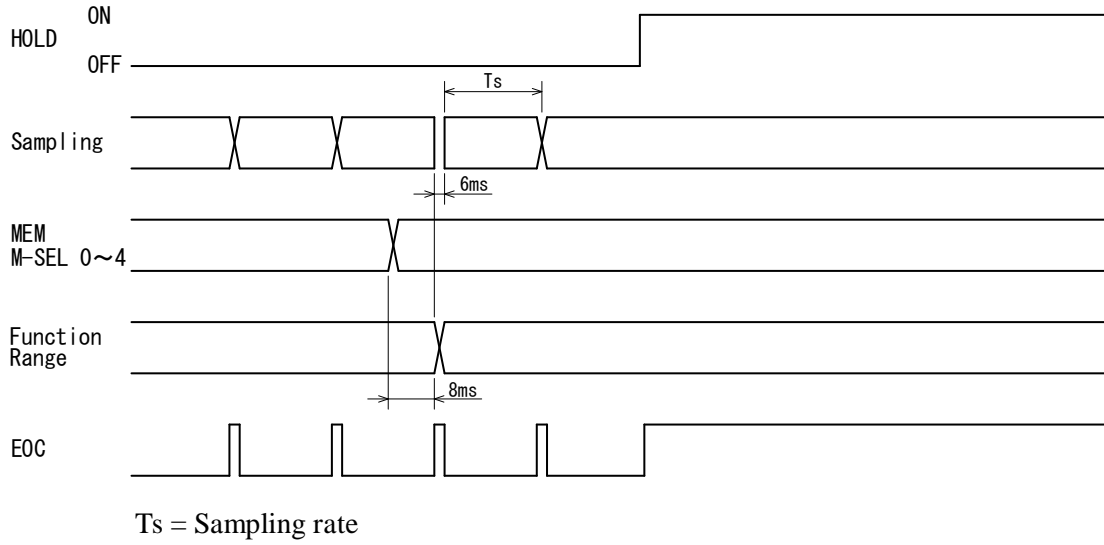
Tsh = Hold, trigger response time

Power source frequency set	Sampling rate	
	50Hz	60Hz
F	13~36ms	12~28ms
M	90~170ms	70~143ms
S	570~650ms	485~540ms

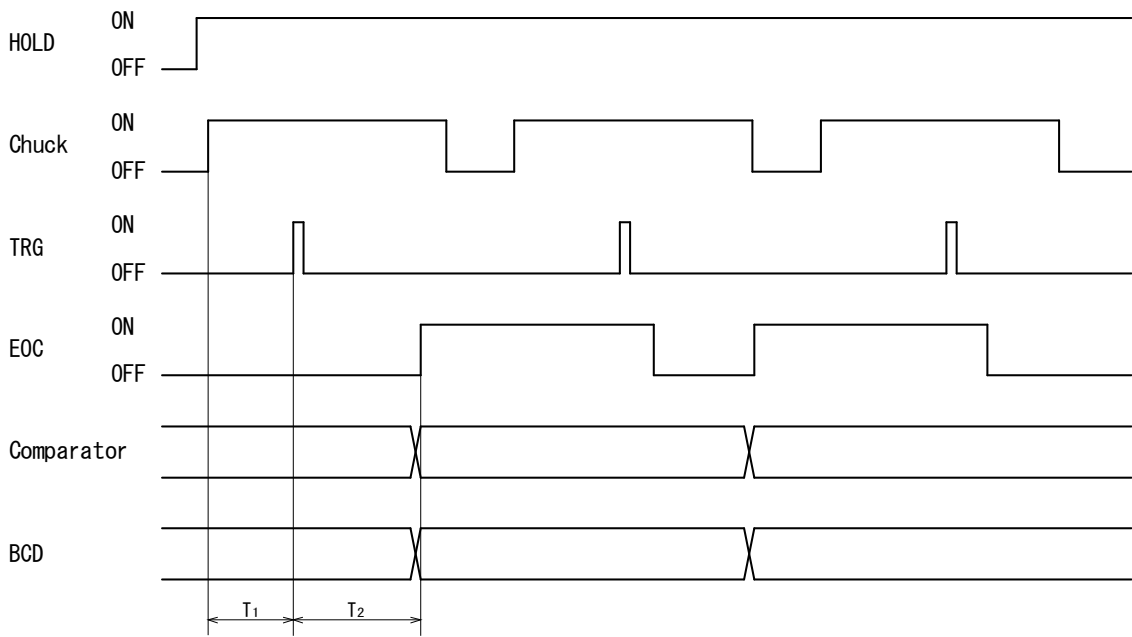
(2) Zero adjustment



(3) Changeover of memory (changeover of memory/manual is same)



