
MODEL **356G**

Digital Resistance meter

Instruction Manual

I-02286

TSURUGA ELECTRIC CORPORATION

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1. Preface

Make sure that this instruction manual is available to the responsible person using this meter.
In order to use this meter properly, read the instruction manual before using.

Caution

- To avoid break-down, malfunction or deterioration of life time, don't use this meter 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 this meter with the case open or with modification.

1.1●Preparation prior to use

1.1.1 Inspection

When the meter is delivered, check whether it conforms to the ordered specifications and hasn't been damaged during shipping.

If there is any damage or does not operate as per the specifications, inform us the model name and the serial number of the meter.

1.1.2 Storage

When the meter is not in use for a long time, store it in the place where the humidity is low and the meter is not exposed to the direct sunlight.

1.2●Confirmations prior to use

1.2.1 Power supply

Use this meter with the power supply voltage within AC90~250V and frequency 50/60Hz.
Also, ensure that the power switch is turned OFF when connecting the power supply cord.

1.2.2 Power supply cable

Power supply cable plug attached to this meter is for the AC100V. In case the supply voltage exceeds AC125V, use the appropriate supply voltage cable that matches the rating.

Make a connection of power supply cable to the power supply connector on the rear panel of the meter.

The plug has 3 pins and the round shaped pin at the center is for earthing.

When the connection is made with the use of the adaptor that comes with the plug, ensure to connect the earth lead coming out from the adaptor to the external earth terminal for grounding.

1.2.3 Replacement of fuse

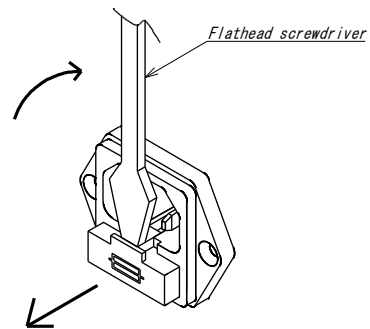
A power supply fuse 250V/2A is mounted when the meter is delivered from the factory.

The fuse socket of this meter is common with the connector for input of power source line.

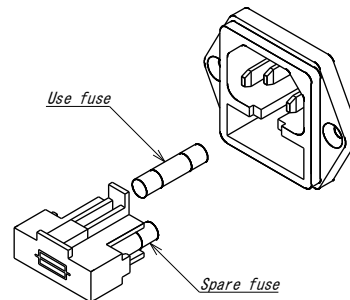
Before connecting the power cord, take off a cap of fuse socket and confirm the rated value of fuse. Two fuses including a spare are stored inside the cap.

① Remove the fuse socket.

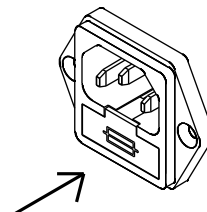
In the inlet center, the flathead screwdriver etc. is placed on the projection of the fuse-socket and pulled out.



② Insert the fuse into the fuse socket paying attention to the mounting position.



③ Mount the fuse socket ensuring that the fuse has been inserted in the correct position.



1.3●Warning and caution of measurement time

1.3.1 Electric shock or failure

Warning

- In order to prevent the electric shock accident or the failure of this unit, don't apply voltage to the measurement terminal.
- In order to prevent the failure, conduct the measurement after turning off the power related to the measurement.
- During the state when the motor is rotating, a large electromotive force is generated in the terminal and this may be the cause for the electric shock accident or the failure of this unit.

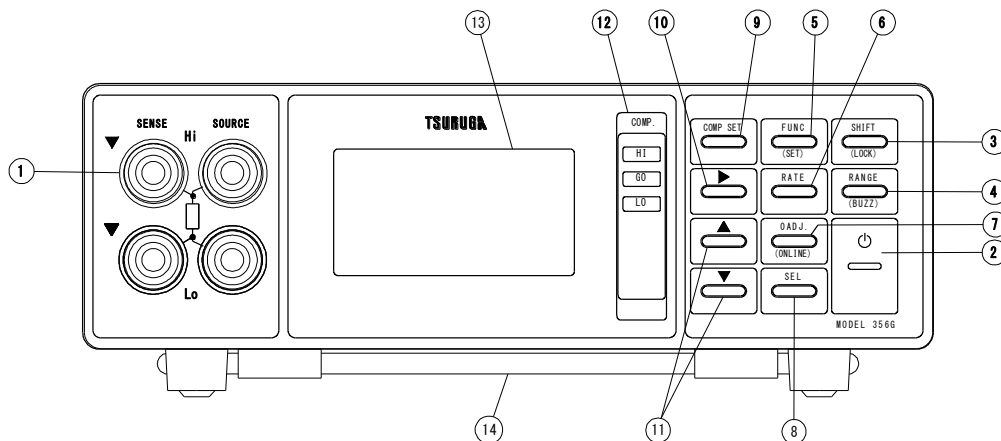
1.3.2 Measurement of transformer and coil

Caution

- Do not use 1A measurement current for the range of 30mΩ, 300mΩ measurement range for the thing with inductance more than about 5H and resistance below 3Ω of transformer and coil. There is a risk to damage this unit.

2. Name of parts

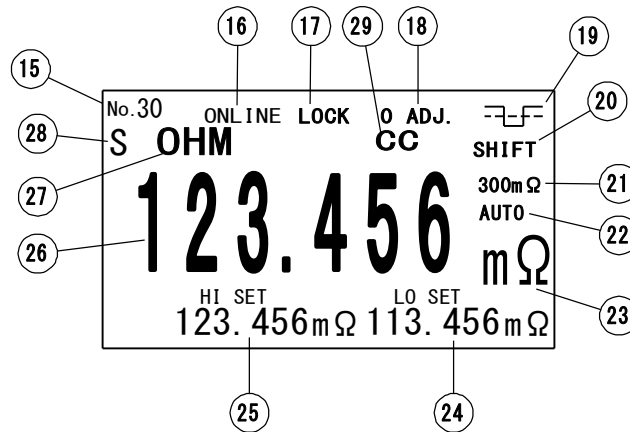
2.1●Front panel



① Measuring terminals	SENSE Hi : + side terminal of voltage input. SENSE Lo : - side terminal of voltage input. SOURCE Hi : + side terminal of current output. SOURCE Lo : - side terminal of current output.
② Power lamp	LED is lit up when power is on.
③ SHIFT key (LOCK)	Press when the function that is marked with orange color () is used. It is cancelled if the key is pressed again. SHIFT mark is displayed when functioning. (The switch of the front panel is operation prohibition switch. If it is pressed for more than 3 seconds, it can be prohibited or release prohibition. During the prohibition, LOCK is displayed on the upper side of LCD.)
④ RANGE key (BUZZ)	Key to select range 30mΩ~300Ω or AUTO range. (Key to select buzzer operation and volume setting.)
⑤ FUNC key (SET)	Key to select measurement function. (Performs various settings.)
⑥ RATE key	Key to select the sampling rate.
⑦ 0 ADJ. key (ONLINE)	Key for ON/OFF of zero adjustment function.
⑧ SEL key	Key to select memory no.
⑨ COMP SET key	Key to perform the setting of the comparator.
⑩ ▶ key	Used for comparator and various settings.
⑪ ▲ ▼ key	Used for comparator and various settings.
⑫ HI GO LO	Red LED is lit up when the measured value is higher than upper limit. Green LED is lit up when good judgment. Red LED is lit up when the measured value is less than lower limit.
⑬ LCD Display window	Measurement function, measurement range, measurement value, comparator settings, memory no. etc. are done.
⑭ Stand	When the stand is pulled in front to be erect, the meter can be tilted. Do not apply strong force from above when the meter is tilted.

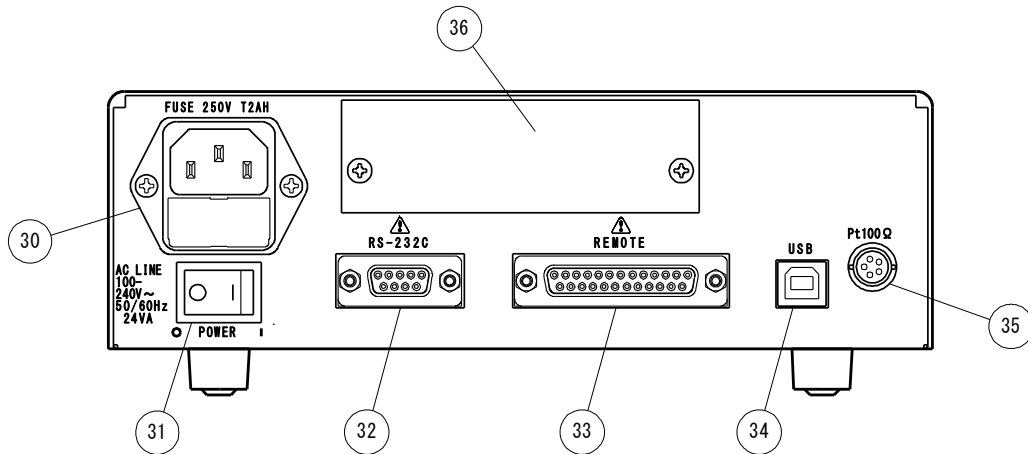
Note () Key is enabled when SHIFT is being displayed.

LCD Display window



⑮ No. display	Displays Memory no.
⑯ ONLINE EXT.	Displays [ONLINE] when setting can be done by USB, RS-232C, RS-485. Displays [EXT.] when memory no. is selected by external control.
⑰ LOCK	Displays when key locked.
⑱ 0 ADJ	Displays during zero adjustment function.
⑲ $\overline{\text{---}}$	Displays at the time of measurement by the offset voltage correction function.
⑳ SHIFT	It works with the linkage with SHIFT key. Displays when SHIFT key is enabled.
㉑ Resistance range	Displays the measured range from 30mΩ to 300Ω.
㉒ AUTO	Displays at the time of auto range.
㉓ Unit	Displays the unit of measurement value.
㉔ LO SET display window	Displays the lower limit of the comparator.
㉕ HI SET display window	Displays the upper limit of the comparator.
㉖ Measurement value display window	Displays measurement value and characters.
㉗ Function	Displays measurement function.
㉘ F M S	[F] is lit up when the sampling rate is 80 times/sec. [M] is lit up when the sampling rate is 20 times/sec. [S] is lit up when the sampling rate is 5 times/sec. Displays and lit under HOLD operation and during sampling stop under setting,
㉙ CC	Displays [CC] at the time of SOURCE open detection. (There is a case of [CC] being displayed when a large resistance is connected with respect to the measurement range.)

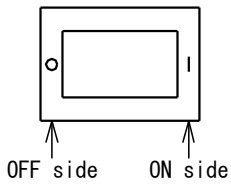
2.2●Rear panel



③⑩ Power inlet	Connect the power supply cord. Ensure to use the power voltage and frequency within the specified range. Fuse of 250V T2AH is to be used.
③⑪ Power switch	ON/OFF switch for power supply
③⑫ RS-232C connector	RS-232C interface connector.
③⑬ REMOTE connector	Connector for external control.
③⑭ USB connector	USB interface connector.
③⑮ Temperature sensor connector	Pt100Ω temperature sensor connector. When using temperature correction function, connect the temperature sensor (5803-11) which is optional.
③⑯ Option interface	In case of BCD output and equipped with RS-485, the interfaces implemented.

3. Function and method of operation

3.1 Power supply

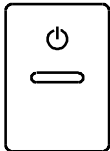


After confirming that the power supply switch on the rear panel is OFF, connect the power supply plug to the connector and turn ON the power supply switch.

When power supply switch is ON, power supply lamp of front panel is lit.

Take more than 30 minutes for pre-heating.

Besides, as it is equipped with function to retain the parameters, the following states are memorized even when the power is OFF.

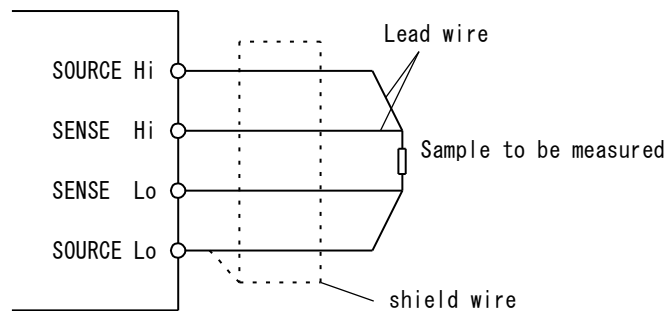


- (1) Measurement range
- (2) Measurement function
- (3) Sampling setting
- (4) Set values of comparator
- (5) Status of key lock
- (6) Status of buzzer
- (7) Contents of various settings

3.2 Connection of measuring terminals

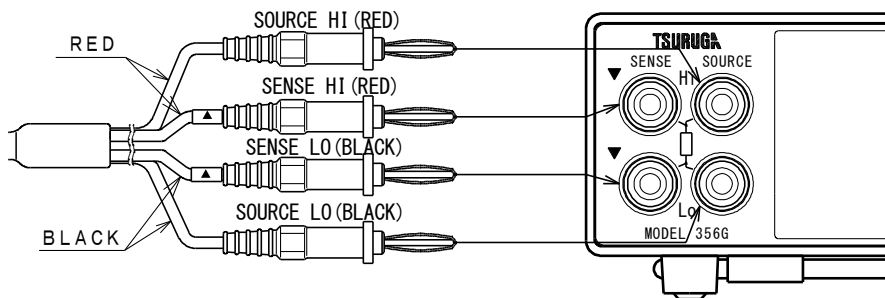
3.2.1 Connection of resistance measurement terminals

Make a connection to the measuring terminals on the front panel as shown in the figure below.



Note: Penetration of noise to the measuring terminals may cause disturbing display or instability in auto range operation. Prevent the noise by using shield wire and connecting shield side to SOURCE Lo.

Carry out the plugging of the Kelvin clips (banana plug side) and the resistance meter as follows.



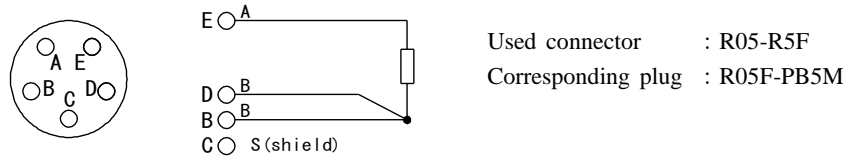
Connection of Kelvin clip (MODEL5811-21B)

3.2.2 Connection of temperature measurement terminals

Temperature sensor is connected during temperature measurement (TEMP) and temperature correction (T.C. and T.C. RATIO).

Temperature sensor is connected to temperature sensor connector of rear panel.

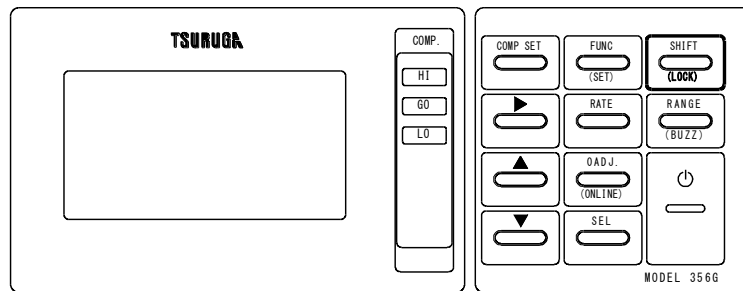
Temperature sensor : 5803-11



3.3●Key lock

This is the switch to prohibit the key operation on the front panel so that the measuring status cannot be unintentionally altered.

LOCK mark is displayed in the upper side of LCD during the key lock. During key lock, in order to operate other switches do it after releasing the key lock.



Method of Key lock

Key lock takes place when **SHIFT** (LOCK) key is pressed for more than 3 seconds. LOCK mark is displayed in the upper side of LCD.

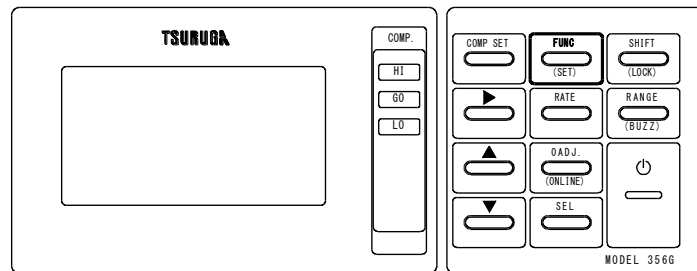
Release of Key lock

Key lock is released when **SHIFT** (LOCK) key is pressed for more than 3 seconds once more.

3.4●Selection of measurement function

Measurement function is selected.

Note: During key lock, HOLD status, ONLINE and external control (EXT. display) status, operation cannot be done.



Function	Display	Measurement	Unit
Resistance measurement	OHM	Resistance is measured and resistance value is displayed.	Ω m Ω
Temperature measurement	TEMP	Temperature is measured and displayed.	$^{\circ}\text{C}$
Temperature correction	T.C	Resistance is measured and temperature correction value is displayed.	Ω m Ω
Temperature correction ratio display	T.C RATIO	Resistance is measured and temperature correction is done. The ratio computed value corresponding to temperature value is displayed.	%
Ratio display	OHM RATIO	Resistance is measured and ratio computed value corresponding to standard value is displayed.	%

Change-over of function

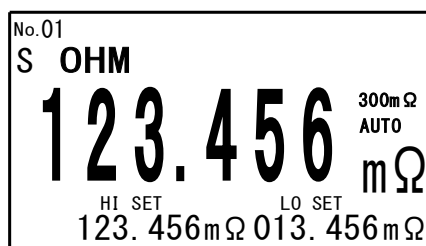
When **FUNC** key is pressed, the function is changed-over and the function display of LCD is changed over.

It is changed-over in the order of OHM→TEMP→T.C→T.C RATIO→OHM RATIO.

3.4.1 Resistance display (OHM)

Resistance measurement value is displayed.

Display screen at the time of resistance display



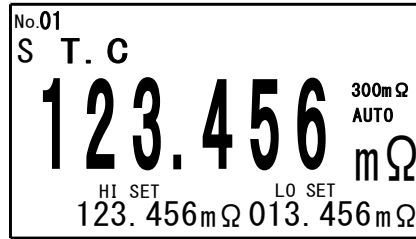
3.4.2 Temperature correction function (T.C)

Conductor resistance and ambient temperature is measured and the measured conductor resistance is computed in terms of reference value and displayed.

Standard temperature and temperature coefficient can be set in the range of 00.0~99.9°C and 1000~9999ppm respectively.

The measurement of ambient temperature is done by connecting Pt100Ω temperature sensor.

Display screen at the time of temperature correction function



Calculation formula:
$$R_T = \frac{R_t}{1+(\alpha \times 10^{-6}) \times (t-T)} \quad (\Omega)$$

t : Ambient temperature (°C)

R_T : Correction resistance (Ω)

R_t : Resistance value (Ω) at t°C

α : Temperature coefficient Set in the front switch
Setting range 1000~9999ppm

T : Standard temperature Set in the front switch
Setting range 00.0~99.9°C

Example) Copper wire 20.0°C , α = 3930ppm

Accuracy: Add ±0.3% of rdg.to the accuracy of resistance measurement

Refer 3.15.1 T.C setting method for setting method of standard temperature and temperature coefficient.

Calculation range: Maximum 399999

If the calculation result exceeds 399999, the display will be OVER.

3.4.3 Ratio display function (OHM RATIO)

It is a function displayed in percentage with respect to standard resistance value by comparing measured resistance value Rx and standard resistance value Rs.

The comparison judgment ($\pm\Delta\%$) of deviation can be done.