(4) Response time

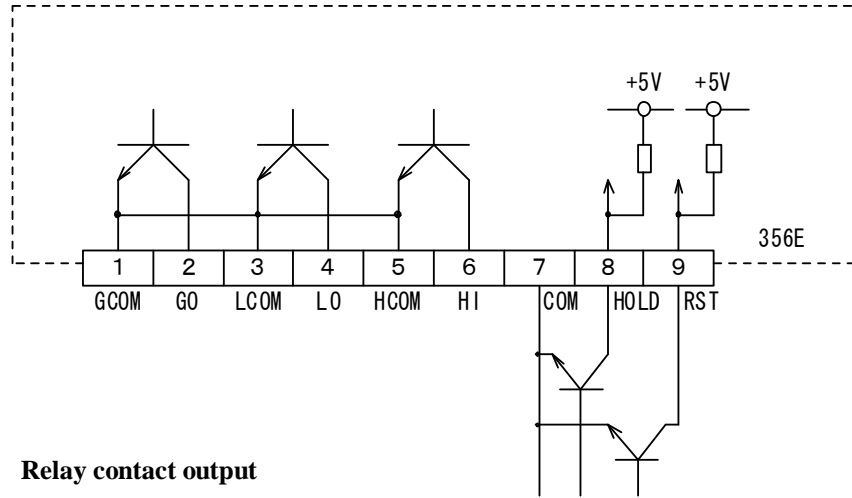


$T_1 = \text{Stabilization time}$
 $T_2 = \text{Judgement time}$
 Response time = $T_1 + T_2$

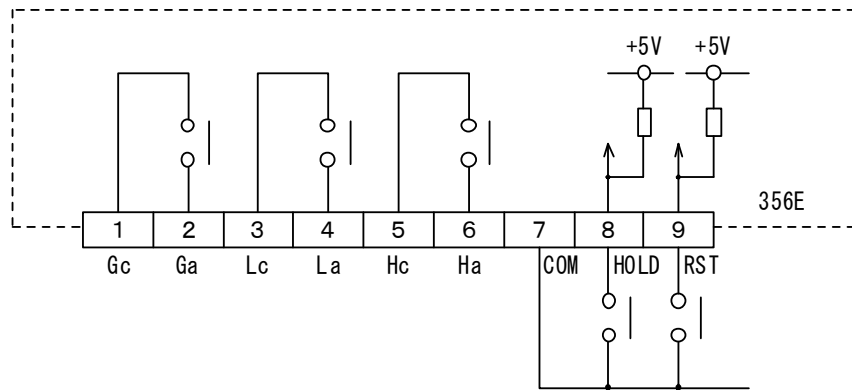
	Sampling rate = F		Sampling rate = M		Sampling rate = S	
	50Hz	60Hz	50Hz	60Hz	50Hz	60Hz
T_1	48ms	48ms	250ms	250ms	250ms	250ms
T_2	13~36ms	12~28ms	90~170ms	78~143ms	570~650ms	485~540ms
$T_1 + T_2$	61~84ms	62~76ms	340~420ms	328~393ms	820~900ms	735~790ms

4.2 Remote control (input and output terminal blocks)

Terminal arrangement **Open collector output**



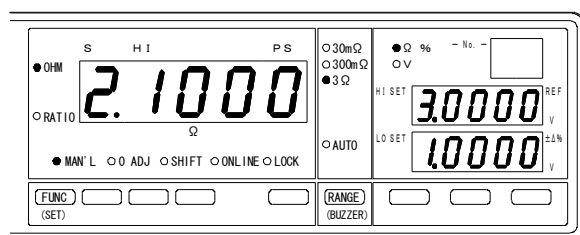
Relay contact output



- (1) **HOLD terminal (Hold)**
By short-circuiting the HOLD terminal on the rear panel to the COM terminal, the display value, comparator output and BCD data output are held. The hold operation prohibits the operation of all the keys.
- (2) **Reset terminal (Reset)**
By short-circuiting the RST terminal on the rear panel to the COM terminal, the comparator output is reset and the comparator display is turned OFF.
 - One sampling hold action
It is possible to do the one sampling hold with the HOLD being short-circuited and making ON/OFF of the RST. Do the one sampling hold with the manual range. In case of the auto-range, it may cause an error.
- (3) **Comparator output**
Open collector output : HI, GO, LO, all sink type
30V 30mA max.
Relay contact output : HI, GO, LO, 1a contact for each
250VAC 1A resistive load