Formula:

$$X = \frac{R_x}{R_s} \times 100\%$$

$$\Delta = \left(\frac{R_x}{R_s} - 1 \right) \times 100\%$$

X : Ratio (%)
 Rs : Standard resistance (Ω)
 Rx : Measured resistance value (Ω)
 Δ : Deviation (%)

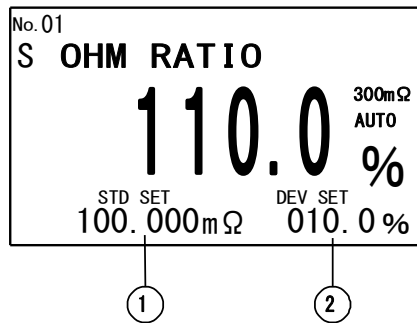
Display range -199.9~199.9%

OVER is displayed when it exceeds the display range.

$\pm\Delta\%$ Comparison operation (Setting range : 0 ~100.0%)

Standard resistance value Rs (Setting range : -199999 ~ 350000)

Display screen at the time of ratio display function



①Standard resistance value (Rs)

②Comparison range $\Delta\%$

When comparison range $\Delta\%$ is set to 10.0%, $\pm 10\%$ of the range corresponding to 100% is made GO judgment.

LO judgment : -199.9~89.9%, -OVER

GO judgment : 90.0~110.0%

HI judgment : 110.1%~199.9%, OVER

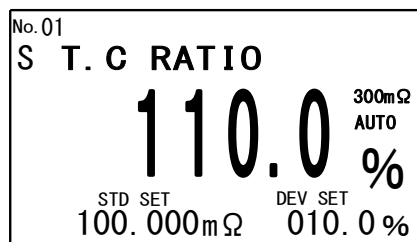
Refer to 3.8.3 Comparator setting method for setting of standard resistance value and comparison range.

3.4.4 Temperature correction ration display function (T.C RATIO)

It is a function displayed in percentage with respect to standard resistance value by comparing resistance value Rx computed by temperature correction (T.C) and standard resistance value Rs.

Refer to 3.4.3 Ratio display function for calculation formula and comparison function.

Display screen at the time of temperature correction ratio display function



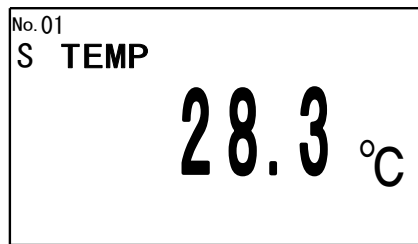
3.4.5 Temperature display (TEMP)

The temperature measured by temperature sensor is displayed.

In temperature measurement, the sampling rate is fixed by [S] and cannot be changed.

In temperature measurement, comparison operation is not performed.

Display screen at the time of temperature display



3.4.6 Measurement disorder detection

When over of the measurement and open of the SOURCE terminal is detected and displayed, signal in the remote control is output together.

Status	Display		Remote connector output signal		
	Measurement display	CC display	ERR-CC	ERR 0	ERR 1
Normal	Display measurement value	OFF	OFF	OFF	OFF
SOURCE Open	Display measurement value	ON *1	ON *1	OFF	OFF
Resistance measurement over	OVER/-OVER	OFF	OFF	ON	OFF
Temperature measurement over	OVER/-OVER	OFF	OFF	OFF	ON *2

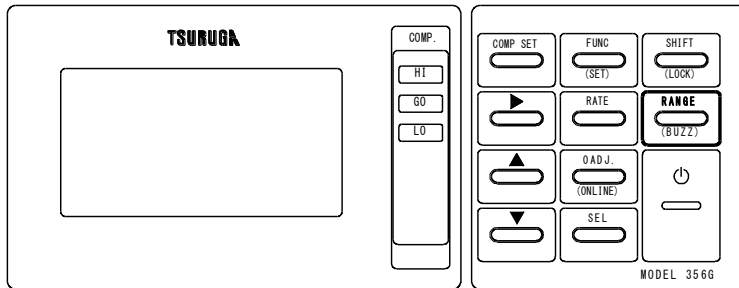
*1: When resistance exceeding the measurement range is connected, there is a case where SOURCE is open.

*2: During TEMP calculation error with temperature correction, it outputs ON. (T.C,T.C RATIO)

3.5●Change-over of measuring range

Select a measuring range (auto range or manual range) of resistance measurement.

During key lock, HOLD status, ONLINE and external control (EXT. display) status, operation cannot be done.



(1) Auto range

The measurement range steps up when display value is above 350000 and steps down when the display value is below 30000.

(During FAST sampling, steps up when above 35000 and steps down when below 3000)

AUTO mark and resistance range is displayed in right side of LCD.

Selection of AUTO range

When the **RANGE** key is pressed at 300Ω range, AUTO mark is displayed in the right side of LCD and the meter enters the auto ranging.

(2) Manual range

The range is fixed at 30mΩ~300Ω.

It is measured by the selected range.

Change-over of range

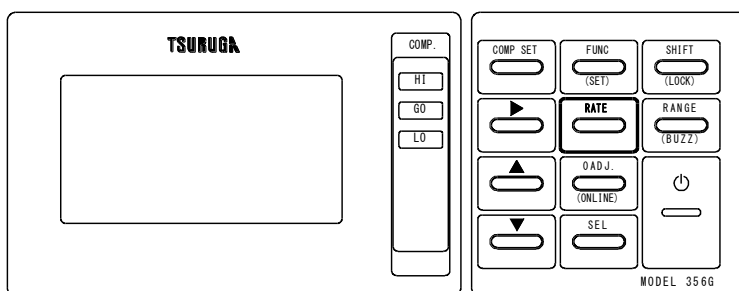
Range mark (30mΩ~300Ω, AUTO) in the right side of LCD is changed-over when the **RANGE** key is pressed.

3.6●Selection of the sampling rate

Select the sampling rate with the key operation of front panel of this meter.

During key lock, HOLD status, ONLINE and external control (EXT. display) status, operation cannot be done.

Note: Sampling cycle cannot be changed with temperature measurement (TEMP).



Sampling rate is changed-over when **RATE** key is pressed.

S→M→F→S...

S display : 5 times/sec.

M display : 20 times/sec.

F display : 80 times/sec.

3.7•Zero adjustment

This is the function to eliminate resistance of tools etc. with resistance measurement.

The data being measured presently is recorded in memory as zero set value and regarding the measurement afterwards, the zero set value subtracted from measurement value is displayed.

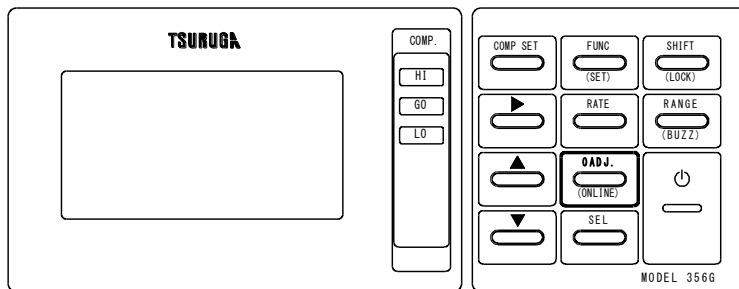
$$\boxed{\text{Display value}} = \boxed{\text{Measured value}} - \boxed{\text{Zero set value}}$$

Note: It does not perform zero adjustment for temperature measurement (TEMP).

Zero set value operates in all ranges.

When zero adjustment is done in the upper range, it may be over in the lower range.

3.7.1 Key operation



When **0 ADJ.** key is pressed, it will be the operating status of zero adjustment.

0 ADJ. mark is displayed in the upper side of LCD during zero adjustment.

Zero adjustment is released when **0 ADJ.** key is pressed once more.

Note: During key lock, HOLD status, ONLINE and external control (EXT.) status, operation cannot be done.

3.7.2 Remote operation

When 0 ADJ input of rear panel REMOTE connector is ON, it is in the zero adjustment function status.

When turned OFF, operation is released.

Note: When this input is turned OFF, the zero adjustment function set by the key operation is released.

3.7.3 Communication operation

With the direction of USB, RS-232C and RS-485, the operation of ON/OFF of zero adjustment is possible.

Communication operation is performed in the ONLINE status.

3.7.4 Zero adjustment operation priority order

Operation	Priority order
Remote operation	↑ High Low
Communication operation (ONLINE)	
Key operation	

Note: During zero adjustment process by remote operation or communication operation, make zero adjustment is OFF.

3.8●Comparator

This is a digital comparator to make a comparison between displayed value and high or low limit value.

Note: It does not perform comparator operation for temperature measurement (TEMP).

During the setting of high or low limit value, sampling is stopped and comparison output is held.

During key lock, HOLD status, ONLINE and external control (EXT. display) status, operation cannot be done.

At the time of ration calculation, high and low comparator becomes standard resistance and deviation.

3.8.1 Conditions for comparison

Display value \geq High limit value (HI SET) HI output

High limit setting value (HI SET) > display value > Low limit setting value (LO SET) GO output

Display value \leq Low limit setting value (LO SET) LO output

Note: Comparator makes comparison including range.

Example) In case that the high limit value is set to 100.000m Ω ,

HI is output when 10.000 Ω is displayed in the range of 30 Ω range.

3.8.2 Comparator output

Open collector output is output through REMOTE connector on the rear panel.

Judgment display . . . HI, LO : Red

GO : Green

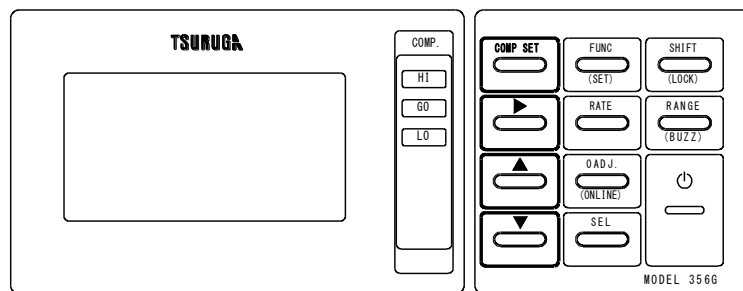
3.8.3 Setting method

Setting cannot be done during ONLINE, EXT. and HOLD.

Adjustable range High limit : -199999~350000

Low limit : -199999~350000

The unit and decimal point are set by **RANGE** key.



Setting of high limit (Standard resistance Rs)

- ① Press **COMP SET** key.

The cursor is moved to the highest digit of HI SET upper limit on the lower side of LCD.

Cursor is moved and the character selected is inverted with **▶** key

The number of digits selected is set with **▲** **▼** key.

Setting of lower limit (comparison range $\Delta\%$)

- ② Press **COMP.SET** key.

The cursor is moved to the highest digit of LO SET lower limit on the lower side of LCD.

Cursor is moved and the character is inverted with **▶** key.

The number of digits selected is set with **▲** **▼** key.

Setting of comparator range

- ③ Select the decimal point position and unit with **RANGE** key.

End of setting

- ④ Press **COMP.SET** key.

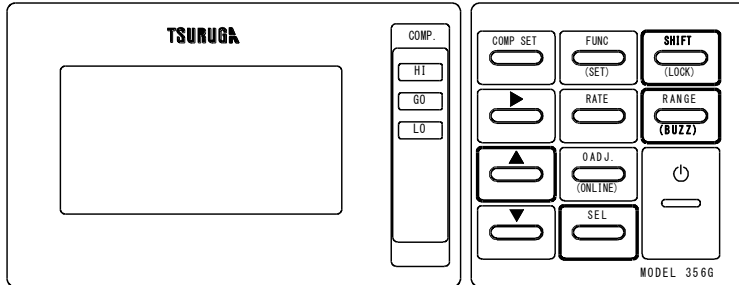
3.9●Buzzer

Setting of buzzer is done with (BUZZ) key on the front panel.

During the setting of buzzer, the sampling is stopped and the comparator output is held.

Note: During key lock, HOLD status, ONLINE and external control (EXT. display) status, operation cannot be done.

3.9.1 Setting method



Setting of buzzer

- ① Press **SHIFT** key.
SHIFT is displayed on the right side of LCD.
- ② Press RANGE(BUZZ)key.
LCD will switch to the setting screen.

Selection of buzzer operation

- ③ Buzzer operation is selected with **▲** key.

Display	Operation
GOOD	Buzzer sounds during GO judgment.
HI NG	Buzzer sounds during HI judgment.
LO NG	Buzzer sounds during LO judgment.
NG	Buzzer sounds during HI and LO judgment.
OFF	Buzzer is turned OFF.

Adjustment of sound volume

- ④ Press **SEL** key.
Buzzer sounds.
Adjust to a proper sound volume with **▲** key.
The volume is adjustable in 10 steps.

End

- ⑤ Press **SHIFT** key.
SHIFT is displayed on the right side of LCD.
- ⑥ Press RANGE (BUZZ) key.

3.10●Average calculation

Average function averages the measurement and displays the outputs.

You can reduce variations in the display by setting the average count.

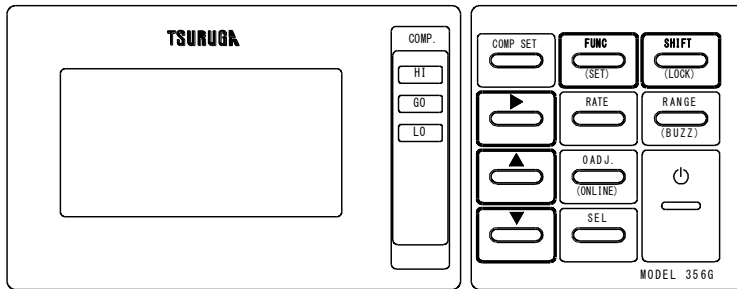
The average count can be set between 1 and 100 times.

Note: Temperature measurement (TEMP) does not perform average calculation.

During the setting, the sampling is stopped and comparator output is held.

During key lock, HOLD status, ONLINE and external control (EXT. display) status, operation cannot be done.

3.10.1 Setting method



Setting after moving to setting screen

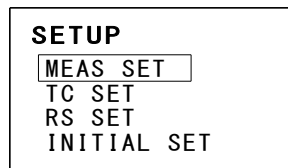
- ① Press **SHIFT** key.

SHIFT is displayed on the right side of LCD.

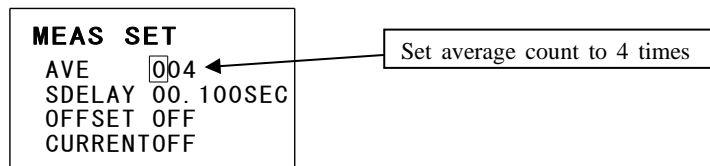
- ② Press FUNC (SET) key.

LCD is switched to 「SETUP」 screen and 「MEAS SET」 becomes selected state.

When 「MEAS SET」 is not in selected state, selection is done by [▼] key.



- ③ When [▶] key is pressed during 「MEAS SET」 selection status, it switches to 「MEAS SET」 screen and becomes in the state of 「AVE」 of highest digit.



Average count is set with 「AVE」.

The digit is changed with [▶] and setting value is changed with [▼][▲] key.

End

- ⑤ Press **SHIFT** key.

SHIFT is displayed on the right side of LCD.

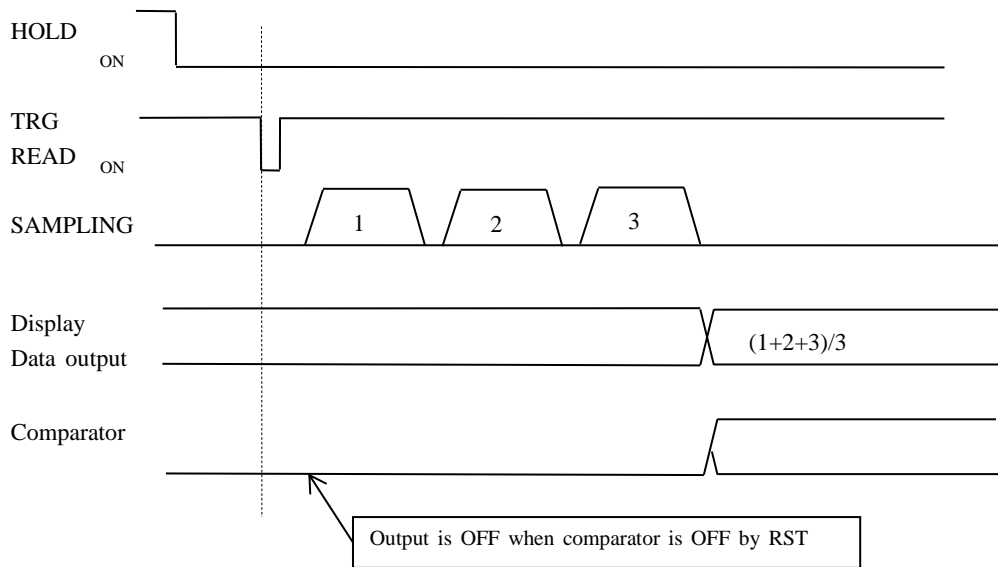
- ⑥ Press FUNC(SET)key.

3.10.2 Operation of the average calculation

Status	Operation
Continuous sampling state	Moving average
Sampling once by TRG signal during HOLD	After average number of sampling, the average value is displayed and HOLD.
Sampling once by communication with READ command during HOLD	
Sampling once by releasing HOLD for short time during HOLD	Display measuring value by first sampling and HOLD.
Continuous sampling with release of HOLD status	Display the measurement value by first sampling and displays average value till average setting factor after second sampling. The moving average value is displayed after average sampling numbers.

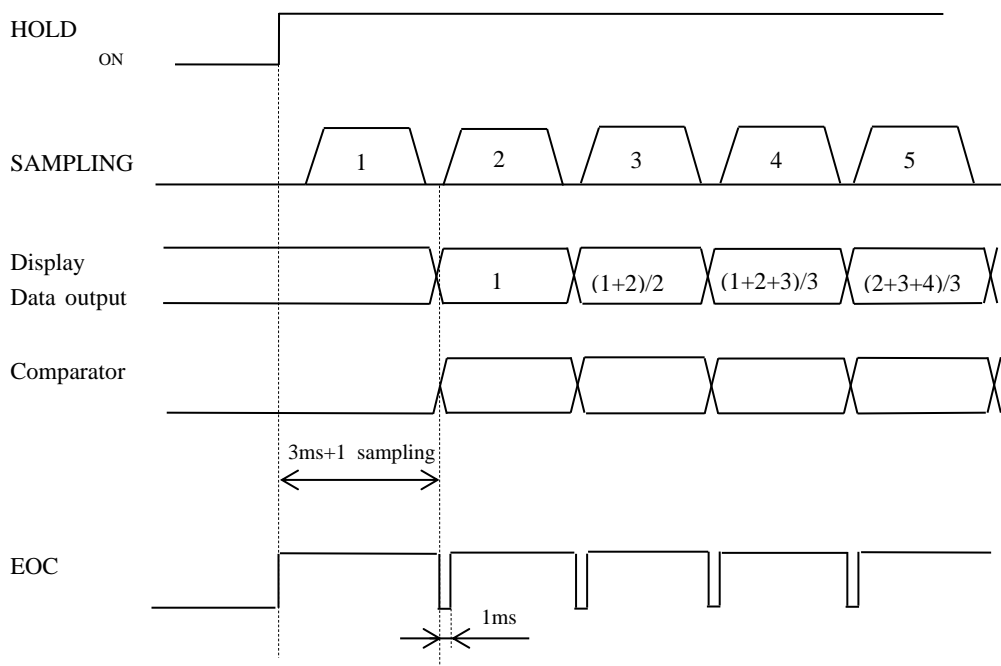
① Start sampling by TRG signal or READ command during HOLD

Average count: Set to 3times



② Start sampling with release of HOLD

Average count: Set to 3 times

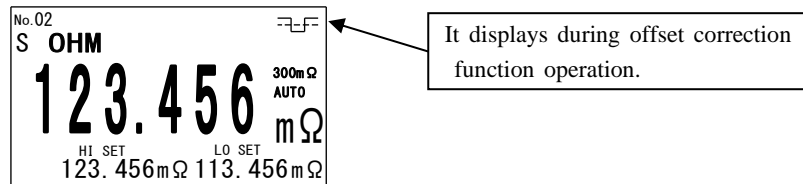


3.11 • Offset voltage correction function

Thermal electromotive force or internal offset voltage of this meter is corrected.