5. Setting method

5.1 ●Resistance measurement



Operating procedure

- ① Set the meter to manual mode.
(Refer to the article 3.14)
- ② Select the Rr mode with the **VIEW** key.
(Refer to the article 3.6)
- ③ Select the resistance measurement with the **FUNC** key. When the resistance measurement is selected, the OHM on the function display is lit up. (RATIO is turned off.)
At this moment, the main display section displays the resistance value and either one of the measuring units Ω or $m\Omega$ is lit up.
- ④ Select the measuring range with the **RANGE** key. Every time the **RANGE** key is pressed, the measuring range changes.
In the auto-range, AUTO lamp and the detected measuring range are lit up.
The decimal point is automatically lit up depending upon the selected range.
- ⑤ Make the setting of comparator.
(Refer to the article 3.12.3)
- ⑥ Connect the sample to be measured to the resistance measuring cable, then the measured resistance value is displayed.
In case that the measured resistance exceeds the measuring range (35000), **UUUUU** blinks to inform the over-range.
In case of the auto-range, the range goes up when exceeded the 35000. Also, the range goes down when the value becomes 1000 or less.

5.2 ●Ratio display function

This is the function to compare the measured resistance value R_X to the referential resistance value R_S , and indicates its ratio to the referential resistance value in percentage. Also, the comparative judgement by the deviation ($\pm \Delta\%$) is possible.

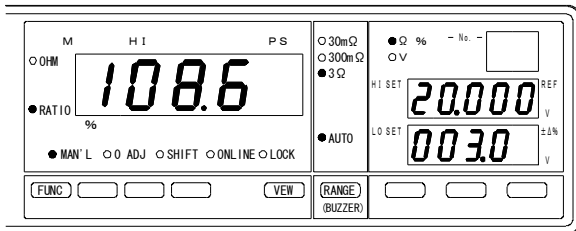
Display range : 0.0~199.9%
Adjustable range of deviation ($\pm \Delta\%$) : 0.0~199.9%

Calculation formula

$$X = \frac{R_X}{R_S} \times 100\%$$

$$\Delta = \left[\frac{R_X}{R_S} - 1 \right] \times 100\%$$

X : Ratio (%)
R_S : Referential resistance value (Ω)
R_X : Measuring resistance value (Ω)
Δ : Deviation (%)



Operating procedure

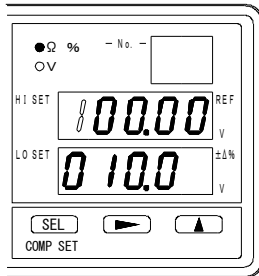
- ① Select the Rr mode with the **VIEW** key.
(Refer to the article 3.6)
- ② Select the resistance measurement with the **FUNC** key.
- ③ Select the measuring range with the **RANGE** key.
- ④ Connect the sample to be measured to the resistance measuring cable, then the measured resistance value is displayed.
- ⑤ Select the ratio display with the **FUNC** key.
When the ratio display is selected, RATIO on the function display is lit up. (OHM is turned off.)
At this moment, the main display section displays the calculated ratio value and the measuring unit % is lit up.
The referential resistance value is displayed on the HI SET, and the comparison range ($\pm \Delta\%$) is displayed on the LO SET.
In the ratio display, the main display section and the lowest digit of the LO SET are turned off.
In case that the measured resistance exceeds the measuring range of the calculation result is 200.0% or above, **UUUUU** blinks to inform the over-range.
- ⑥ Make a setting of the referential resistance and deviation ($\pm \Delta\%$). (Refer to the article 5.2.1)

Note: When changed over to the ratio display, the high limit of the resistance comparator becomes the referential resistance as it is. Also, in case of the memory mode, the low limit of the resistance comparator becomes the deviation ($\pm \Delta\%$) as it is.

5.2.1 Setting of referential resistance value and deviation

Move to the ratio display function

- ① Refer to the operating procedure.

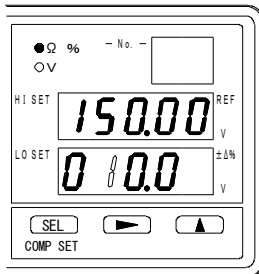


Setting of referential resistance value

- ② Press the **SEL** key.
The highest digit of the REF display section blinks.
Set the numeral with the **▶** and **▲** key.
The digit selected with the **▶** key blinks.
- ③ Set the range of referential resistance value with the **RANGE** key.

Adjustable range : 00000~35000

Setting of deviation ($\pm \Delta\%$)



- ④ Press the **SEL** key.
The highest digit of the deviation ($\pm \Delta\%$) display section blinks.
Set the numeral with the **▶** and **▲** key.
The digit selected with the **▶** key blinks.

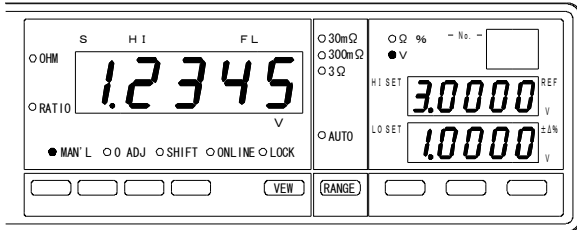
Adjustable range : 0.0~199.9%

Finish

- ⑤ Press the **SEL** key.

Note: When the content tried to be set is out of the adjustable range, the Err is displayed for a while at the setting item out of the range, and then return to ③ or ④.

5.3 ● Voltage measurement



Operating procedure

- ① Select the voltage measurement display with the **VIEW** key.
(Refer to the article 3.6)
- ② Select the measuring range with the **RANGE** key. Confirm the measuring range with the position of decimal point.

Note: When the resistance measurement range is set to AUTO, the AUTO is lit up and the voltage measurement range also becomes auto-range operation.

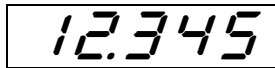
At this moment, it is not possible to make the setting of range with key operation.

- ③ Make the setting of comparator.
(Refer to the article 3.12.3)
- ④ Connect the sample to be measured to the resistance measuring cable, then the measured voltage is displayed.

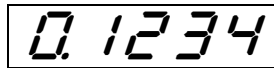
In case that the measured voltage exceeds the 50000, *UUUUU* blinks to inform the over-range.

In case of the auto-range, the range goes up when exceeded the 50000. Also, the range goes down when the value becomes 1000 or less.

Examples of range display



At 50V range



At 5V range

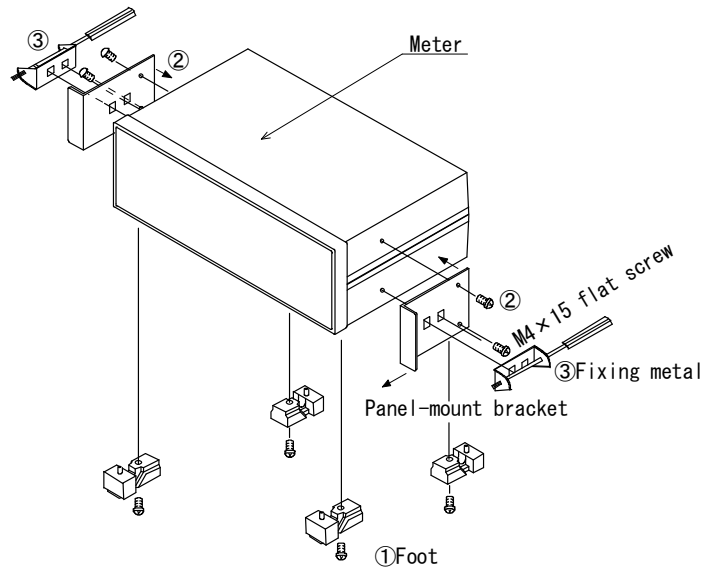
5.4 ● Character display

Display	Name	Explanation
<i>UUUUU</i>	Error 0	When the measurement is over-range.
<i>SET</i>	Set	Setting of memory.
<i>Err</i>	Setting error	Blinks for about 1 second when the setting item is out of the range.
<i>r-SET</i>	R set	In process of setting of the resistance comparator.
<i>v-SET</i>	V set	In process of setting of the voltage comparator.