The result computed from the calculation formula is displayed as below from the measurement value (Rp) of the current flowing in the positive direction and the measurement value (Rr) of the current flowing in the reverse direction.

$$\frac{R_p - R_r}{2} \quad \text{Thermal electromotive force acceptable range} \cdots \text{Less than 1mV}$$



If the measured target is capacitive, it might take a long time for the switching response of the current.

In such a case, it is possible to set the delay time with start delay time.

Set the delay time aimed to be ten times the calculation formula as shown below so that the inductance is not affected.

$$t = -\frac{L}{R} \ln\left(1 - \frac{IR}{V_o}\right)$$

L : Inductance of the sample

R : Resistance of the sample + lead resistance + contact resistance

I : Measured current

V_o : Open voltage (6V)

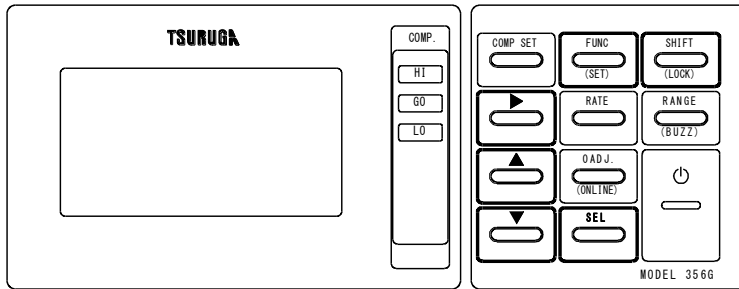
Even when the sample is a pure resistance, it is important to have 1ms~10ms of delay time.

Note: When zero adjustment is used, after setting of the offset voltage correction, re-set the zero adjustment.

When offset voltage correction function is enabled, the sampling time becomes about two times longer.

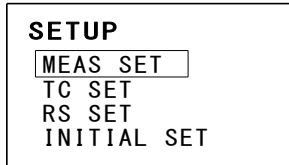
3.11.1 Setting method

During key lock, HOLD status, ONLINE and external control (EXT. display) status, operation cannot be done.

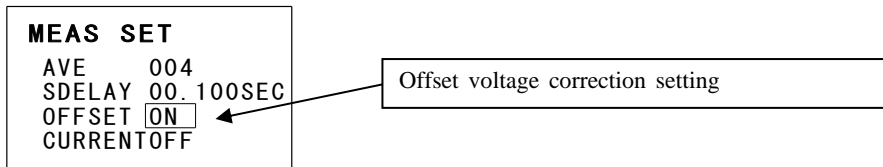


Setting after moving to setting screen

- ① Press **SHIFT** key.
SHIFT is displayed on the right side of LCD.
- ② Press **FUNC(SET)** key.
LCD switches to 「SETUP」 screen and 「MEAS SET」 becomes selection status.
When 「MEAS SET」 is not in the selection status, selection is done with [▼] key.



- ③ When [▶] key is pressed during 「MEAS SET」 selection status, it switches to 「MEAS SET」 screen and becomes in the state of 「AVE」 of highest digit.



- ④ Offset voltage correction is set by selecting 「OFFSET」 with [SEL] key.
Set ON/OFF with [▼][▲] key.
ON : Offset voltage correction function is enabled.
OFF: Offset voltage correction function is disabled.

End

- ⑤ Press **SHIFT** key.
SHIFT is displayed on the right side of LCD.
- ⑥ Press **FUNC(SET)** key.
Setting is memorized and returns to the measurement display.

3.12●Start delay

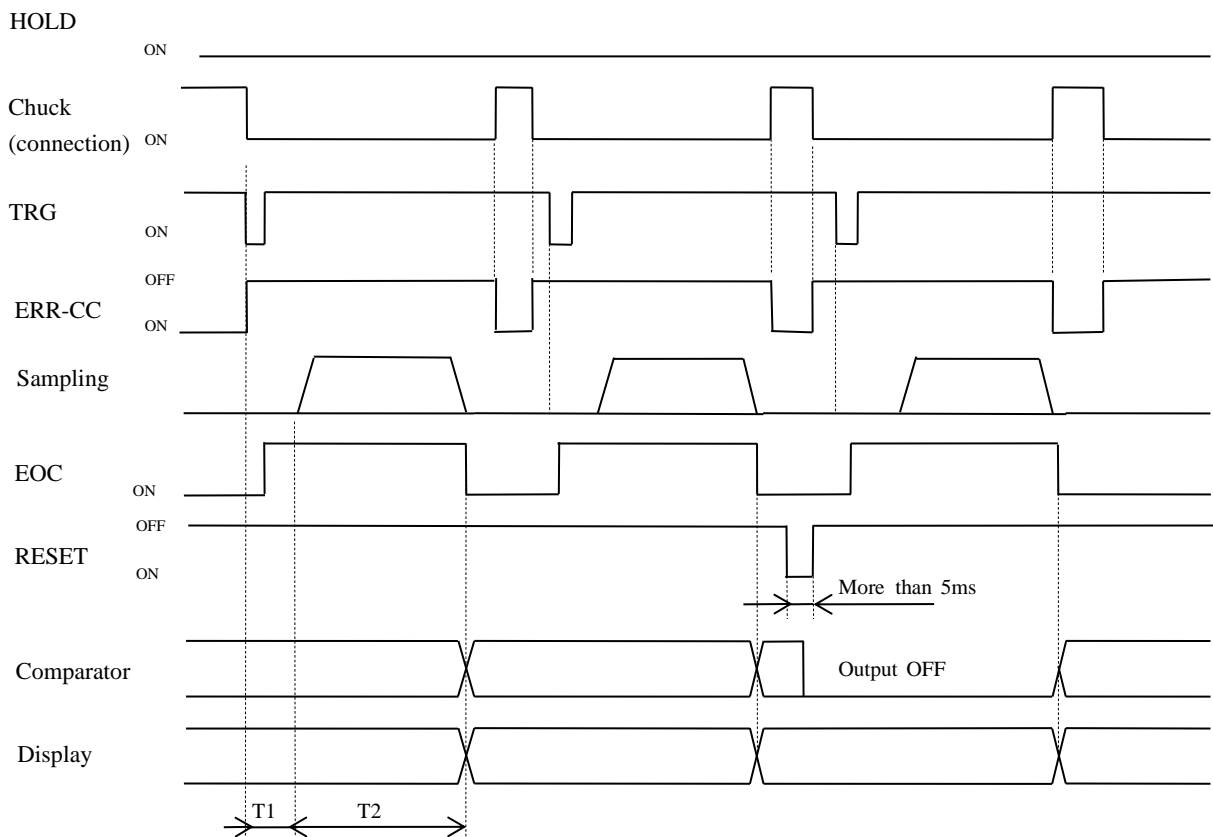
The setting of delay time until the start of measurement during HOLD, TRG signal and start time with READ communication command is possible.

After the connection with the sample, even when started, it is possible to do the stable measurement.

Setting range 0ms~10.000s (10 sec.)
 Accuracy Within $\pm 1\%$ of setting value

Timing chart

- Average count 1time
- Offset voltage correction function OFF



T : Response time
 $T=T1+T2$
 T1 : Start delay
 T2 : Measurement time (Measurement+ Processing time)
 T1+T2 : Response time

T1 Processing time

Offset voltage correction function OFF

Average count $\times 0.1\text{ms}+3\text{ms}$

Offset voltage correction function ON

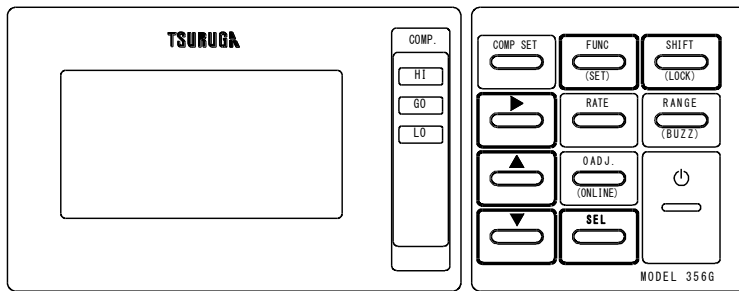
Average count $\times 0.1\text{ms}+6\text{ms}$

When the range is changed during HOLD, 15ms of range switching time will be added.



3.12.1 Setting method

During key lock, HOLD status, ONLINE and external control (EXT. display) status, operation cannot be done.



Setting after moving to setting screen

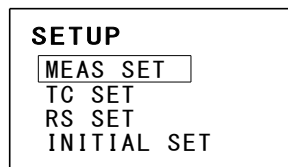
- ① Press **SHIFT** key.

SHIFT is displayed on the right side of LCD.

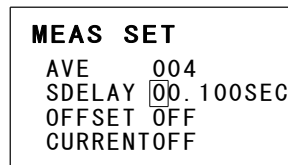
- ② Press **FUNC (SET)** key.

LCD switches to 「SETUP」 screen and 「MEAS SET」 becomes selection status.

When 「MEAS SET」 is not in selection status, selection is done with [▼] key.



- ③ When [▶] key is pressed during 「MEAS SET」 selection status, it switches to 「MEAS SET」 screen and becomes in the selected state of 「AVE」 of highest digit.



Start delay is set to 0.1 sec.

- ④ 「SDELAY」 is selected with [SEL] key and start delay is set.

Digit is changed with [▶] key and setting value is changed with [▼] [▲] key.

There is no start delay in case the setting is 0.000sec.

End

- ⑤ Press **SHIFT** key.

SHIFT is displayed on the right side of LCD.

- ⑥ Press **FUNC (SET)** key

The setting is memorized and it returns to measurement display.

3.13●Measured current limit function

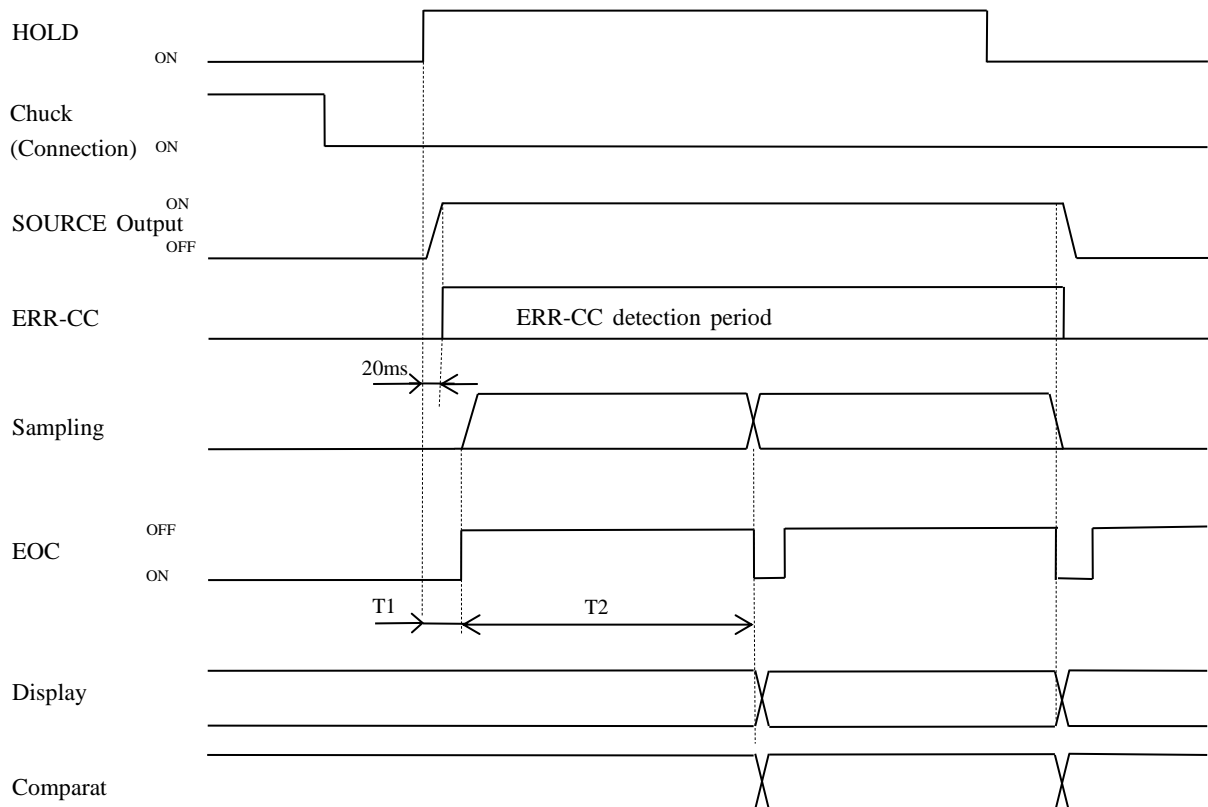
It is a function to turn off the measured current (SOURCE) during sampling HOLD.

If the measured object is inductive, during probe connection, resonance phenomenon is occurred and the measurement is not stable and there is a case when stress is added to the resistance meter where overvoltage is applied due to the counter electromotive force. By using the measured current limit function, it is possible to reduce the resonance phenomenon and back electromotive force.

Timing chart

- Average count 1 time
- Offset voltage correction function OFF

[During release of HOLD]

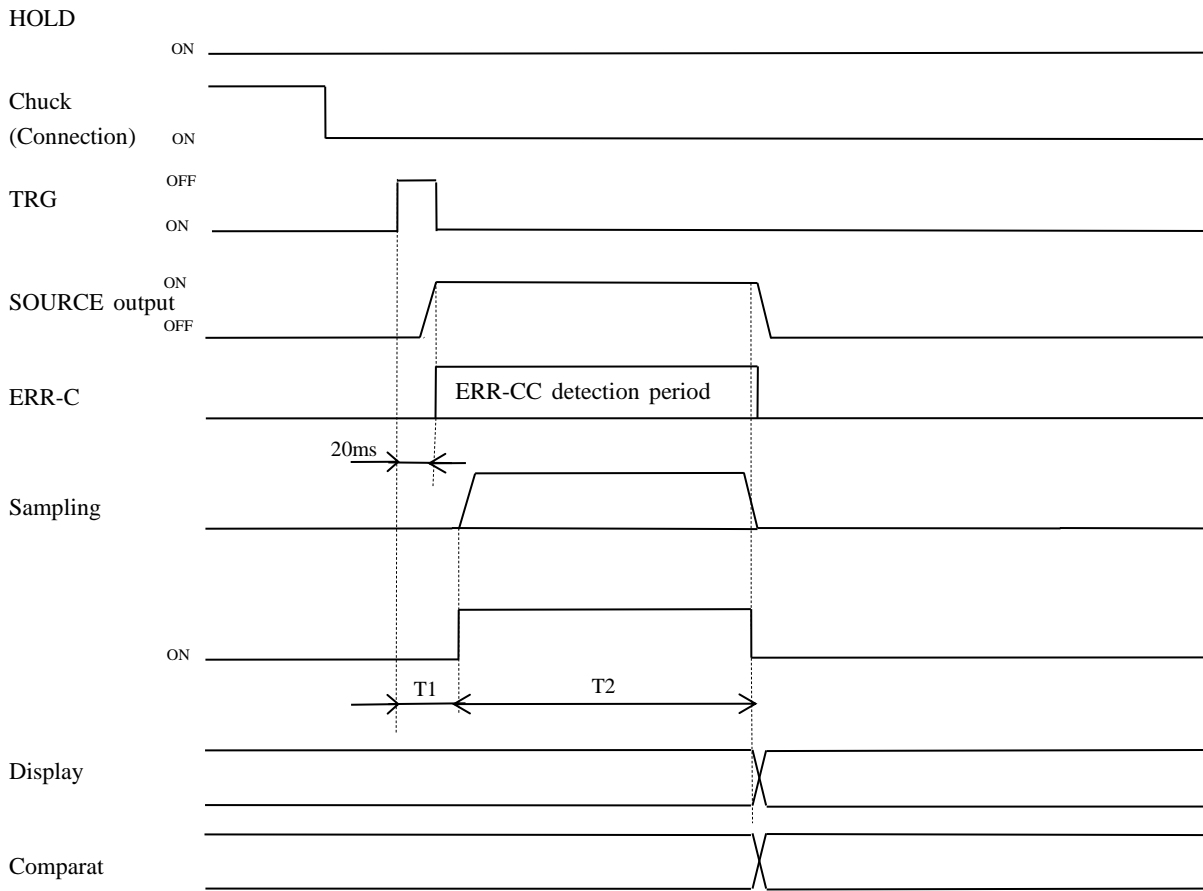


T1 : 50ms + Start delay time

When the range is changed during HOLD, 15ms of range switching time will be added.

T2 : Sampling time + processing time

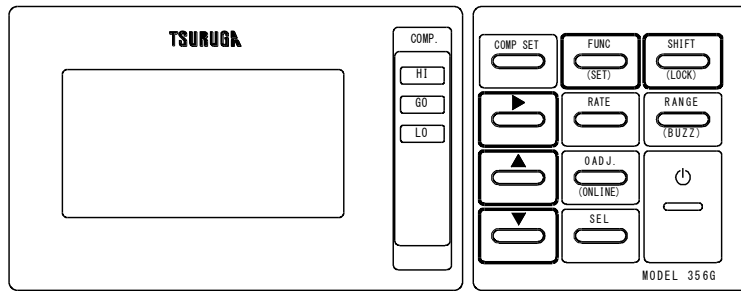
[Sampling with TRG or READ during HOLD]



T1 : 50ms + Start delay time
 When the range is changed during HOLD, 15ms of range switching time will be added.
 T2 : Sampling time + processing time

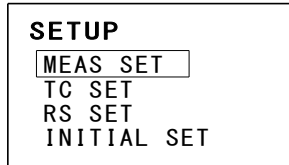
3.13.1 Setting method

During key lock, HOLD status, ONLINE and external control (EXT. display) status, the operation cannot be done.

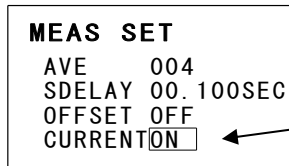


Setting after moving to setting screen

- ① Press **SHIFT** key.
SHIFT is displayed on the right side of LCD.
- ② Press FUNC (SET) key
LCD switches to 「SETUP」 screen and 「MEAS SET」 becomes selection status.
When 「MEAS SET」 is not in selection status, selection is done by [▼] key.



- ③ When [▶] key is pressed during 「MEAS SET」 selection status, it switches to 「MEAS SET」 screen and becomes in the selected state of 「AVE」 of highest digit.



Measured current limit function setting

- ④ Measured current limit function is set by selecting 「CURRENT」 with [SEL] key.
Setting value is changed with [▼] [▲] key.

End

- ⑤ Press **SHIFT** key.
SHIFT is displayed on the right side of LCD.
- ⑥ Press FUNC (SET) key.
The setting is memorized and returns to the measurement display.

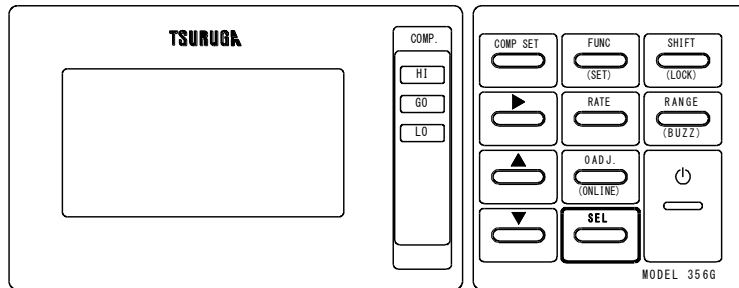
3.14●Program memory

This meter is equipped with 30 sets of program memory which memorizes measurement function, range, comparator setting.

It is possible to select the memory with key operation, signal and communication of REMOTE connector.

3.14.1 Selection of program memory

During key lock, HOLD status, ONLINE and external control (EXT. display) status, the operation cannot be done.



Selection of program memory

Program memory no. is displayed on the left side of LCD.

When [SEL] key is pressed, memory no. changes and it switches to the setting being memorized in memory.

3.14.2 Registration of program memory

Set the measurement function, measurement range and upper and lower limit comparator after the selection of registered memory no. (During ratio calculation, upper and lower comparator becomes standard resistance and the deviation)

3.15•Temperature correction function

The conductor resistance and ambient temperature are measured and the measured conductor resistance is displayed in terms of the standard value.

The standard temperature can be set to 0.0~99.9°C and the temperature coefficient can be set to the range of 1000~9999ppm. Measurement of ambient temperature is done by connecting Pt100Ω temperature sensor.

Calculation formula:
$$R_T = \frac{R_t}{1+(\alpha \times 10^{-6}) \times (t-T)} \quad (\Omega)$$

t : Ambient temperature (°C)

R_T : Correction resistance (Ω)

R_t : Resistance value (Ω) at the ambient temperature

α : Temperature coefficient ∙ ∙ ∙ Setting range 1000~9999ppm

T : Standard temperature ∙ ∙ ∙ ∙ Setting range 0.0~99.9°C

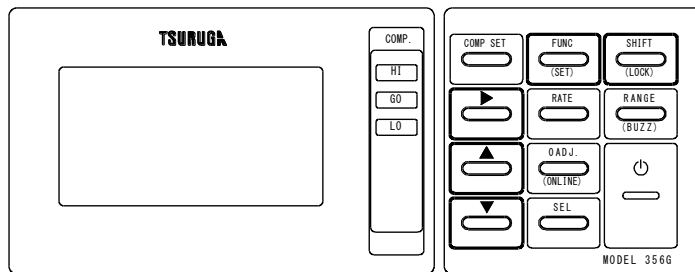
Accuracy during temperature correction function : Addition of ±0.3% of rdg. to accuracy of resistance measurement.

Calculation range : Maximum 399999

When the calculation result exceeds 399999, it becomes OVER display.

3.15.1 Setting method

During key lock, HOLD status, ONLINE and external control (EXT. display) status, the operation cannot be done.



Setting after moving to setting screen

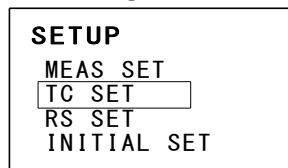
① Press **SHIFT** key.

SHIFT is displayed on the right side of LCD.

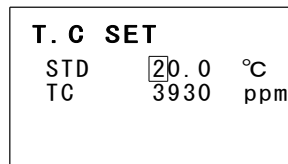
② Press **FUNC(SET)** key.

LCD switches to 「SETUP」 screen and 「MEAS SET」 becomes selection status.

「T.C SET」 is selected with [▼] key.



③ When [▶] is pressed during 「T.C SET」 selection status, it switches to 「T.C SET」 screen and becomes in the selected state of 「STD」 of highest digit.



STD : Correction temperature setting

T.C : Correction constant (Temperature coefficient)

④ 「STD」 and 「T.C」 are selected with [SEL] key.

Digit is selected with [▶] key.

Setting value is set with [▼] [▲] key.

End

⑤ Press **SHIFT** key.

SHIFT is displayed on the right side of LCD.

⑥ Press **FUNC (SET)** key.

The setting is memorized and returns to the measurement display.

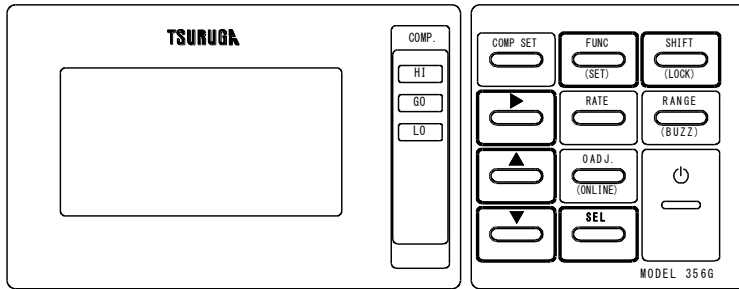
3.16●Communication setting

Communication setting of USB, RS-232C and RS-485 are performed.

Equipment number	The equipment which communicates during connection with multiple units is specified with RS-485. 01 is set in case of USB and RS-232C
Communication speed ,Parity	When communication is done with RS-232C and RS-485, the communication speed of the equipment that communicates and parity is matched.

3.16.1 Setting method

During key lock, HOLD status, ONLINE and external control (EXT. display) status, the operation cannot be done.



Setting after moving to setting screen

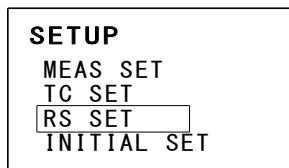
- ① Press **SHIFT** key.

SHIFT is displayed on the right side of LCD.

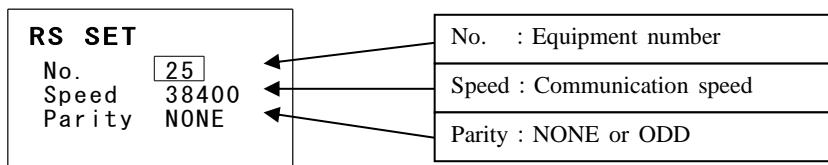
- ② Press **FUNC(SET)** key.

LCD switches to 「SETUP」 screen and it 「MEAS SET」 becomes selection status.

「RS SET」 is selected with [▼] key.



- ③ When [▶] key is pressed during 「RS SET」 selected status, it changes to 「RS SET」 and 「No.」 becomes the selected status.



- ④ 「No.」, 「Speed」 and 「Parity」 are selected with [SEL] key.

Setting value is set with [▼] [▲] key.

No. : Communication equipment number

Setting range : 00~99

Equipment number is added to the communication data.

In RS485, the equipment is identified with the connection of multi-drop.

Speed : RS-232C and RS-485 communication speed is set.

Setting range : 4800,9600,19200,38400bps

Parity : Parity of RS-232C and RS-485 are set.

Setting range : NONE, EVEN, ODD

End

- ⑤ Press **SHIFT** key.

SHIFT is displayed on the right side of LCD.

- ⑥ Press **FUNC (SET)** key.

After setting is memorized, it returns to measurement display.

3.17●Memory and initialization of setting

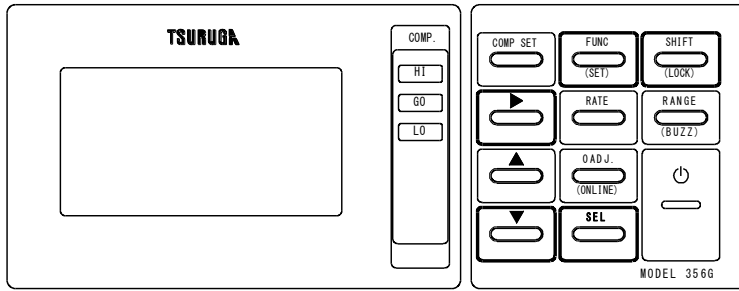
Program memory and various settings are returned to factory settings.

Items		Setting range	Default value (Factory settings)
Key lock		ON/OFF	OFF
Sampling		SLOW/MEDIUM/FAST	SLOW
Zero adjustment state		ON/OFF	OFF
Zero adjustment value		-199999~350000	0
Buzzer setting		OFF/GO/HI/LO/NG	OFF
Buzzer volume		1~10	5
RS232C RS-485	Equipment no.	00~99	01
	Communication speed	4800/9600/19200/38400 (bps)	19200 (bps)
	Parity	None/Even/Odd	None
Start delay		0.000~10.000 (sec.)	0.010 (sec.)
T.C Temperature coefficient		1000~9999 (ppm)	3930 (ppm)
T.C Standard temperature		0.0~99.9 (°C)	20.0 (°C)
Average function		1~100	1
Offset voltage correction		ON/OFF	OFF
Measurement current limit function		ON/OFF	OFF
Memory no.		01~30	01
Function		OHM/ TEMP/ T.C/ T.C-RATIO/ OHM-RATIO	OHM
Range		30mΩ/ 300mΩ/ 3Ω/ 30Ω/ 300Ω/ AUTO	3Ω
Comparator H		-199999~350000	300000
Comparator L		-199999~350000	100000
Comparator range		30mΩ/ 300mΩ/ 3Ω/ 30Ω/ 300Ω	3Ω
RATIO deviation		0.0~100.0	10.0
RATIO range		30mΩ/ 300mΩ/ 3Ω/ 30Ω/ 300Ω	3Ω
RATIO standard resistance value		-199999~350000	300000

Setting value
memory
(01~30)

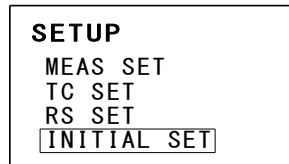
3.17.1 Setting method

During key lock, HOLD status, ONLINE and external control (EXT. display) status, the operation cannot be done.

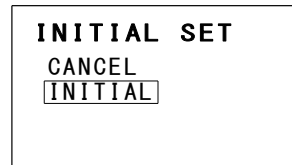


Setting after moving to setting screen

- ① Press **SHIFT** key.
SHIFT is displayed on the right side of LCD.
- ② Press FUNC(SET)key.
LCD switches to 「SETUP」 screen and 「MEAS SET」 becomes selection status.
「RS SET」 is selected with [▼] key.



- ③ When [▶] key is pressed during 「INITIAL SET」 selection status, it switches to 「INITIAL SET」 screen.



- ④ 「CANCEL」 and 「INITIAL」 can be selected with [SEL] key.
CANCEL : The initialization of setting value is not performed.
INITIAL : If the operation is performed after setting, the setting value is initialized.

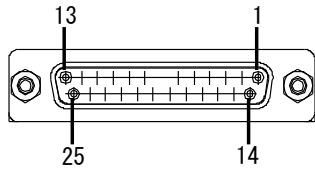
Initialization and End

- ⑤ Press **SHIFT** key.
SHIFT is displayed on the right side of LCD.
- ⑥ Press FUNC(SET)key.
In case INITIAL is selected, setting memory is initialized and returns to the measurement display.
In case CANCEL is selected, it returns to the measurement display without initialization.

4. External control

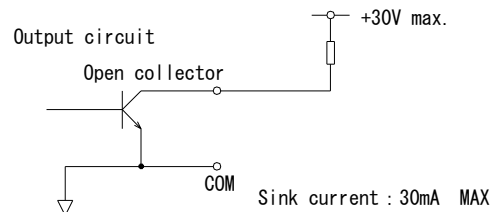
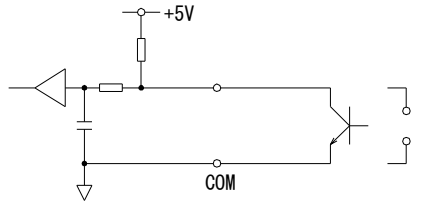
4.1 Remote connector

4.1.1 Pin array



Connector use [OMRON:XM3B-2522-112]

Input circuit ("L" =Less than 1.5V "H" =3.5~5V $I_{IL} \leq -1mA$)



Pin no.	Signal		Functions
	Signal name	Input/ Output	
1	HI OUT	Output	HI judgment output : During HI judgment, output is ON
2	GO OUT	Output	GO judgment output : During GO judgment, output is ON
3	LO OUT	Output	LO judgment output : During LO judgment, output is ON
14,15, 16	HI COM GO COM LO COM		Common of HI OUT, GO OUT, LO OUT judgment output (HI COM, LO COM, GO COM are connected internally)
4	HOLD	Input	Hold the display value and comparison output at Lo level input.
5	RESET	Input	Reset (OFF) the judgment at Lo level input.
6	0ADJ.	Input	Hold resistance measurement value just before the change from Hi level to Lo level as zero adjustment and display the value obtained by subtracting the zero adjustment value from measurement value during Lo level.
7	TRG	Input	During HOLD, sampling is done once if there is a change from Hi level to Lo level. After sampling (during display update), measurement data is output once in RS-232C and USB. Note: During the connection of RS-485, when the multiple units are controlled at the same time, there is a collision of data output, so control is done at different times.
8	EOC	Output	When sampling ends, it outputs 1ms of ON pulse.
9	ERR0	Output	When resistance measurement is over, it outputs ON. (OHM, T.C, T.C RATIO, OHM RATIO)
10	ERR1	Output	During TEMP calculation error with temperature correction, it outputs ON.(T.C,T.C RATIO)
11	ERR-CC	Output	When current output terminal is open (disconnected), it outputs ON.
23	MEM EN	Input	In Lo level input, specified memory is called with M-SEL0~M-SEL4. During this time, [EXT] is displayed on LCD display and external control status is displayed.
18 19 20 21 22	M-SEL0 M-SEL1 M-SEL2 M-SEL3 M-SEL4	Input	Memory number of memory code table is specified.
12,24	COM		Common input output signal other than judgment
17	Unused		Unused pin It is connected to internal circuit, so don't use for relay etc.
13,25	A+, A-	Output	It is an optional analog output terminal. A+ : + pole of analog output A- : - pole of analog output NC in the case of no analog output.

4.1.2 Memory selection

- ①When MEM EN signal is at Lo level, it is possible to select the memory.
[EXT] is displayed on LCD display.
- ②Code of memory number is entered.

Memory code table

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	1 6																

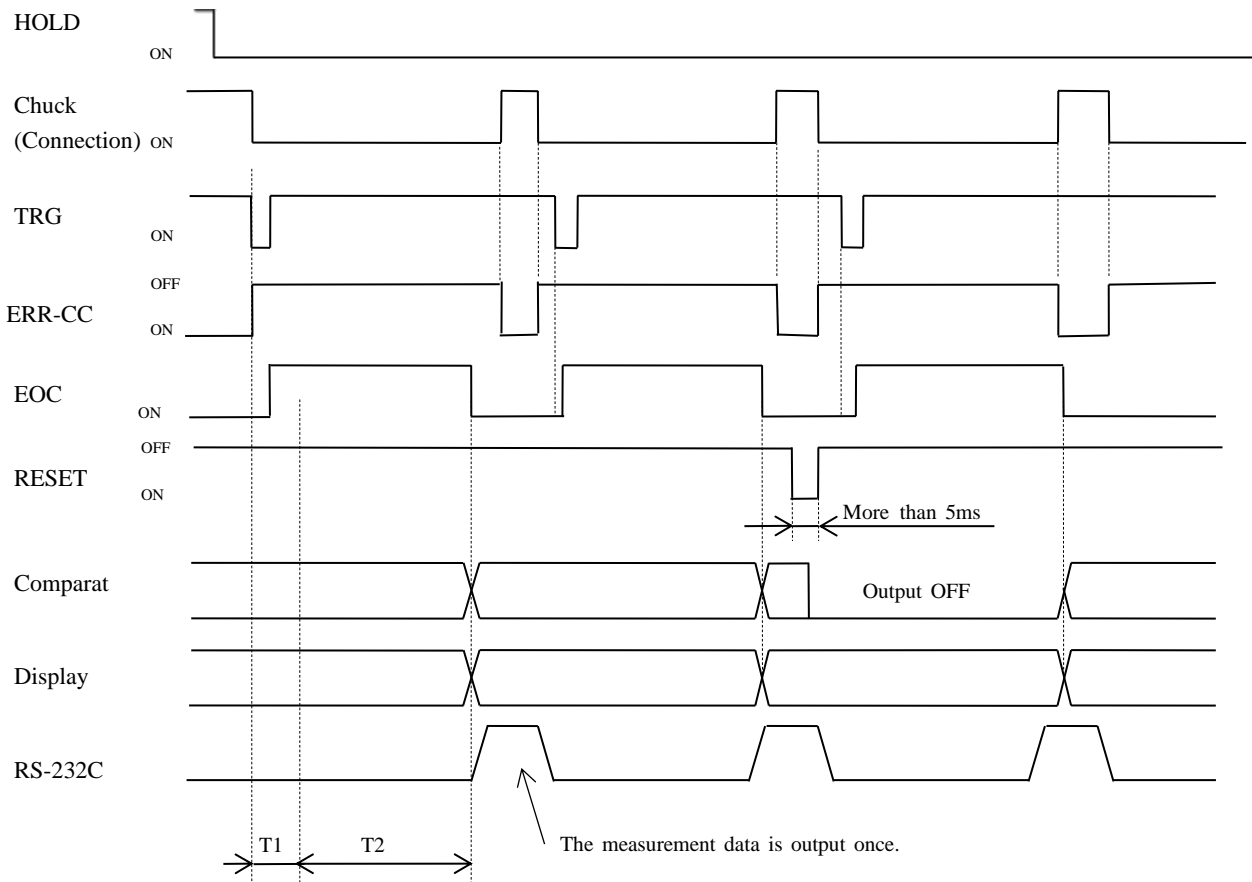
Signal	Weight	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
M-SEL0	1		○		○		○		○		○		○		○		○
M-SEL1	2			○	○			○	○			○	○			○	○
M-SEL2	4					○	○	○	○					○	○	○	○
M-SEL3	8									○	○	○	○	○	○	○	○
M-SEL4	1 6	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○

- : Turned ON.
- Blank : Turned OFF.
- 0,31 : This code is invalid.
- EXT. display is turned off.

Note : During HOLD, display does not change even when the memory is switched.
It will be reflected at the time of sampling start.

4.1.3 External control timing chart

① When sampling is done with TRG signal during HOLD



T : Response time

$$T = T1 + T2$$

T1 : Start delay

When range is changed during HOLD, 15ms of range switching time is added.

When the measurement current limit function is ON, 50ms is added.