6. Use in panel-mount

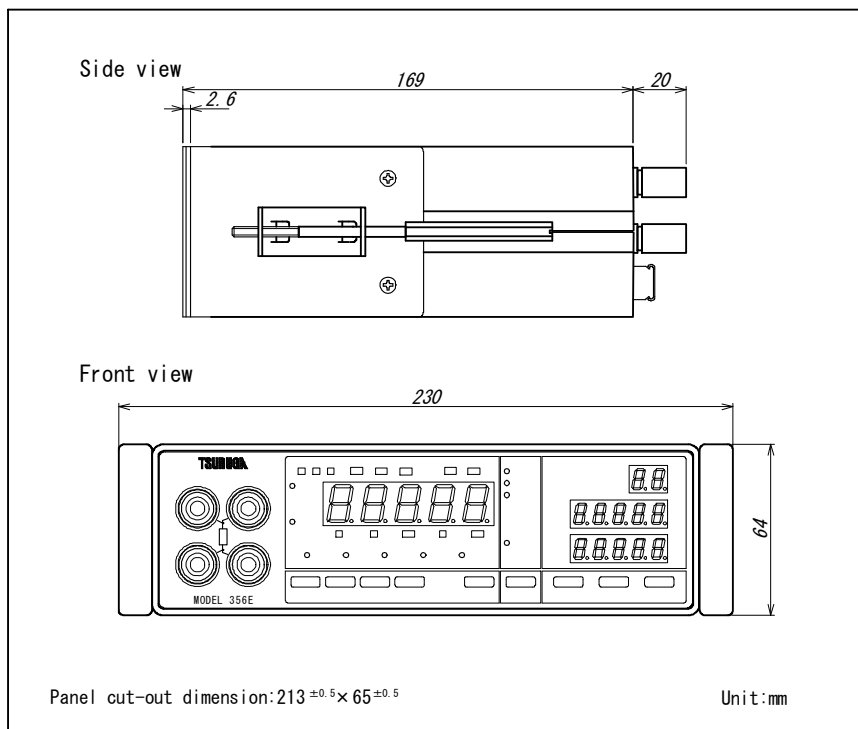
6.1 ●Assembly drawing

When the meter is used by panel-mounting, use the optional panel-mount bracket.



- ① Remove the feet (4 parts) at the bottom of the meter.
 - ② Fix the panel-mount bracket to both side of the meter (M4 × 15 flat screw)
 - ③ Insert the meter from the front of the panel and fix it to the panel with the fixing metal.
- Note:** In case that the meter is installed to the chassis, utilizing the bottom screw taps of the meters, keep the length of screw at 6mm + thickness of chassis (mm).

6.2 ●External dimensions when fitted with panel-mount bracket



7. Calibration

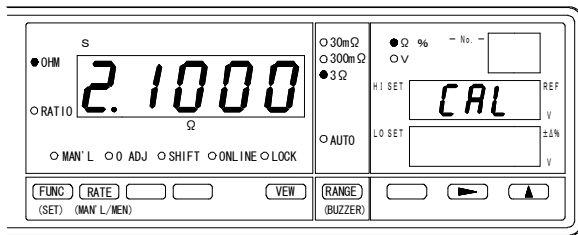
7.1 ● Things to prepare

When calibrate the 356E, please prepare the following devices for the calibration.
 Standard resistors for calibration of resistance measuring range: 30mΩ, 300mΩ, 3Ω
 Standard voltage generator for calibration of voltage measuring range: 5V, 50V
 Voltmeter for analog output

Note: Select the calibration devices whose accuracy satisfies the accuracy of 356E.

7.2 ● Calibration

7.2.1 Calibration of resistance measurement

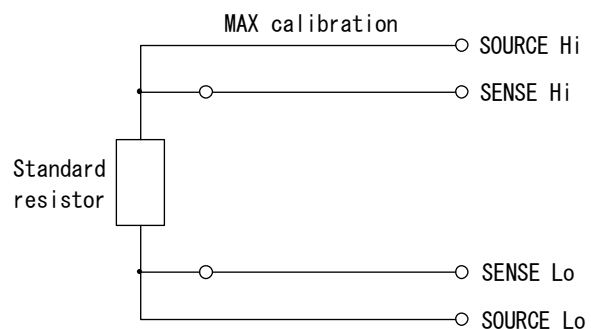
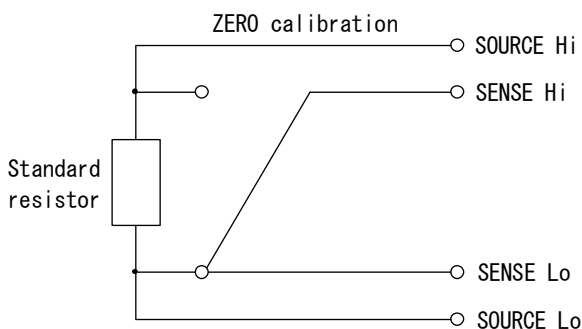