T2 : Measurement time

$$\text{Sampling rate} \times \text{Average count} + \text{Processing time}$$

Processing time

Offset voltage correction function OFF

$$\text{Average count} \times 0.1\text{ms} + 3\text{ms}$$

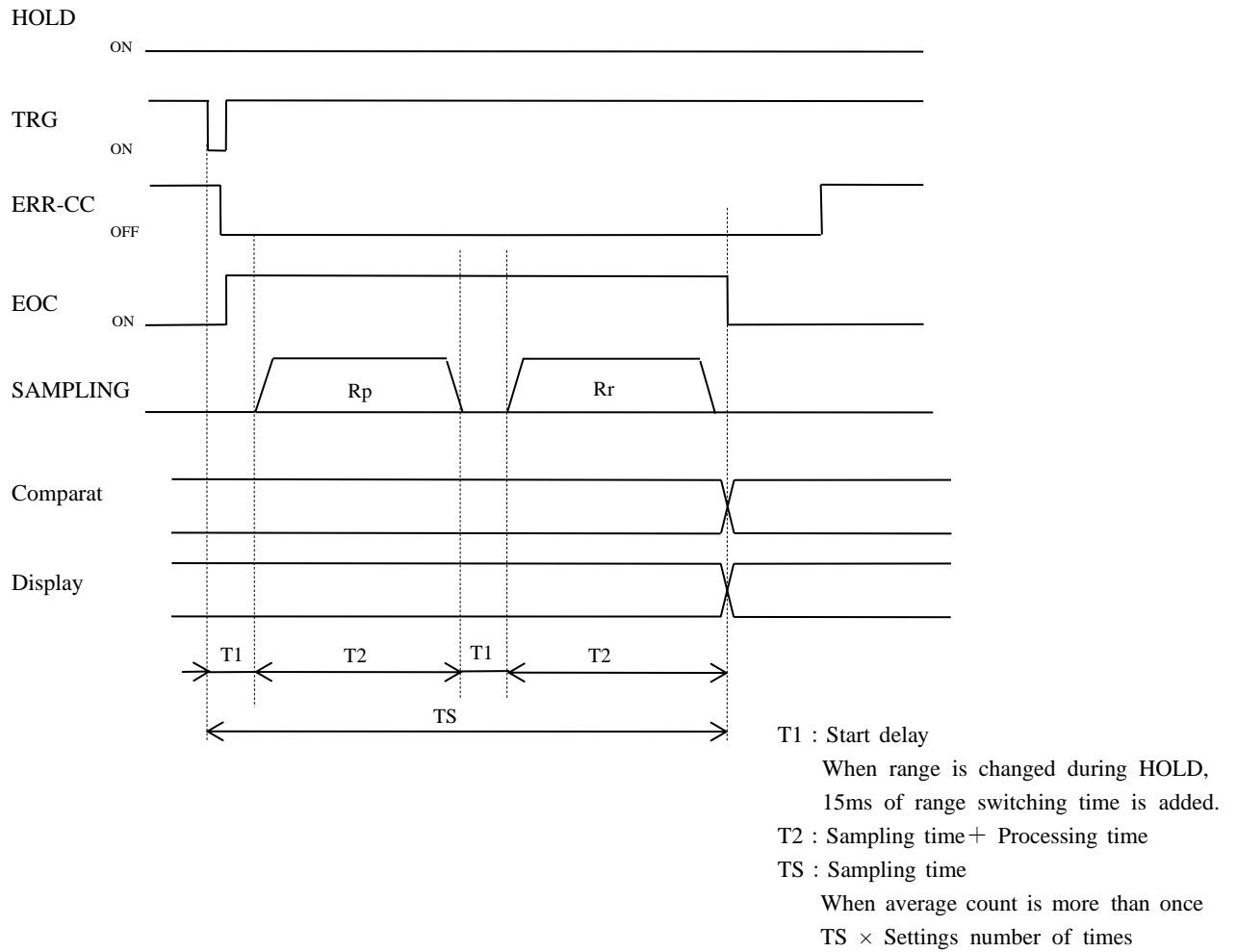
Offset voltage correction function ON

$$\text{Average count} \times 0.1\text{ms} + 6\text{ms}$$

Operation description

1. After connecting the measurement probe, wait till the measurement value is stable (T1) and output of TRG signal is obtained in the resistance meter.
2. When TRG signal is ON, the sampling is started.
When sampling ends (T2), EOC is output together with the judgment output, update of the display and output of data in RS-232C and USB.
3. The judgment ends the next sampling and holds till the judgment output is renewed.
4. During HOLD, if RESET input is turned ON, judgment output is turned OFF.

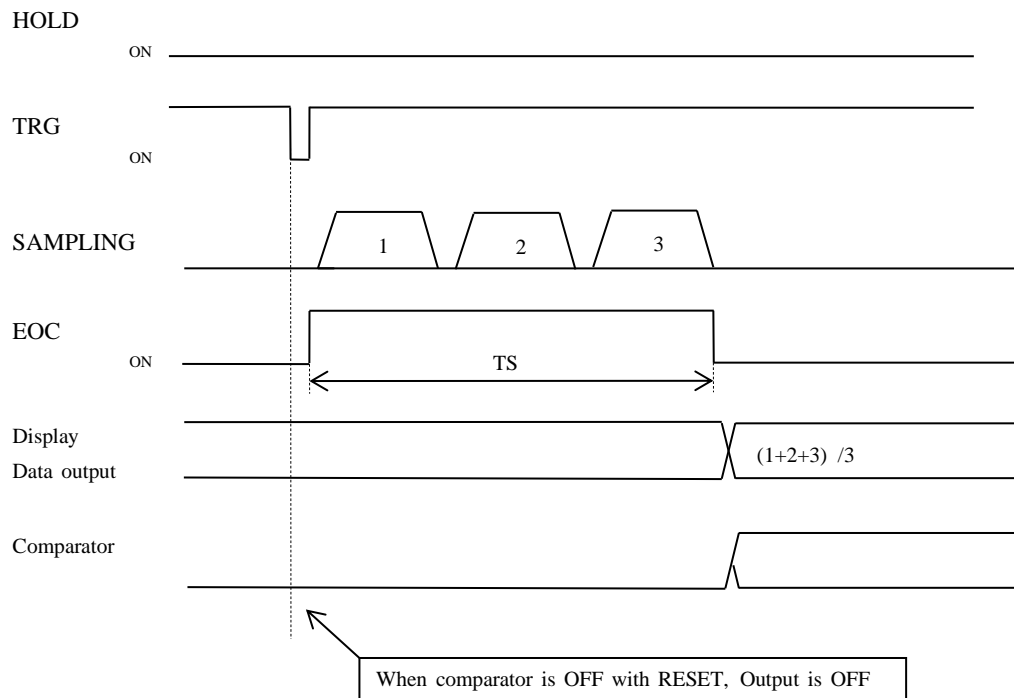
When offset voltage correction function is ON and measurement current limit function is OFF



Operation description

1. When offset voltage correction function is set ON, the current output operates as one time sampling with the measurement of the positive electrode (R_p) and negative electrode (R_r).
The update period of judgment output and display is about 2 times.
During the current polarity reversal, start delay setting time ($T1$) is waited for the circuit stability.

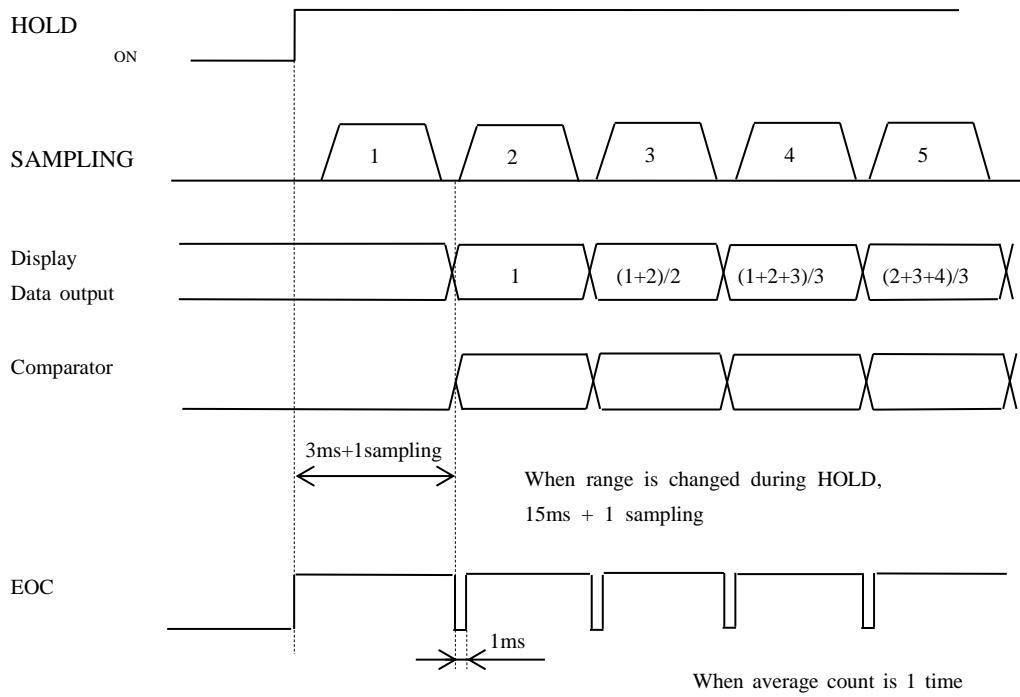
- ②When average calculation is performed (When average setting is greater than 1)
 Start sampling with TRG signal during HOLD.



Operation description

1. When sampling is started with TRG signal during HOLD, after average count of sampling, judgment output and display are renewed.
 When offset voltage correction function is ON, as current positive electrode and current negative electrode becomes 1 sampling, the sampling time (TS) becomes double.

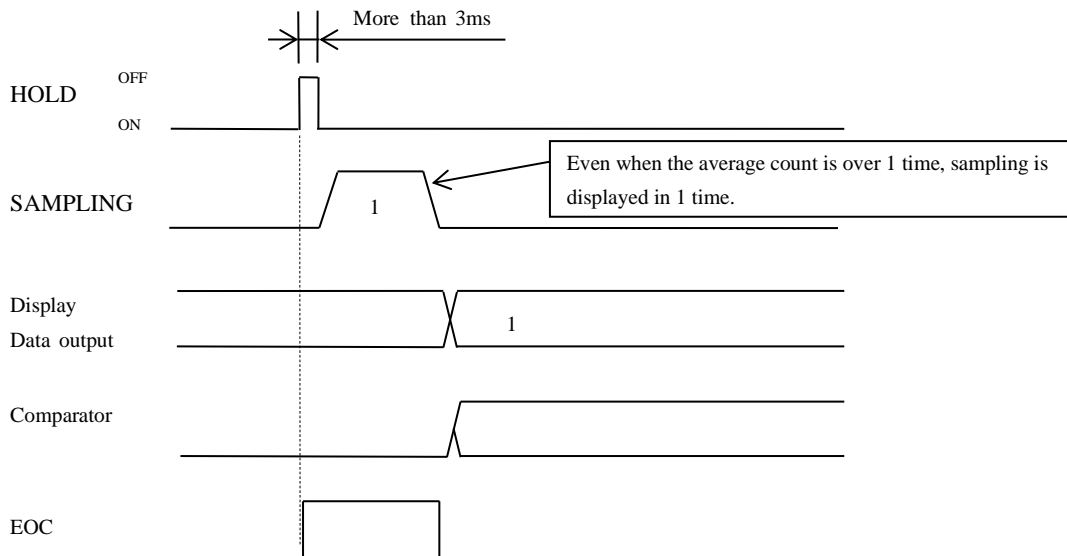
Start sampling with HOLD release (OFF)



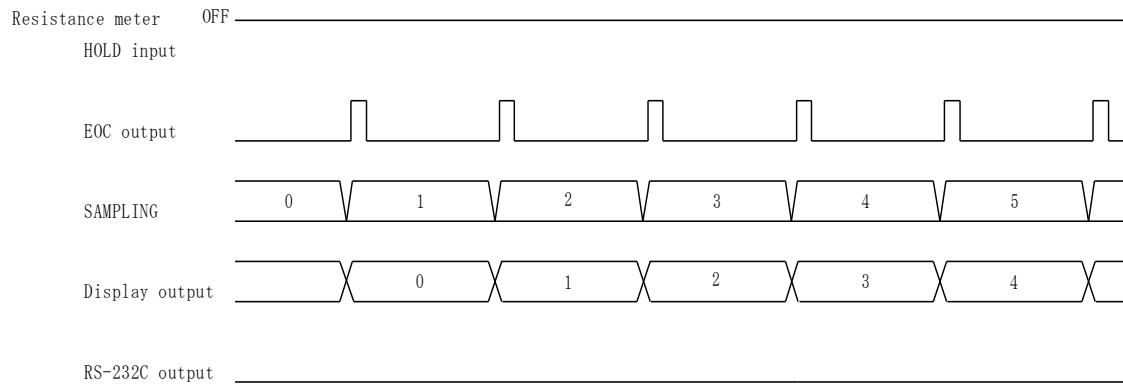
Operation description

1. When sampling is started with release (OFF) of HOLD during HOLD, judgment output and display are renewed in the first time sampling. The display value is average value till average count and beyond the average count, moving average value is displayed.

When HOLD is released (OFF) with the pulse within 1 sampling time



③When HOLD signal is opened (Free sampling)



Operation description

1. 356G performs sampling repeatedly.

Judgment output and display are renewed before the end of sampling and simultaneously with EOC output.

When offset voltage correction function is ON, as current positive electrode and current negative electrode becomes 1 sampling, the sampling time (TS) becomes double.

5. Communication (RS-232C, RS-485, USB)

The setting of this meter and the measurement data can be read with the communication interface.

Note: The connection of communication cable must be done in the state when the power cable of 356G is disconnected.

5.1●Specifications

5.1.1 Specifications of RS-232C, RS-485

Transmission system	RS-232C : Start-stop synchronous full duplex RS-485 : Start-stop synchronous half duplex
Transmission speed	38400, 19200, 9600, 4800 bps (Set to 19200bps at delivery from factory)
Data bit length	8 bit
Stop bit	1 bit
Parity bit	Nil, even number, odd number (Set to nil at delivery from factory)
Delimiter	CR+LF

5.1.2 Specifications of USB

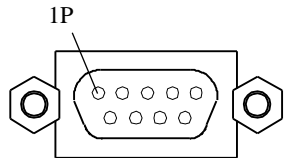
Class	HID class
Connector	Type B

Note: The use of RS485 USB and RS-232C cannot be done simultaneously.

5.2●Connection

5.2.1 Connection of RS-232C

Meter connector D-sub 9 pin



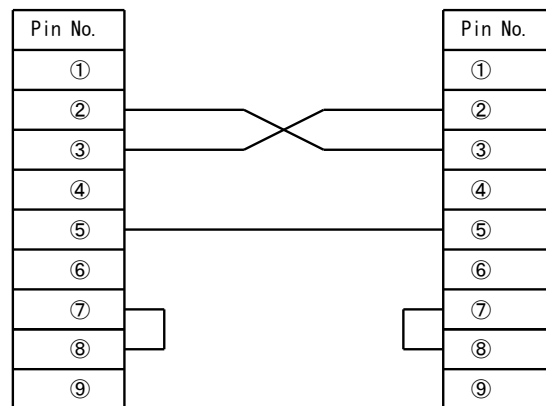
Connector in use [OMRON:XM2C-0942-132L]

Pin No.	Signal name (JIS)	Direction	Name
①			Not in use
②	RD (RXD)	Input	Receiving data
③	SD (TXD)	Output	Transmission data
④			Not in use
⑤	SG (GND)		Ground for signal
⑥			Not in use
⑦			Not in use
⑧			Not in use
⑨			Not in use

Connection cable : Use the cross cable 5881-11-020.

(The communication may not be possible when cable other than specified is used.)

Connection of cable



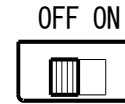
5.2.2 Connection of RS-485

RS-485 terminal, Terminator

Terminal No.	1	2
Signal Name	+ (A)	- (B)

If the rear panel switch is switched ON, the terminal resistor 200Ω will be connected in parallel.

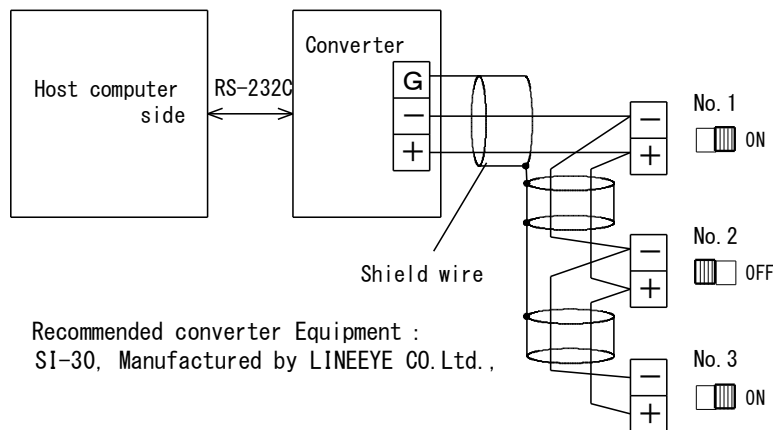
If you want to use this meter in end station, terminator is switched ON.



If high level computer is included, RS-485 can be connected up to 32 units.

Besides, for the both ends of the equipment of the transmission line, it is necessary to specify the end stations.

When specifying the end station, switch ON the terminator switch.



5.2.3 Connection of USB

Connect the cable with the included utility software.

5.3●Communication setting

The setting of equipment no., transmission speed and parity bit is done according to the type of the equipment. For setting method refer 3.16.1 Communication setting method.

Setting items	Setting required interface		
	USB	RS-232C	RS-485
Equipment no.	— ※	— ※	○ ※
Transmission speed	—	○	○
Parity bit	—	○	○

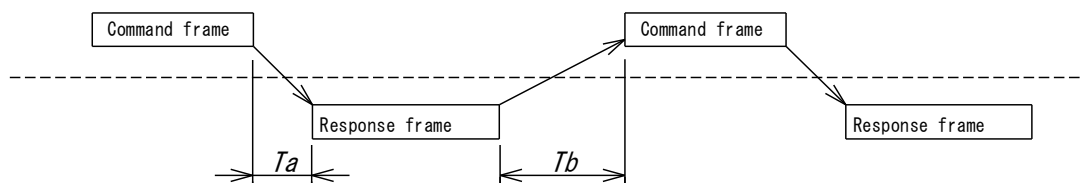
— : No setting needed

○ : Setting needed

※ : The setting detail will be the equipment number of data.

When connecting multiple units with multi-drop connection of RS-485, do the setting so that the equipment number does not overlap.

5.4●Operation description



T_a Command response time : MAX. About 50ms (WRITE MEMORY Command time MAX. 2.2sec.)

T_b Command prohibition time after response : RS-232C, USB MAX. 5ms

RS-485 MAX. 15ms

Response frame: If a valid setting command is received, received content is returned.

If a valid output command is received, specified data is output.

Note: When performing data communication, use the ONLINE of 356G in the ON state.

When ONLINE performs communication during OFF, there is no response except read out command.

If in case of changing by setting command, make HOLD status OFF.

5.5●List of communication commands

Read out command	Contents	Set and control command	Contents
MEM?	Read out the memory no.	MEM=CALL	Switching of memory no.
MEM01?	Read out the memory setting data of specified no.	WRITE MEMORY	Write down the setting value in the FLASH memory
COMP?	Read out comparator setting	COMP=	Comparator setting
FUNC?	Read out function	FUNCTION=	Function setting
RANGE?	Read out range setting	RANGE=	Range setting
HOLD?	Read out HOLD state	HOLD=	HOLD setting ON/OFF
RST?	Read out reset	RST=	Reset setting ON/OFF
SAMPLING?	Read out sampling setting	SAMPLING=	Sampling setting
RATIOSTD?	Read out RATIO setting	RATIOSTD=	RATIO setting
ZEROADJ?	Read out zero adjustment state	ZEROADJ=	Zero adjustment setting ON/OFF
ONLINE?	Read out online state	ONLINE=	Online setting ON: It is possible for each type of setting and read out (Including measurement value). OFF: Read out of measurement and setting is possible.
AVERAGE?	Read out average no. of times setting	AVERAGE=	Average no. of times setting
READ	Do sampling once and output data during HOLD	-	-
DATA?	Output measurement data	-	-

5.6●Data format

5.6.1 Command frame

Request for read out of measurement data and setting

0	1	D	A	T	A	?	C	L
							R	F
①		②					③	

Transmission of setting data

0	1	R	A	N	G	E	=	3	0	0	m	O	H	M	C	L
															R	F
①		②												③		

- ① : Equipment no. (2characters)
- ② : Command data (No. of characters depend on the command)
- ③ : Delimiter
 CR : Carriage Return (13H)
 LF : Line Feed (10H)

5.6.2 Response frame

0	1	A	R	A	N	G	E	=	3	0	0	m	O	H	M	C	L
																R	F
①		②	③											④			

- ① : Equipment no. (2characters)
- ② : Exit code (1character)

Exit code	Contents	Description	Presence or absence of response to command	
			=	?
A (41H)	Normal	Command has been received	○	○
B (42H)	Under setting	Under panel setting with key operation	○	—
C (43H)	Setting error	Specify the outside range with setting command	○	—
D (44H)	CC	Source terminal is open during measurement data transmission	—	○
E (45H)	Under external control	Under external control REMOTE connector	○	—
F (46H)	Command error	Received the setting command when ONLINE is switched to OFF state and command data is not correct.	○	○
P (50H)	Protect error	Under protection circuit operation after overvoltage is applied to measurement terminal	—	○

- ③ : Response data (No. of characters depend on the command)
- ④ : Delimiter
 CR : Carriage Return (13H)
 LF : Line Feed (10H)

●Temperature measurement (TEMP)

0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	2	2	2	2
1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3
0	1	A	T	E	M	P	§	=	§	§	§	1	0	0	.	0	§	'	C	§	C	L
																					R	F
①		②		③													④			⑤		

① : Equipment no.

② : Exit code

③ : Measurement data

T	E	M	P	§	=	§	§	§	1	0	0	.	0	During 100.0°C							
T	E	M	P	§	=	§	§	§	§	2	4	.	5	During 24.5°C							
T	E	M	P	§	=	-	§	§	§	1	9	.	9	During -19.9°C							

④ : Unit

⑤ : Delimiter (CR+LF)

●Temperature correction (T.C)

0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	2	2	2
1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2
0	1	A	T	.	C	§	§	=	§	2	9	9	.	9	9	9	§	O	H	M	,
①		②		③													⑥			⑦	

2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	
3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8					
R	§	=	§	3	0	0	.	0	0	0	m	O	H	M	,					
④													⑥			⑦				

3	4	4	4	4	4	4	4	4	4	4	4	5	5	5	5	5	5	5	5	5
9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6			
T	E	M	P	=	§	§	§	§	3	9	.	9	§	'	C	§	.			
⑤													⑥			⑦				

5	5	5	6	6	6	6	6	6	6	6	6	6	7	7	7	7	7	7	7	
7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3				
§	J	U	D	G	E	=	H	I	G	H	§	L	O	W	C	L				
⑧																⑨				

① : Equipment no.

② : Exit code

③ : Correction resistance value (R_T)

④ : Resistance measurement value (R_t)

⑤ : Ambient temperature (t)

⑥ : Unit

⑦ : Punctuation

⑧ : Judgment

⑨ : Delimiter (CR+LF)

●Ratio (OHM RATIO, T.C RATIO)

0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	2	2	2
1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2
0	1	A	R	A	T	I	O	=	§	§	§	1	9	9	.	9	§	§	%	§	,
①	②	③														⑥			⑦		

2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3
3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8					
R	s	=	§	3	0	0	.	0	0	0	m	O	H	M	,					
④											⑥					⑦				

3	4	4	4	4	4	4	4	4	4	4	4	5	5	5	5	5	5	5	5	5
9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4					
R	x	=	§	1	9	9	.	9	9	9	m	O	H	M	,					
⑤											⑥					⑦				

5	5	5	5	5	6	6	6	6	6	6	6	6	6	6	6	7	7	7	7	7
5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1				
§	J	U	D	G	E	=	H	I	G	H	§	L	O	W	C	L	R	F		
⑧																⑨				

- ① : Equipment no.
- ② : Exit code
- ③ : Ratio calculation value
- ④ : Standard resistance value (Rs)
- ⑤ : During OHM RATIO : Resistance measurement value
During T.C RATIO : Temperature correction value
- ⑥ : Unit
- ⑦ : Punctuation
- ⑧ : Judgment
- ⑨ : Delimiter (CR+LF)

5.7.4 RANGE? ... Read out of measurement range

Request of read out

0	0	0	0	0	0	0	0	0	0	1
1	2	3	4	5	6	7	8	9	0	
0	1	R	A	N	G	E	?	C	L	
								R	F	
①		②						③		

- ① : Equipment no.
- ② : Range request command (RANGE?)
- ③ : Delimiter (CR+LF)

Response

0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1
1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8
0	1	A	R	A	N	G	E	=	3	0	0	m	O	H	M	C	L
																R	F
①		②		③												④	

- ① : Equipment no.
- ② : Exit code
- ③ : Range setting

R	A	N	G	E	=	Ⓢ	3	0	m	O	H	M	30mΩ
R	A	N	G	E	=	3	0	0	m	O	H	M	300mΩ
R	A	N	G	E	=	Ⓢ	Ⓢ	3	Ⓢ	O	H	M	3Ω
R	A	N	G	E	=	Ⓢ	3	0	Ⓢ	O	H	M	30Ω
R	A	N	G	E	=	3	0	0	Ⓢ	O	H	M	300Ω
R	A	N	G	E	=	A	U	T	O	Ⓢ	Ⓢ	Ⓢ	AUTO

- ④ : Delimiter (CR+LF)

Note) Ⓢ : Space (20H)

5.7.5 RANGE= ... Setting of range

Range setting

0	0	0	0	0	0	1	1	1	1	1	1	1	1	2	2	
1	2	3	4	5	6	7	0	1	2	3	4	5	6	7	0	1
0	1	R	A	N	G	E	=	3	0	0	m	O	H	M	C	L
															R	F
①		②												③		

- ① : Equipment no.
- ② : Range setting

R	A	N	G	E	=	Ⓢ	3	0	m	O	H	M	30mΩ
R	A	N	G	E	=	3	0	0	m	O	H	M	300mΩ
R	A	N	G	E	=	Ⓢ	Ⓢ	3	Ⓢ	O	H	M	3Ω
R	A	N	G	E	=	Ⓢ	3	0	Ⓢ	O	H	M	30Ω
R	A	N	G	E	=	3	0	0	Ⓢ	O	H	M	300Ω
R	A	N	G	E	=	A	U	T	O	Ⓢ	Ⓢ	Ⓢ	AUTO

- ③ : Delimiter (CR+LF)

Note) Ⓢ : Space (20H)

Response

0	0	0	0	0
1	2	3	4	5
0	1	A	C	L
			R	F
①		②		③

- ① : Equipment no.
- ② : Exit code
- ③ : Delimiter (CR+LF)

5.7.6 SAMPLING? ... Read out of sampling

Request of read out

0	0	0	0	0	0	0	0	0	0	1	1	1	1
1	2	3	4	5	6	7	8	9	0	1	2	3	
0	1	S	A	M	P	L	I	N	G	?	C	L	
											R	F	
①		②										③	

- ① : Equipment no.
- ② : Sampling request command (SAMPLING?)
- ③ : Delimiter (CR+LF)

Response

0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	2
1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0
0	1	A	S	A	M	P	L	I	N	G	=	M	E	D	I	U	M	C	L
																		R	F
①		②		③														④	

- ① : Equipment no.
- ② : Exit code
- ③ : Sampling setting

S	A	M	P	L	I	N	G	=	S	L	O	W	␣	␣	SLOW
S	A	M	P	L	I	N	G	=	M	E	D	I	U	M	MEDIUM
S	A	M	P	L	I	N	G	=	F	A	S	T	␣	␣	FAST

- ④ : Delimiter (CR+LF)
- Note)** ␣ : Space (20H)

5.7.7 SAMPLING= ... Setting of sampling

Sampling setting

0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1
1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9
0	1	S	A	M	P	L	I	N	G	=	M	E	D	I	U	M	C	L
																	R	F
①		②														③		

- ① : Equipment no.
- ② : Sampling setting

S	A	M	P	L	I	N	G	=	S	L	O	W	␣	␣	SLOW
S	A	M	P	L	I	N	G	=	M	E	D	I	U	M	MEDIUM
S	A	M	P	L	I	N	G	=	F	A	S	T	␣	␣	FAST

- ③ : Delimiter (CR+LF)
- Note)** ␣ : Space (20H)

Response

0	0	0	0	0
1	2	3	4	5
0	1	A	C	L
			R	F
①		②		③

- ① : Equipment no.
- ② : Exit code
- ③ : Delimiter (CR+LF)

5.7.8 AVERAGE? ... Read out of average no. of times

Request of read out

0	0	0	0	0	0	0	0	0	0	1	1	1
1	2	3	4	5	6	7	8	9	0	1	2	
0	1	A	V	E	R	A	G	E	?	C	L	
										R	F	
①	②									③		

- ① : Equipment no.
- ② : Average no. of times request command (AVETIME?)
- ③ : Delimiter (CR+LF)

Response

0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6
0	1	A	A	V	E	R	A	G	E	=	1	0	0	C	L
														R	F
①	②	③										④			

- ① : Equipment no.
- ② : Exit code
- ③ : Average no. of times setting

A	V	E	R	A	G	E	=	1	0	0	100 times
A	V	E	R	A	G	E	=	0	1	0	10 times

- ④ : Delimiter (CR+LF)

Note) ☐ : Space (20H)

5.7.9 AVERAGE= ... Average no. of times setting

Average no. of times setting

0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
1	2	3	4	5	6	7	8	9	0	1	2	3	4	5
0	1	A	V	E	R	A	G	E	=	☐	9	0	C	L
													R	F
①	②										③			

- ① : Equipment no.
- ② : Average no. of times (1~100 time)

A	V	E	R	A	G	E	=	1	0	0	100 times
A	V	E	R	A	G	E	=	☐	☐	1	1 time

- ③ : Delimiter (CR+LF)

Note) ☐ : Space (20H)

Response

0	0	0	0	0
1	2	3	4	5
0	1	A	C	L
			R	F
①	②	③		

- ① : Equipment no.
- ② : Exit code
- ③ : Delimiter (CR+LF)

5.7.10 COMP? ... Read out of comparator setting

When function is OHM or T.C, setting of comparator HIGH (High limit value), LOW (Low limit value) is read out.

Request of read out

0	0	0	0	0	0	0	0	0	0	
1	2	3	4	5	6	7	8	9		
0	1	C	O	M	P	?	C	L		
							R	F		
①		②					③			

- ① : Equipment no.
- ② : Comparator setting request command (COMP?)
- ③ : Delimiter (CR+LF)

Response

0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	2	2	2
1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2
0	1	A	C	O	M	P	=	H	␣	3	0	0	.	0	0	0	m	O	H	M	,
①		②	③					④													⑥

2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3
3	4	5	6	7	8	9	0	1	2	3	4	5	6	7			
L	␣	1	0	0	.	0	0	0	0	m	O	H	M	C	L		
														R	F		
⑤														⑦			

- ① : Equipment no.
- ② : Exit code
- ③ : Comparator setting
- ④ : HIGH setting (High limit value)
- ⑤ : LOW setting (Low limit value)

H	␣	1	9	9	.	9	9	9	␣	O	H	M	HIGH	199.999	Ω
L	␣	␣	1	0	.	0	0	0	␣	O	H	M	LOW	10.000	Ω
H	␣	1	9	.	9	9	9	9	␣	O	H	M	HIGH	19.9999	Ω
L	-	␣	1	.	0	0	0	0	␣	O	H	M	LOW	- 1.0000	Ω

- ⑥ : Punctuation
- ⑦ : Delimiter (CR+LF)

Note) ␣ : Space (20H)

5.7.11 COMP= ... Comparator setting

When function is OHM or T.C, setting of comparator HIGH (High limit value), LOW (Low limit value) is done.

Comparator setting

0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	2	2
1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1
0	1	C	O	M	P	=	H	␣	3	0	0	.	0	0	0	m	O	H	M	,
①	②						③													⑤

2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	
2	3	4	5	6	7	8	9	0	1	2	3	4	5	6			
L	␣	1	0	0	.	0	0	0	m	O	H	M	C	L			
													R	F	④		⑥

- ① : Equipment no.
- ② : Comparator setting
- ③ : HIGH setting (High limit value)
- ④ : LOW setting (Low limit value)

H	␣	1	9	9	.	9	9	9	␣	O	H	M	HIGH	199.999	Ω
L	␣	␣	1	0	.	0	0	0	␣	O	H	M	LOW	10.000	Ω
H	␣	1	9	.	9	9	9	9	␣	O	H	M	HIGH	19.9999	Ω
L	-	␣	1	.	0	0	0	0	␣	O	H	M	LOW	-1.0000	Ω

Set the unit of HIGH setting and LOW setting to the same unit.

If different units are set, the unit of HIGH setting will be valid.

- ⑤ : Punctuation
- ⑥ : Delimiter (CR+LF)

Note ␣ : Space (20H)

5.7.12 RATIOSTD? ... Read out the ratio setting

When function is OHM RATIO or T.C RATIO, the standard resistance and deviation are read out.

Request of read out

0	0	0	0	0	0	0	0	0	0	1	1	1	1
1	2	3	4	5	6	7	8	9	0	1	2	3	
0	1	R	A	T	I	O	S	T	D	?	C	L	
											R	F	
①	②										③		

- ① : Equipment no.
- ② : Ratio setting request command (RATIOSTD?)
- ③ : Delimiter (CR+LF)

Response

0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2
1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5
0	1	A	R	A	T	I	O	S	T	D	=	␣	1	9	9	.	9	9	9	m	O	H	M	,
①	②	③										④										⑥		

2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3
6	7	8	9	0	1	2	3	4	5	6	7	8	9		
␣	␣	␣	1	0	0	.	0	␣	␣	%	␣	C	L		
												R	F		
⑤												⑦			

- ① : Equipment no.
- ② : Exit code
- ③ : Ratio setting
- ④ : Standard resistance value (Rs)
- ⑤ : Deviation setting value
- ⑥ : Punctuation
- ⑦ : Delimiter (CR+LF)

Note ␣ : Space (20H)

5.7.13 RATIOSTD= ··· Ratio setting

When function is OHM RATIO or T.C RATIO, standard resistance value and deviation are set.

Ratio setting

0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	
1	2	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5
0	1	R	A	T	I	O	S	T	D	=	␣	1	9	9	.	9	9	9	m	O	H	M	,
①	②										③										⑤		

2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
6	7	8	9	0	1	2	3	4	5	6	7	8	9	␣	␣	%	␣	C	L	R	F	
④										⑥												

- ① : Equipment no.
- ② : Ratio setting
- ③ : Standard resistance value setting

␣	2	0	.	0	0	0	0	m	O	H	M	Standard resistance value 30mΩ is set in range 20.0000mΩ									
␣	2	.	0	0	0	0	0	␣	O	H	M	Standard resistance value 3Ω is set in range 2.00000Ω									

- ④ : Deviation setting

␣	␣	␣	1	0	0	.	0	␣	␣	%	␣	Ratio range 100.0 %									
␣	␣	␣	␣	1	5	.	3	␣	␣	%	␣	Ratio range 15.3 %									

- ⑤ : Punctuation
- ⑥ : Delimiter (CR+LF)

Note) ␣ : Space (20H)

5.7.14 MEM? ... Read out of memory no.

Request of read out

0	0	0	0	0	0	0	0	0
1	2	3	4	5	6	7	8	
0	1	M	E	M	?	C	L	
						R	F	
①	②					③		

- ① : Equipment no.
- ② : Request command of memory no. (MEM?) being displayed
- ③ : Delimiter (CR+LF)

Response

0	0	0	0	0	0	0	0	0	1	1	1	1	1
1	2	3	4	5	6	7	8	9	0	1	2	3	4
0	1	A	M	E	M	=	N	o	.	0	9	C	L
												R	F
①	②	③										④	

- ① : Equipment no.
- ② : Exit code
- ③ : Memory no. (01~30)
- ④ : Delimiter (CR+LF)

5.7.15 MEM=CALL ... Switching of memory no.

Memory no. switching

0	0	0	0	0	0	0	0	0	1	1	1	1	1
1	2	3	4	5	6	7	8	9	0	1	2	3	4
0	1	M	E	M	=	C	A	L	L	0	1	C	L
												R	F
①	②										③		

- ① : Equipment no.
- ② : Memory no. switching command (MEM=CALL)
Memory no. 01~30
- ③ : Delimiter (CR+LF)

Response

0	0	0	0	0
1	2	3	4	5
0	1	A	C	L
			R	F
①	②	③		

- ① : Equipment no.
- ② : Exit code
- ③ : Delimiter (CR+LF)

5.7.16 MEM01? ... Read out of memory setting contents

Request of the read out

0	0	0	0	0	0	0	0	0	0	1
1	2	3	4	5	6	7	8	9	0	
0	1	M	E	M	0	1	?	C	L	
								R	F	
①		②						③		

- ① : Equipment no.
- ② : Read out command of memory setting contents (MEM□□?)
□□ : Memory no.01~30
- ③ : Delimiter (CR+LF)

Response

0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	2	2	2	2	
1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3
0	1	A	M	E	M	=	N	o	.	1	9	,	O	H	M	§	§	§	§	§	§	,
①		②	③				④					⑤	⑥					⑦				

2	2	2	2	2	2	3	3
4	5	6	7	8	9	0	1
3	0	0	m	O	H	M	,
⑧							⑨

3	3	3	3	3	3	3	3	3	4	4	4	4	4	4
2	3	4	5	6	7	8	9	0	1	2	3	4	5	
H	§	3	0	0	.	0	0	0	m	O	H	M	,	
⑩													⑪	

4	4	4	4	5	5	5	5	5	5	5	5	5	5	5	6
6	7	8	9	0	1	2	3	4	5	6	7	7	9	0	
L	§	1	0	0	.	0	0	0	m	O	H	M	C	L	
⑫													⑬		

- ① : Equipment no.
- ② : Exit code
- ③ : Read out of memory setting contents
- ④ : Memory no. (No.01~No.30)
- ⑤ : Measurement function (5.7.2 Refer [Read out of function])
- ⑥ : Measurement range (5.7.4 Refer [Read out of measurement range])
- ⑦ : HIGH setting (5.7.11 Refer [Comparator setting])
- ⑧ : LOW setting (5.7.11 Refer [Comparator setting])
- ⑨ : Punctuation
- ⑩ : Delimiter (CR+LF)

5.7.17 WRITE MEMORY ... Storage of memory

The setting value transmitted with communication is memorized in the non-volatile memory.