- ① Turn OFF the power supply switch, and keep pressing the **FUNC** key and the **RATE** key together, turn ON the power supply switch again. **CAL** is displayed on the HI SET display, and the meter enters the calibration mode.
- ② When entered the calibration, it is the resistance calibration. In the resistance calibration, the OHM lamp and the Ω % lamp are lit up.
- ③ Make a connection of the standard resistor with the lead wires as the figures show.
Connect the standard resistor to suit each range.
- ④ By pressing the **▶**, ZERO is calibrated, and MAX by pressing the **▲** key. Calibrate each range selecting it by **RANGE** key.
When the calibration is properly made, **CAL** is displayed in blinking on the display section for a while.
If the **Err** is displayed, it is exceeding the range which can be calibrated. Connect a right resistor.
- ⑤ The standard resistance value and their display value to connect each range are as the **Table 7.2.1** shows.

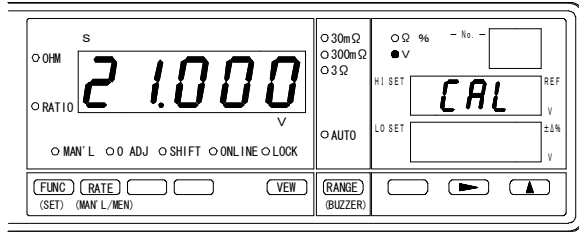
Range	Standard resistance value	ZERO display value	Max display value
30mΩ	30mΩ	0.000mΩ	30.000mΩ
300mΩ	300mΩ	0.00mΩ	300.00mΩ
3Ω	3Ω	0.0000Ω	3.0000Ω

Table 7.2.1

- ⑥ When the calibration is finished, turn OFF the power supply and cancel the calibration mode. When the meter is powered ON again, it returns to measurement.



7.2.2 Calibration of voltage measurement

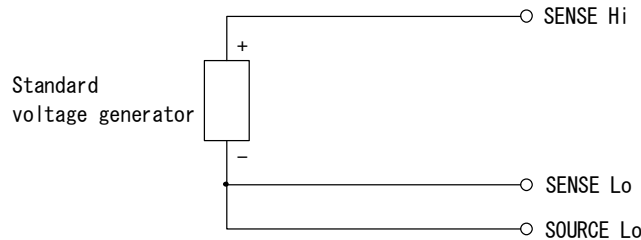


- ① Turn OFF the power supply switch, and keep pressing the **FUNC** key and the **RATE** key together, turn ON the power supply switch again. **CAL** is displayed on the HI SET display, and the meter enters the calibration mode.
- ② When entered the calibration, it is the resistance calibration. The **VIEW** key allows the changeover between the voltage calibration and the resistance calibration. For the voltage calibration, the V lamp is lit up.
- ③ Make a connection of the standard voltage generator with the lead wires as the figure shows. Connect the input voltage to suit each range.
- ④ By pressing the **▶**, **ZERO** is calibrated, and **MAX** by pressing the **▲** key. Calibrate each range selecting it by **RANGE** key. When the calibration is properly made, **CAL** blinks on the display section for a while. If the **Err** is displayed, it is exceeding the range which can be calibrated.
- ⑤ The voltage to connect each range are as the **Table 7.2.2** shows.

Range	ZERO calibration voltage	Max calibration voltage
5V	0.0000V	5.000V
50V	0.0000V	50.000V

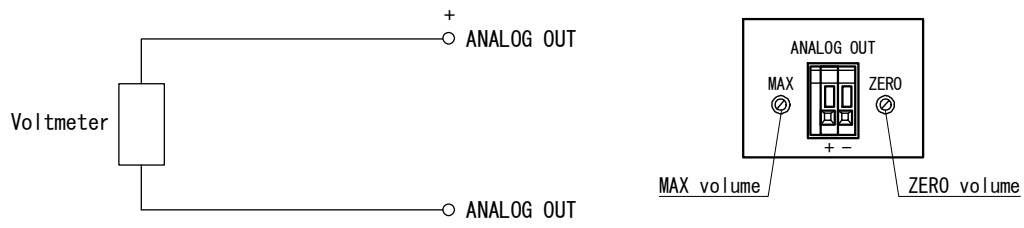
Table 7.2.2

- ⑥ When the calibration is finished, turn OFF the power supply and cancel the calibration mode. When the meter is powered ON again, it returns to measurement.