0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	
0	1	W	R	I	T	E	Ⓢ	M	E	M	O	R	Y	C	L	
														R	F	
①		②											③			

- ① : Equipment no.
- ② : Memory storage
- ③ : Delimiter (CR+LF)

Note) Ⓢ : Space (20H)

Response

0	0	0	0	0
1	2	3	4	5
0	1	A	C	L
			R	F
①		②		③

- ① : Equipment no.
- ② : Exit code
- ③ : Delimiter (CR+LF)

5.7.18 ONLINE? ... Read out of online status

Request of read out

0	0	0	0	0	0	0	0	0	1	1
1	2	3	4	5	6	7	8	9	0	1
0	1	O	N	L	I	N	E	?	C	L
									R	F
①		②							③	

- ① : Equipment no.
- ② : Online state request command (ONLINE?)
- ③ : Delimiter (CR+LF)

Response

0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
1	2	3	4	5	6	7	8	9	0	1	2	3	4	5
0	1	A	O	N	L	I	N	E	=	O	N	␣	C	L
													R	F
①		②	③										④	

- ① : Equipment no.
- ② : Exit code
- ③ : Online state

O	N	L	I	N	E	=	O	N	␣	ON
O	N	L	I	N	E	=	O	F	F	OFF

- ④ : Delimiter (CR+LF)

Note) ␣: Space (20H)

5.7.19 ONLINE= ... Setting of online

Online setting

0	0	0	0	0	0	0	0	0	1	1	1	1	1
1	2	3	4	5	6	7	8	9	0	1	2	3	4
0	1	O	N	L	I	N	E	=	O	N	␣	C	L
												R	F
①		②										③	

- ① : Equipment no.
- ② : Online setting

O	N	L	I	N	E	=	O	N	␣	ON
O	N	L	I	N	E	=	O	F	F	OFF

- ③ : Delimiter (CR+LF)

Note) ␣: Space (20H)

Response

0	0	0	0	0
1	2	3	4	5
0	1	A	C	L
			R	F
①		②	③	

- ① : Equipment no.
- ② : Exit code
- ③ : Delimiter (CR+LF)

Note) ONLINE is possible to switch ON/OFF even with key operation. In case of operation of setting ONLINE with communication, it is recommended for communication with key-lock ON.

5.7.20 HOLD? ... Read out of HOLD state

Request of read out

0	0	0	0	0	0	0	0	0	0	
1	2	3	4	5	6	7	8	9		
0	1	H	O	L	D	?	C	L		
							R	F		
①		②					③			

- ① : Equipment no.
- ② : HOLD state request command (HOLD?)
- ③ : Delimiter (CR+LF)

Response

0	0	0	0	0	0	0	0	0	1	1	1	1
1	2	3	4	5	6	7	8	9	0	1	2	3
0	1	A	H	O	L	D	=	O	N	␣	C	L
											R	F
①		②	③							④		

- ① : Equipment no.
- ② : Exit code
- ③ : State of HOLD

H	O	L	D	=	O	N	␣	ON
H	O	L	D	=	O	F	F	OFF

- ④ : Delimiter (CR+LF)

Note) ␣ : Space (20H)

5.7.21 HOLD= ... Setting of HOLD

HOLD setting

0	0	0	0	0	0	0	0	0	1	1	1
1	2	3	4	5	6	7	8	9	0	1	2
0	1	H	O	L	D	=	O	N	␣	C	L
										R	F
①		②							③		

- ① : Equipment no.
- ② : HOLD setting

H	O	L	D	=	O	N	␣	ON
H	O	L	D	=	O	F	F	OFF

- ③ : Delimiter (CR+LF)

Note) ␣ : Space (20H)

Response

0	0	0	0	0
1	2	3	4	5
0	1	A	C	L
			R	F
①		②	③	

- ① : Equipment no.
- ② : Exit code
- ③ : Delimiter (CR+LF)

5.7.22 RST? ... Read out of reset state

Request of read out

0	0	0	0	0	0	0	0	0	0	0	0
1	2	3	4	5	6	7	8				
0	1	R	S	T	?	C	L				
						R	F				
①		②					③				

- ① : Equipment no.
- ② : Reset state request command (RST?)
- ③ : Delimiter (CR+LF)

Response

0	0	0	0	0	0	0	0	0	0	1	1	1
1	2	3	4	5	6	7	8	9	0	0	1	2
0	1	A	R	S	T	=	O	N	␣	C	L	
										R	F	
①		②		③							④	

- ① : Equipment no.
- ② : Exit code
- ③ : State of reset

R	S	T	=	O	N	␣	ON
R	S	T	=	O	F	F	OFF

- ④ : Delimiter (CR+LF)

Note ␣ : Space (20H)

5.7.23 RST= ... Setting of reset

Setting of reset

0	0	0	0	0	0	0	0	0	1	1	
1	2	3	4	5	6	7	8	9	0	1	
0	1	R	S	T	=	O	N	␣	C	L	
									R	F	
①		②							③		

- ① : Equipment no.
- ② : Setting of reset

R	S	T	=	O	N	␣	ON
R	S	T	=	O	F	F	OFF

- ③ : Delimiter (CR+LF)

Note ␣ : Space (20H)

Response

0	0	0	0	0
1	2	3	4	5
0	1	A	C	L
			R	F
①		②		③

- ① : Equipment no.
- ② : Exit code
- ③ : Delimiter (CR+LF)

5.7.24 ZEROADJ? ... Read out of zero adjustment state

Request of read out

0	0	0	0	0	0	0	0	0	1	1	1
1	2	3	4	5	6	7	8	9	0	1	2
0	1	Z	E	R	O	A	D	J	?	C	L
										R	F
①		②								③	

- ① : Equipment no.
- ② : Zero adjustment state request command (ZEROADJ?)
- ③ : Delimiter (CR+LF)

Response

0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6
0	1	A	Z	E	R	O	A	D	J	=	O	N	␣	C	L
														R	F
①		②		③									④		

- ① : Equipment no.
- ② : Exit code
- ③ : State of zero adjustment

Z	E	R	O	A	D	J	=	O	N	␣	ON
Z	E	R	O	A	D	J	=	O	F	F	OFF

- ④ : Delimiter (CR+LF)
- Note** ␣ : Space (20H)

5.7.25 ZEROADJ= ... Setting of zero adjustment

Setting of zero adjustment

0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
1	2	3	4	5	6	7	8	9	0	1	2	3	4	5
0	1	Z	E	R	O	A	D	J	=	O	N	␣	C	L
													R	F
①		②										③		

- ① : Equipment no.
- ② : Zero adjustment setting

Z	E	R	O	A	D	J	=	O	N	␣	ON
Z	E	R	O	A	D	J	=	O	F	F	OFF

- ③ : Delimiter (CR+LF)
- Note** ␣ : Space (20H)

Response

0	0	0	0	0
1	2	3	4	5
0	1	A	C	L
			R	F
①		②		③

- ① : Equipment no.
- ② : Exit code
- ③ : Delimiter (CR+LF)

5.7.26 READ ... Sampling data output

Sampling is performed once and measurement data is output if READ command is received under sampling hold.

0	0	0	0	0	0	0	0
1	2	3	4	5	6	7	8
0	1	R	E	A	D	C	L
						R	F
①		②				③	

- ① : Equipment no.
- ② : Sampling data output command (READ)
- ③ : Delimiter (CR+LF)

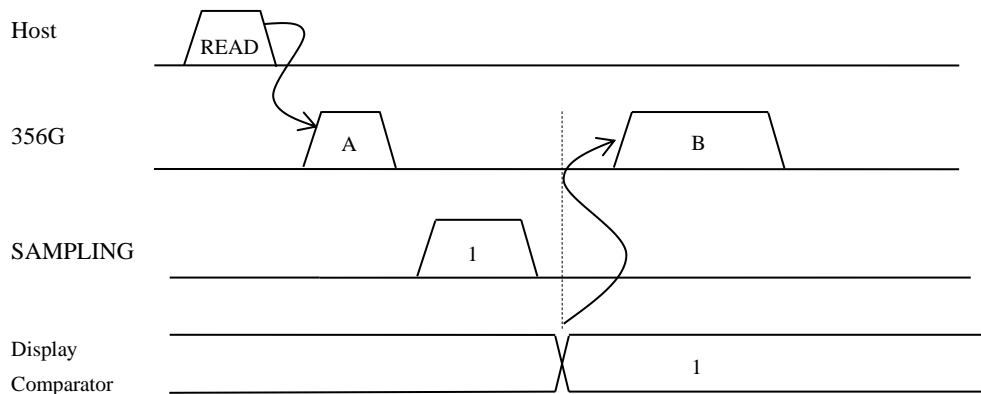
Response A

0	0	0	0	0
1	2	3	4	5
0	1	A	C	L
			R	F
①		②	③	

- ① : Equipment no.
- ② : Exit code
 - During ONLINE OFF: Exit code F
 - During HOLD OFF: Exit code C
- ③ : Delimiter (CR+LF)

Response B

Refer response of "5.7.1 DATA?...Read out of measurement data"



- A : A response code corresponding to READ is output.
- B : Measured data is output once after end of sampling.

6. Analog output

The voltage of 0~3V is output in the resistance or temperature corrector value.

6.1●Output specifications

Output	Full scale: 3V, Load resistance: More than 2kΩ Output is done corresponding to resistance display or correction resistance value.
Output voltage range	0.0~3.5V When minus display: 0.0V When over display: During OHM and OHM-RATIO: 3.5V During T.C and T.C-RATIO: Maximum 4.0V (Over value)
Conversion method	D/A conversion method
Accuracy	One year accuracy ±0.2% F.S (Defined by the range of 0V~3V)
Output data	During OHM and TEMP: Output resistance measurement value During T.C: Output correction resistance value (display value)
Output cycle	Renewed with display cycle
Response time	Time for the output to enter within the accuracy after renewed of the display: Less than 3ms
Resolution	1/30000

Range	Display	Analog output	Range	Display	Analog output
30mΩ	0.0000 mΩ	0.0000 V	300mΩ	0.000 mΩ	0.0000 V
	10.0000 mΩ	1.0000 V		100.000 mΩ	1.0000 V
	24.9999 mΩ	2.4999 V		249.999 mΩ	2.4999 V
	30.0000 mΩ	3.0000 V		300.000 mΩ	3.0000 V
	35.0000 mΩ	3.5000 V		350.000 mΩ	3.5000 V
	OVER	3.5000 V		OVER	3.5000 V
3Ω	0.00000 Ω	0.0000 V	30 Ω	0.0000 Ω	0.0000 V
	1.00000 Ω	1.0000 V		10.0000 Ω	1.0000 V
	2.49999 Ω	2.4999 V		24.9999 Ω	2.4999 V
	3.00000 Ω	3.0000 V		30.0000 Ω	3.0000 V
	3.50000 Ω	3.5000 V		35.0000 Ω	3.5000 V
	OVER	3.5000 V		OVER	3.5000 V
300 Ω	0.000 Ω	0.0000 V			
	100.000 Ω	1.0000 V			
	249.999 Ω	2.4999 V			
	300.000 Ω	3.0000 V			
	350.000 Ω	3.5000 V			
	OVER	3.5000 V			

When display is below 0 due to zero adjustment function etc., output is 0.0000V.

In case of temperature correction, the correction resistance value calculated exceeds 350000 and is calculated maximum till 399999. In this case analog output is output maximum 4.000V together with the display.

Measurement function and output data

FUNCTION	Analog output
TRMP	Resistance measurement value (OHM)
OHM	Resistance measurement value (OHM)
OHM RATIO	Resistance measurement value (OHM)
T.C	Correction value resistance value (T.C)
T.C RATIO	Correction value resistance value (T.C)

7. BCD output

The measurement data of 356G is output with BCD data.

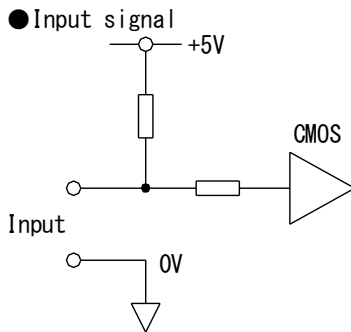
7.1●Output specifications

7.1.1 TTL output (-03)

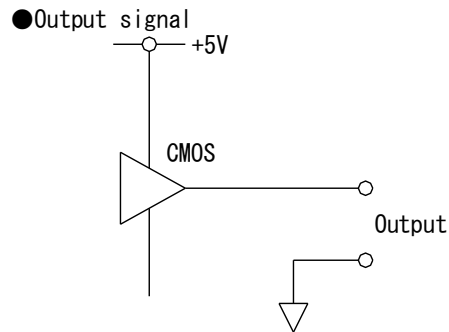
BCD data is output with TTL level.

Output method : BCD parallel code Positive logic

Output "L" level with logic "0" Output "H" level with logic "1"



Input level : $I_{IL} \leq -1\text{mA}$
"L" = Less than 0.8V
"H" = 3.5~5V



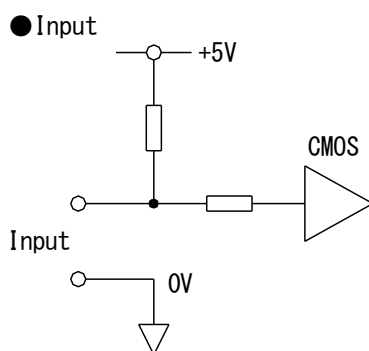
Output level : TTL level
 $I_{oh} = 4\text{mA}$
 $I_{ol} = -4\text{mA}$

7.1.2 Open collector output (-04)

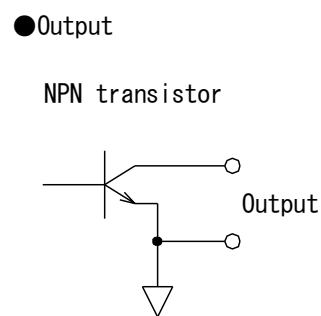
BCD data is output with open collector.

Output method: BCD parallel code

Output "OFF" with logic "0" Output "ON" with logic "1"



Input level : $I_{IL} \leq -1\text{mA}$
"L" = Less than 1.5V
"H" = 3.5~5V



Output capacity : DC30V, 30mA

7.2●Connector pin array

Signal name		№	№	Signal name	
×10 ⁰	1	1	19	1	×10 ¹
	2	2	20	2	
	4	3	21	4	
	8	4	22	8	
×10 ²	1	5	23	1	×10 ³
	2	6	24	2	
	4	7	25	4	
	8	8	26	8	
×10 ⁴	1	9	27	1	×10 ⁵
	2	10	28	2	
	4	11	29	SEL1	Output data selection
	8	12	30	SEL2	
POL (+)		13	31	DP1 (10 ¹)	
OVER		14	32	DP3 (10 ³)	
RANGE mΩ		15	33	DP4 (10 ⁴)	
RANGE Ω		16	34	DP5 (10 ⁵)	
STROBE		17	35	ENABLE	
COM		18	36	COM	

Connector in use : Amphenol 36 pin

7.3•Descriptions of input and output signals

7.3.1 Output signal

Measurement data output : 1,2,4,8 ($\times 10^0 \sim \times 10^5$)

Measurement data is output with parallel BCD code.

Note) During F sampling, 10^0 outputs 0.

Decimal point output

Decimal point corresponding with measurement range is output with code.

Display	DP5	DP4	DP3	DP1
3.50000	0	1	1	1
35.0000	1	0	1	1
350.000	1	1	0	1
100.0	1	1	1	0

Unit output

Unit is output with code.

Range	mΩ	Ω	%	°C
RANGE mΩ	1	0	1	0
RANGE Ω	0	1	1	0

7.3.2 Input signal

Data being output in BCD data are selected by SEL1 and SEL2.

Output data (SEL1,SEL2)

		Function				
SEL 1	SEL 2	OHM	TEMP	T.C	OHM RATIO	T.C RATIO
H	H	Resistance *1	Temperature *1	Correction resistance value *1 *2	Ratio *1	Ratio *1 *2
L	H	Resistance *1	Temperature *1	Resistance *1	Resistance *1	Correction resistance value *2
H	L	Resistance *1	Temperature *1	Temperature *1	Ratio *1	Ratio *1 *2
L	L	Resistance *1	Temperature *1	Correction resistance value *1 *2	Standard resistance value (Rs)	Standard resistance value (Rs)

*1 ERR 0 : When data exceeds 350000, correction resistance value is 399999 or in case the temperature range exceeds with temperature measurement, OVER becomes 1 and output is 000000 data.

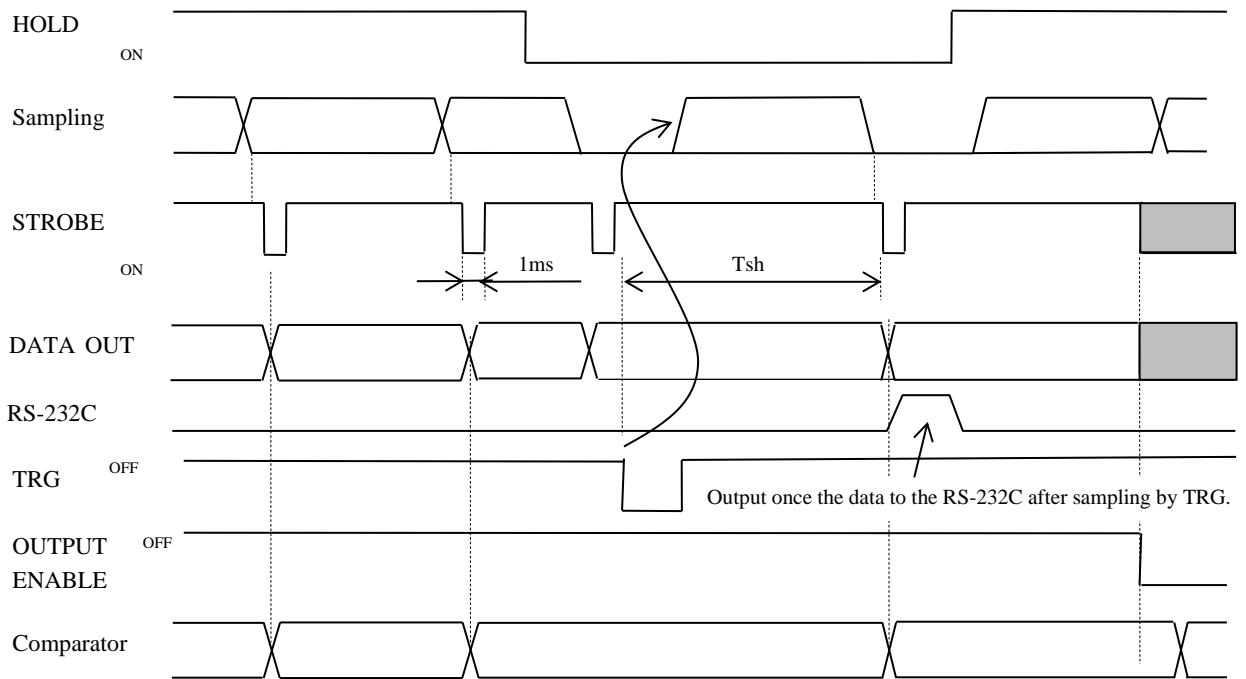
*2 ERR 1 : In case measurement range exceeds the temperature measurement, OVER becomes 1 and output is 000000 data.