7.2.3 Calibration of analog output

- ① The analog output is calibrated in the resistance measurement. Press the **VIEW** key to make the Rr mode.
- ② Connect the voltmeter to the analog output terminal. Connect also the Kelvin clip to the resistance measuring input.
- ③ Make the measurement display 0, and adjust the output voltage to 0.000V with the **ZERO** volume. (When the two clips are connected in 3Ω range, the display becomes 0Ω.)
- ④ Make the measurement display 30000, and adjust the output voltage to 3.000V with the **MAX** volume. (For the over-range, 3.5V is output.)



8. Specifications

8.1 ● Model name

Model name	Content
356E -□	No data output
356E-01-□	With GP-IB
356E-03-□	With BCD data output (TTL level)
356E-04-□	With BCD data output (open collector)
356E-05-□	With RS-232C
356E-06-□	With RS-485

-□ : Judgement output
 Nil : Open collector NPN
 RY : Relay output

8.2 ● Measuring range and accuracy

■ Resistance measurement (At SLOW and MEDIUM sampling)

Measuring range	30mΩ	300mΩ	3Ω
Resolution	1 μΩ	10 μΩ	100 μΩ
Measuring current	7.4mA	1mA	100 μA
Accuracy ※	Note-1	±(1.0% of rdg. + 15 digit)	
Temperature coefficient	Note-2	±(0.1% of rdg. + 1 digit)/°C	
Open terminal voltage	Peak 1V or less		

※Accuracy : Defined at 23°C±5°C, 45~75%RH
 When the sampling rate is FAST, the accuracy is ±1.0% of rdg. + 5 digit)

Note-1: ±(1.0% of rdg. + 20 digit)

Note-2: ±(0.1% of rdg. + 2 digit) /°C

■ Voltage measurement (At SLOW, MEDIUM and FAST sampling)

Measuring range	±5V	±50V
Resolution	100 μV	1 mV
Accuracy ※	±(0.05% of rdg. + 5 digit)	
Temperature coefficient	±(0.005% of rdg. + 0.5 digit)/°C	

※Accuracy : Defined at 23°C±5°C, 45~75%RH

※For the accuracy of MEDIUM sampling rate, a 3 digit is to be added.

※For the accuracy of FAST sampling rate, a 5 digit is to be added.