7.3.3 Description of signals

Signal	Signal name	Logic (TTL)	Logic (OC)
BCD data	$\times 10^0, \times 10^1, \times 10^2, \times 10^3, \times 10^4,$	Positive logic 1 :H (3.5~5V) 0 :L (Less than 0.8)	Positive logic 1 :Tr ON 0 :Tr OFF
Decimal point	DP1, DP3, DP4, DP5	Decimal point output table	
Sign	POL Output 1 during plus (no minus display)	Positive logic 1 :H (3.5~5V) 0 :L (Less than 0.8)	Positive logic 1 :Tr ON 0 :Tr OFF
Over	OVER	Positive logic 1 :H (3.5~5V) 0 :L (Less than 0.8V)	Positive logic 1 :Tr ON 0 :Tr OFF
Synchronization signal	STROBE	L level pulse Pulse width 1ms	Tr ON pulse Pulse width 1ms
Measurement range	RANGE m Ω , RANGE Ω	Range output table	
Data selection	SEL1, SEL2	Range data table	
Enable	ENABLE	H (3.5~5V) : Enable L (Less than 0.8V) : Disable Output during disable TTL: Total output data Hi-Z OC : Total output data Tr OFF	

7.4●Timing chart

Start delay=0, Average count=1time



Tsh : Sampling rate+Processing time

■ : Hi Impedance

Processing time

Offset voltage correction function OFF

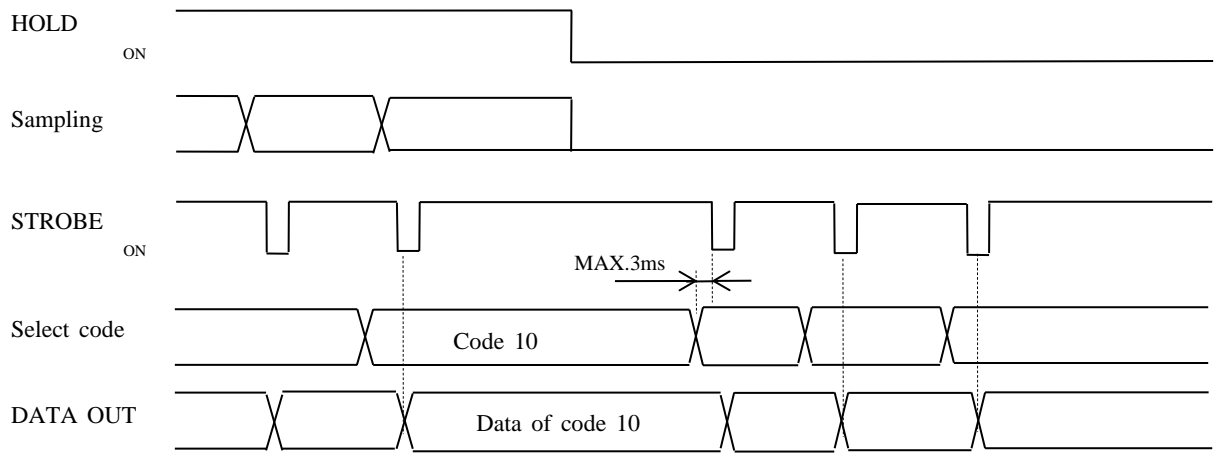
Average count×0.1ms+3ms

Offset voltage correction function ON

Average count×0.1ms+6ms

When the range is changed during HOLD, 15ms of range switching time will be added.

Data select timing chart



If the select code is changed during sampling, the data after the end of the sampling will be affected.
 If select code is changed during HOLD, output will change corresponding to the change in the code.

8. Calibration

8.1 Things needed for preparation

Prepare the calibration equipment like below.

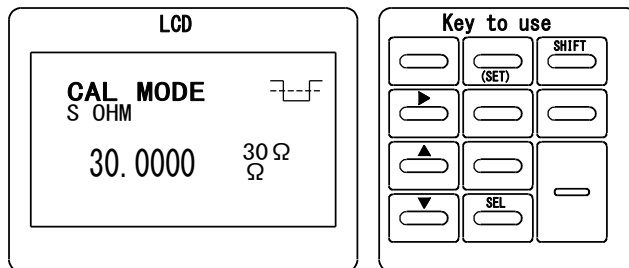
Standard resistance for resistance measurement range calibration : 30mΩ, 300mΩ, 3Ω, 30Ω, 300Ω

8.2 Calibration method

8.2.1 Calibration of resistance measurement range

Apply power while holding down **FUNC** key and **SHIFT** key.

The screen becomes "Calibration mode" if it is pressed continuously more than 1 second.



When **FUNC** key is pressed, the switching over of resistance measurement/temperature/ analog output calibration is done. Resistance measurement (OHM) is selected.

Resistance calibration

When **RANGE** key is pressed, the switching over of the range of resistance measurement is done.

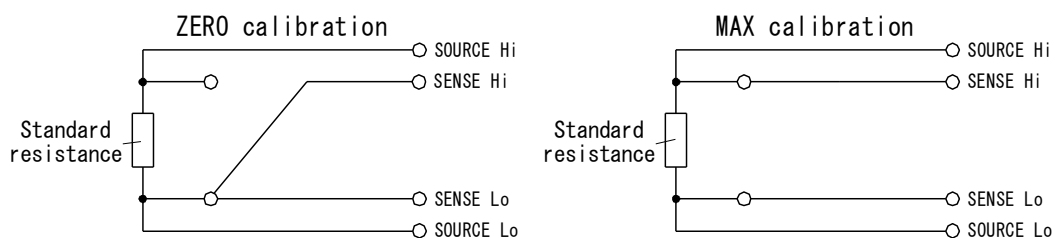
Calibration of each range of 30mΩ/ 300mΩ/ 3Ω/ 30Ω/ 300Ω

When **▶** key is pressed, ZERO calibration value is memorized.

When **▲** key is pressed, MAX. calibration value is memorized.

Range	Standard resistance value	ZERO display value	MAX. display value
30 mΩ	30mΩ	0.0000mΩ	30.0000mΩ
300mΩ	300mΩ	0.000mΩ	300.000mΩ
3 Ω	3 Ω	0.00000 Ω	3.00000 Ω
30 Ω	30 Ω	0.0000 Ω	30.0000 Ω
300 Ω	300 Ω	0.000 Ω	300.000 Ω

Connection during calibration



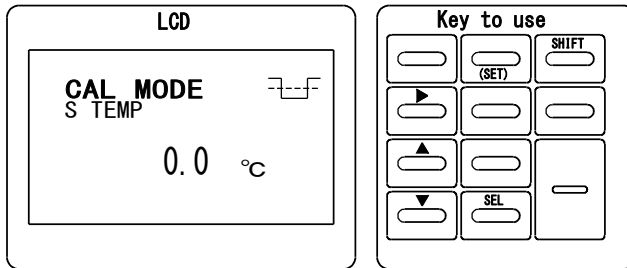
End

Power is put off.

8.2.2 Calibration of temperature

Apply power while holding down **FUNC** key and **SHIFT** key.


The screen becomes "Calibration mode" if it is pressed continuously more than 1 second.



When **FUNC** key is pressed, the switching over of resistance measurement/temperature/analog output calibration is done. Temperature (TEMP) is selected.

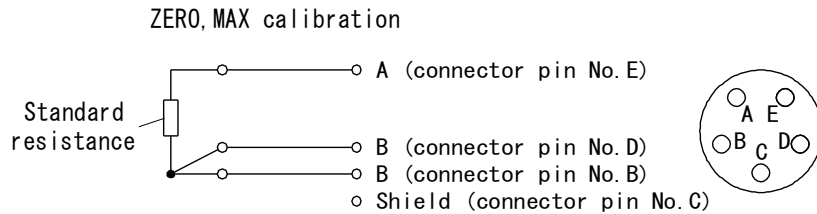
Temperature calibration (ZERO : 0°C / MAX.190°C)

When  key is pressed, ZERO calibration value is memorized.

When  key is pressed, MAX. calibration value is memorized.

	Resistance value	Display value
ZERO calibration	100.00Ω	0.0 °C
MAX. calibration	172.12Ω	190.0 °C

Connection during calibration



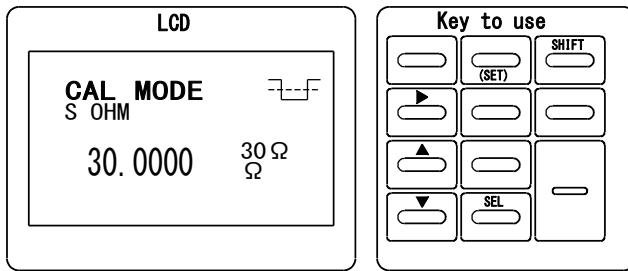
End

Power is put off.

8.2.3 Calibration of analog output

Apply power while holding down **FUNC** key and **SHIFT** key.

The screen becomes "Calibration mode" if it is pressed continuously more than 1 second.

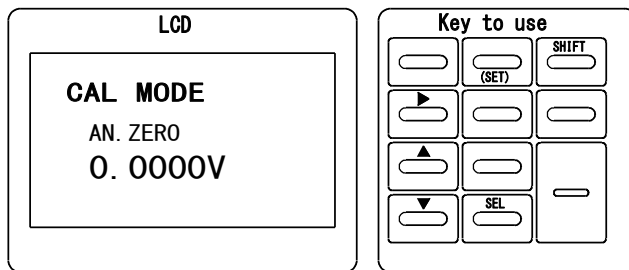


When **FUNC** key is pressed, the switching over of resistance measurement/temperature/analog output calibration is done.

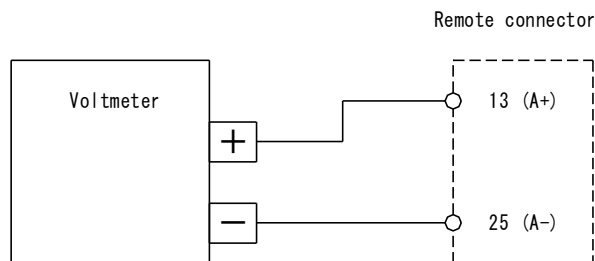
When **▶** key is pressed, MAX. calibration and ZERO calibration are switched over.

Output is set with **▲** **▼** keys.

The calibration value is memorized with **SEL** key.



Connection during calibration.



End

Power is put off.

9. Specifications

9.1 Model name

option 1	option 2	Contents
X	—	No output
0 3	—	BCD output (TTL level)
0 4	—	BCD output (open collector level)
0 6	—	RS-485 output
X	—	No analog output
0 3	—	Analog output

9.2 Measurement range

■ Resistance measurement

During SLOW,MEDIUM sampling

Measurement range	30mΩ	300mΩ	3Ω	30Ω	300Ω
Resolution	0.1μΩ	1μΩ	10μΩ	100μΩ	1mΩ
Measured current	DC1A		DC100mA		DC10mA
Measured maximum applied voltage	30mV	300mV		3V	
Accuracy	±(0.1% of rdg.+30digit)		±(0.08% of rdg.+25digit)		
Temperature coefficient	± (0.01% of rdg.+3digit) / °C				
Open terminal voltage	DC6V Max.				

※ Accuracy : Accuracy in 1 year 23°C±5°C Defined by the state of 45~75 % RH
Resistance measurement, offset voltage correction function: OFF

※ Sampling Add ±3digit in the accuracy during MEDIUM.

During FASTING sampling

Measurement range	30mΩ	300mΩ	3Ω	30Ω	300Ω
Resolution	1μΩ	10μΩ	100μΩ	1mΩ	10mΩ
Measured current	DC1A		DC100mA		DC10mA
Measured maximum applied voltage	30mV	300mV		3V	
Accuracy	± (0.2% of rdg.+10digit)				
Temperature coefficient	± (0.02% of rdg.+1digit) / °C				
Open terminal voltage	DC6V Max.				

※ Accuracy : Accuracy in 1year 23°C±5°C Defined by the state of 45~75 % RH
Resistance measurement, offset voltage correction function: OFF

When the current limit function is on, the measurement value for the first time from the HOLD status, there is a case where the error is larger by 30Ω and 300Ω range. When the offset voltage correction function is turned on, there is a case where the error is larger by 30Ω and 300Ω range. During such case set the start delay to more than 5ms.

■ Temperature measurement

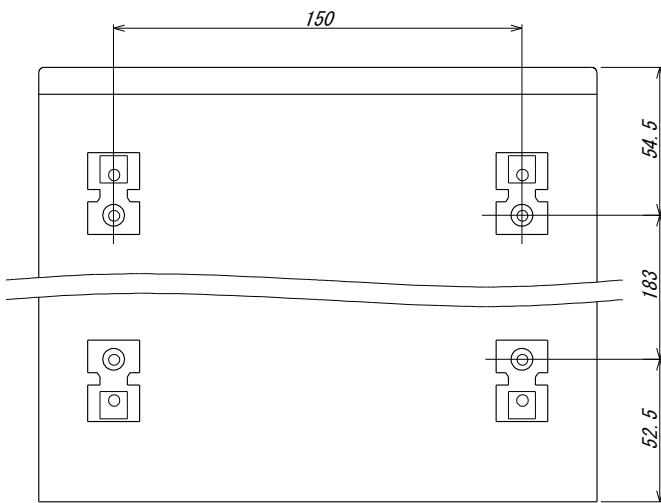
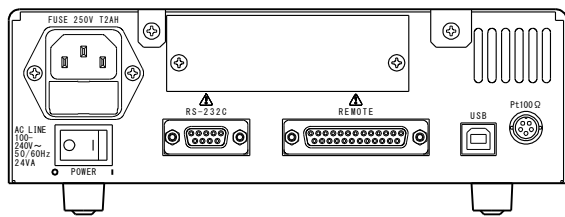
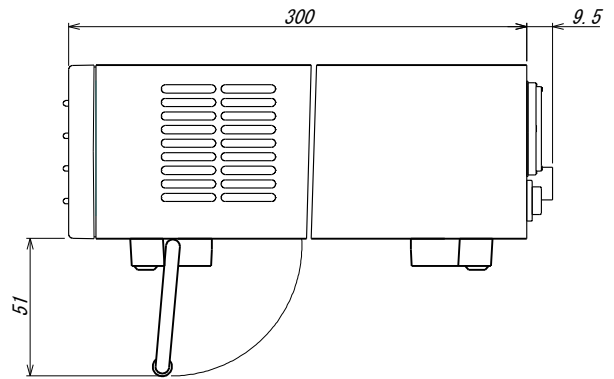
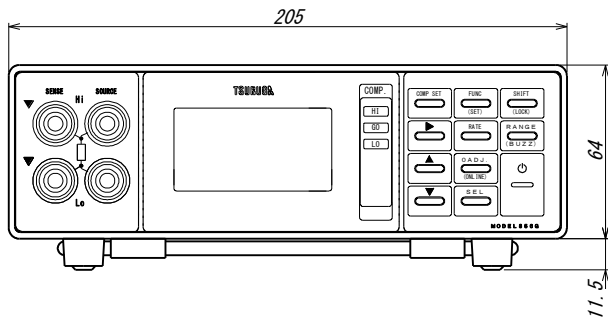
Measurement range	-19.9~199.9°C
Resolution	0.1°C
Accuracy ※	± (0.2% of rdg. +0.2°C)
Temperature coefficient	± (0.02% of rdg. +0.02°C)
Sensor	Pt100Ω, 3-wires
Measured current	About 1mA

※ Accuracy : Accuracy in 1year 23°C±5°C Defined by the state of 45~75 % RH

9.3●General specifications

Measurement method	4 terminal method (Front face only)
Maximum allowable applied voltage	Whole range 50V DC
Measurement cable resistance	During measured current DC1A: Less than 2Ω Other: Less than 5Ω
Display	LCD display Resistance measurement : 350000 (FAST is 35000) Temperature measurement : 199.9 With zero suppression function
Measurement range	30mΩ,300mΩ,3Ω,30Ω,300Ω,AUTO AUTO range Range up More than 350000 (FAST sampling More than 35000) Range down Below 30000 (FAST sampling Below 3000)
Over display	OVER
Error display	ERR-1: When FUNCTION are T.C, T.C RATIO and temperature measurement is over
CC display	CC: During resistance measurement, when SOURCE is OPEN
Unit display	mΩ, Ω, %, °C
Sampling rate	SLOW : 5 times/sec. MEDIUM : 20 times/sec. FAST : 80 times/sec. Temperature measurement : 5times/sec.
Noise rejection ratio	Normal mode More than 60dB (Maximum applied voltage conversion) Common mode More than 100dB (Maximum applied voltage conversion)
Response speed 1	When it is connected to the specimen from input open, time till it is within the accuracy (fixed range) SLOW : About 500ms MEDIUM : About 100ms FAST : About 30ms Note: When offset correction is valid, response time becomes about two times.
Response speed 2	In the state when it is connected to the specimen, when measurement is started with TRG signal during HOLD, time till the judgment output. (Fixed range, Average no. of times = 1, No start delay) SLOW : About 220ms MEDIUM : About 70ms FAST : About 30ms Note: When offset correction becomes valid, response time becomes double.
Insulation resistance	Supply terminal / Between outer box (FG) DC 500V More than 100MΩ Measurement terminal / Between output terminal DC 500V More than 10MΩ
Withstand voltage	CONTROL,RS-232C,USB / Between outer box (FG) AC 500V 1 min. Supply terminal / Between outer box (FG) AC2000V 1 min.
Parameter retention	Due to non-volatile memory, the contents due to setting by function, range, constant etc. key, are retained even when power supply is OFF.
Power supply	AC100~240V 50/60Hz
Power supply voltage range	AC 90~250V
Power consumption	During AC100V About 24VA During AC200V About 27VA
Operating ambient temperature	0~40°C 80%RH (No condensation)
Storage temperature	-20~70°C 80%RH (No condensation)
Weight	About 2.8kg
Degree of protection	IP20
Accessories	Power cord(3P→2P with conversion plug) 1 pc. Power fuse (spare part) 1 pc. Control input connector 1 pc. Instruction manual 1 pc. Utility software (5890-13) [with USB cable] 1 pc.
Option	Kelvin clip (5811-21C) Temperature sensor (5803-11) RS-232C cable (5881-11-020) 2m

10. Dimensions



If 356G is to be fixed, fix it together with the foot with fixed screw hole of the foot.
 Recommended screw: M4×18 + thickness

11. Maintenance and calibration

11.1●Cleaning

In order to remove the dirt from this instrument, wipe lightly by a soft cloth with small amount of water and small amount of mild neutral detergent. Do not use detergent containing solvents like benzene, alcohol, paint thinner etc. It may cause deformation and decoloration.

11.2●Problem solving

In order to solve the problem, check the description in “When you think that there is a breakdown” and contact the nearest dealer or nearest sales office.

When breakdown goods are to be returned

The goods are to be packed so that it does not get damaged during transportation and write and attach the breakdown description as well. There is no guarantee for the damage during transportation.

When you think that there is a breakdown

Conditions	Confirmation	Countermeasure
Power lamp is not turned on and there is no display even when the power switches turned on.	Check if the power cord is unplugged.	Plug in the power cord.
	Check if the power fuse is blown out.	Change the spare fuse and turn on the power supply after disconnecting the input output cables.
Cannot operate the keys.	Is it in the key lock state?	Release the key lock.
	ONLINE and EXT. are displayed and is it in external control state?	Turn off the ONLINE. Confirm the remote control and turn OFF the EXT.
Display value differs largely with respect to the resistance being measured	0. ADJ is displayed and is zero adjustment turned ON?	Turn OFF the zero adjustment.
Measurement display does not change.	Is sampling display of S, M, F blinking? When the sampling display is not blinking the display is not renewed.	When HOLD is ON with remote control, turn it OFF. When HOLD is ON with communication, turn it OFF.
Error display		Refer error display table.

11.3●Calibration

To maintain the accuracy for the long term, it is recommended to calibrate about every one year. For calibration, request the place where it is purchased or our sales office. However, in case some fixed time has elapsed after purchase or the production of the parts have stopped or has exceeded the guarantee time, repair and the calibration may be declined.

11.4●Error display

Error display	Contents	Countermeasure
ERR-1	During temperature correction function, temperature measurement is over or calculation error	Confirm the temperature input. Confirm if Rs is not set to 0 with ratio display.
CC	SOURCE input open	Confirmation of connection state of SOURCE input terminal. Confirm if the connection resistance is not large with regards to the measurement range.
OHM A/D ERROR TEMP A/D ERROR	AD converter error	It is the failure of measurement circuit. Repair is requested.
FLASH MEMORY ERROR	ROM error	It is the failure of setting memory. Repair is requested.

Tsuruga Electric Corporation

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