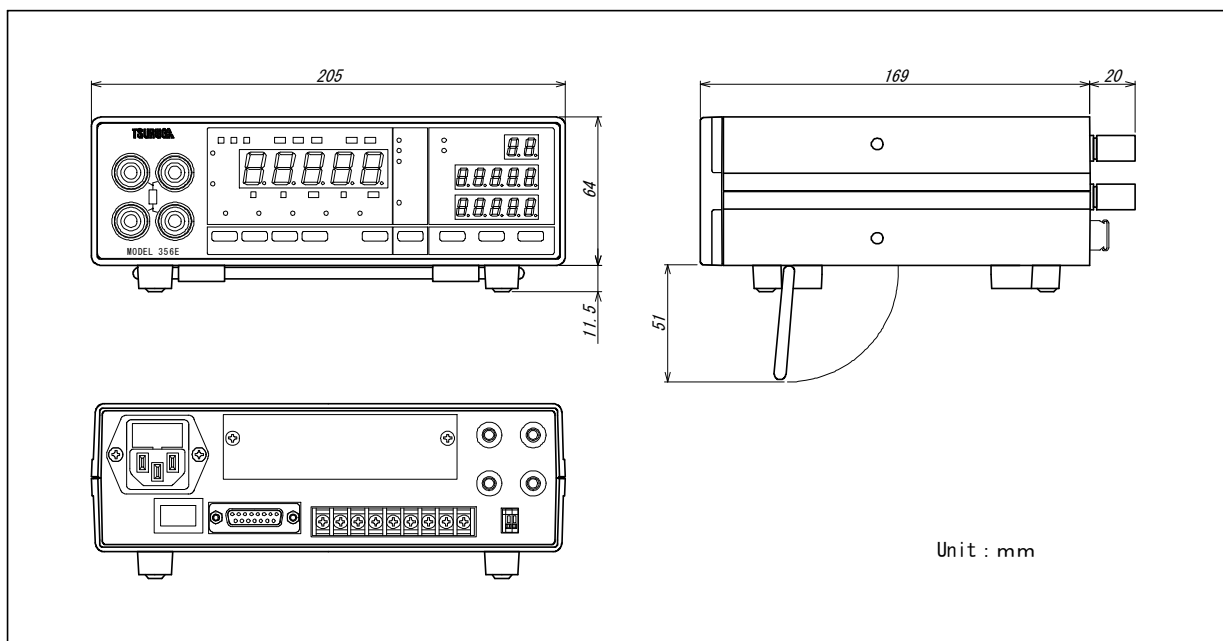
8.3 ● General specifications

Measuring system	: AC 4 terminals system.
A/D working system	: Δ - Σ system.
Tolerable max. voltage to apply	: 60V DC for all the ranges.
Measuring frequency	: AC 10kHz \pm 200Hz.
Lead wire resistance	: Between SOURCE Hi – SOURCE Lo 0.4 Ω or less.
Display	: Green LED (character height 14.2mm). Resistance measurement : 35000 (3500 at the sampling rate F) Voltage measurement : 50000 (5000 at the sampling rate F, with polarity indication) With zero-suppress function.
Over-range display	: UUUUU
Display mode	: Resistance, resistance comparator setting. Voltage, voltage comparator setting. Resistance, voltage.
Sampling rate	: 50Hz 60Hz SLOW : 1.56 times/sec. 1.88 times/sec. MEDIUM : 6.25 times/sec. 7.52 times/sec. FAST : 50 times/sec. 60 times/sec.
Response speed	: SLOW : approx. 1.92s approx. 1.60s MEDIUM : approx. 800ms approx. 667ms FAST : approx. 100ms approx. 84ms
Analog output	: Analog signal to the resistance value is output. Output Full scale 3V, output impedance 1k Ω or less. (With zero and max. adjustment volumes) Output voltage 0~3.000V with digital display 0~30000 (3000) digits. Conversion system D/A conversion system. Output accuracy Accuracy of resistance measurement +0.2%F.S. Note: During the ratio display, the measured resistance value is output. During the setting of standard resistance value in the ratio display function, the output is retained.
Insulation resistance	: Terminal blocks in a lump / Housing 500VDC, 100M Ω or more
Withstanding voltage	: Terminal blocks in a lump / Housing 1500VAC for 1 minute Power source / Housing 1500VAC for 1 minute Measuring terminals / Output terminals 500VAC for 1 minute
Parameter retention	: The content of the setting for the function, range, value etc. set by key are retained by EEPROM even if the power is turned OFF.
Supply voltage	: 100~240VAC 50/60Hz
Range of supply voltage	: 90~250VAC
Power consumption	: Approx. 17VA at the 100VAC input. Approx. 21VA at the 200VAC input.
Working ambient temperature	: 0~50°C
Storage temperature	: -20~70°C
Weight	: Approx. 1 kg.
Accessories	: Power supply fuse: : 1 piece (Spare fuse: Mounted inside the power supply connector) Power supply cord with 3P→2P converter : 1 piece Connector for control input : 1 piece Instruction manual : 1 copy

8.4 ●Table of initial setting (at delivery from factor)

Measuring range	3 Ω
Memory 1~30	Resistance measurement, 3 Ω range
Comparator	HI SET: 3.0000 Ω, LO SET: 0.0000 Ω
Ratio display function	± Δ%: 010.0%
Key-lock	OFF
Buzzer	OFF setting, sound volume 5
Zero adjustment	OFF
Power source frequency setting	60Hz

8.5 ●External dimensions



8.6 ●Option

- For the model 356E, the following interfaces are prepared.
For the handling of each interface, please refer to the instruction manual of respective interface.
 - GP-IB interface board : Model 5811-01C
 - BCD data output board (TTL) : Model 5811-03C
 - BCD data output board (open collector) : Model 5811-04C
 - RS-232C interface board : Model 5811-05C
 - RS-485 interface board : Model 5811-06C
- Others
 - Kelvin clip : 5811-24
 - Clip type lead : 5811-25
 - Panel-mount bracket : 5811-31

Contact Information

Name : Tsuruga Electric Corporation
 Address : 1-3-23 Minami-Sumiyoshi, Sumiyoshi-ku, Osaka-shi
 558-0041 Japan