MODEL 3565

Digital Ohm Meter

Instruction Manual

I-01261

TSURUGA ELECTRIC CORPORATION

Contents

1. Preface

We thank you for your purchase of our MODEL 3565. For safety and proper use of this product, please carefully read this instruction manual before the initial operation.
Model 3565 is a fast speed type Digital Ohm Meter of maximum sampling rate 100 times/sec. and response speed 50ms. For the resistance measurement, the meter is provided with a wide range from 300mΩ to 300kΩ and it can perform high precision measurement of high resolution 10μΩ.
Also provided as standard are the temperature compensation function, ratio display function and temperature conversion function which allows to measure the risen temperature of coil resistance.
With a comparator memory function of 30 patterns, it is also possible to preset the test conditions for plural numbers of test samples.
Six different types of optional data output interfaces such as GP-IB, RS-232C etc. are provided for the meter to serve a wide range of applications from stand alone use to systematized operation.

⚠ CAUTION

- **To avoid break-down, malfunction or deterioration of life time, do not use this product 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 dismantle or modify this product.**

1.1 ●Preparations prior to use

1.1.1 Inspection

When the meter is delivered, please check whether it conforms to the ordered specifications and has not been damaged in transit. If any damage or inconvenience in operation is found, please inform us of the model name and serial number of the product.

1.1.2 Storage

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

1.2 ●Confirmations prior to use

1.2.1 Power supply

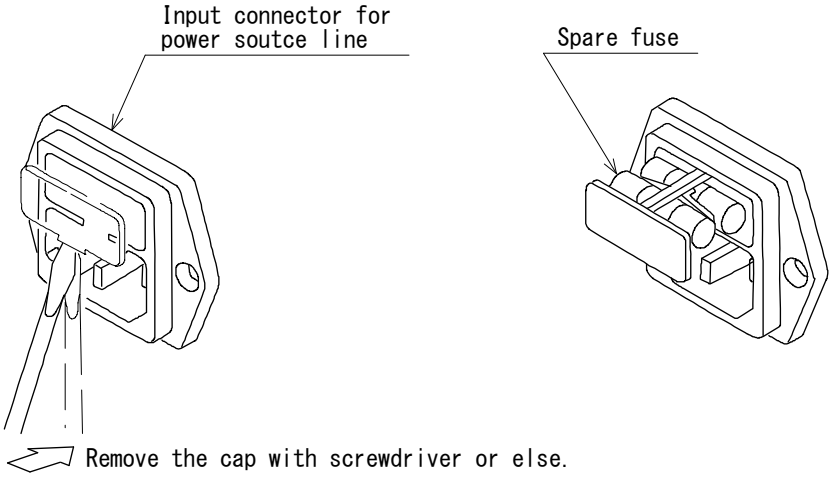
Use this meter with the power supply voltage within the range 90V~250VAC, frequency 50~60Hz. Also, ensure that the power switch is turned OFF when connecting the power supply cord.

1.2.2 Power supply cable

Power supply cable plug attached to this meter is for the 100VAC. When the meter is used with 200VAC, replace the plug with appropriate one for 200VAC use.
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 grounding. When the connection is made to a plug receptacle by use of the adaptor attached to the plug, ensure to connect the earth lead coming out from the adaptor to the external earth terminal for grounding.

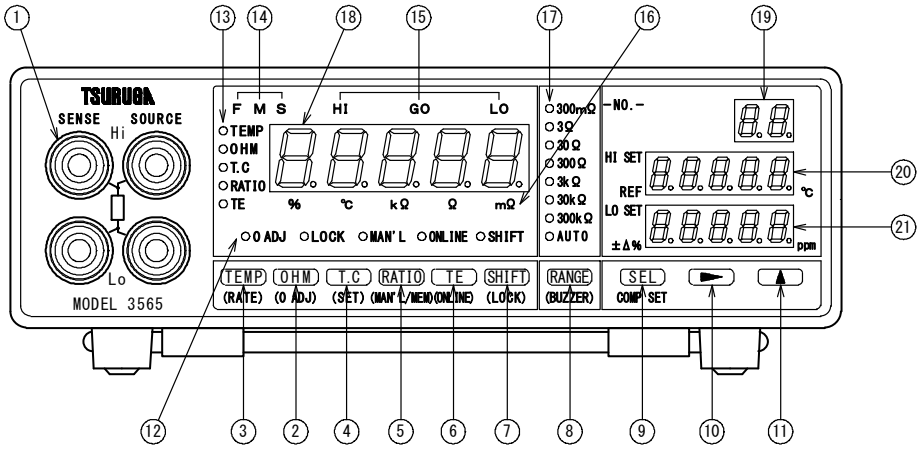
1.2.3 Replacement of fuse

A power supply fuse 250V/2A is mounted when the meter is delivered from 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. The fuse at outer side can be removed by pushing it toward right or left, and another fuse at inner side pushing downward.



2. Name of parts and functions

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 [OHM] key (0 ADJ)
Key to select resistance measurement. OHM lamp is lit up when selected.
(ON/OFF key for zero adjustment. 0 ADJ lamp is lit up during operation.)

③ [TEMP] key (RATE)
Key to select temperature measurement. TEMP lamp is lit up when selected.
(Key to select a sampling rate.)

④ [T.C.] key (SET)
Key to select temperature compensation function. T.C lamp is lit up when selected.
(Used for various setting.)

⑤ [RATIO] key (MAN'L/MEM)
Key to select ratio display function. RATIO lamp is list up when selected.
(Key to switch over manual-mode/memory-mode. MAN'L lamp is lit up with manual-mode.)

⑥ [TE] key (ONLINE)
Key to select temperature conversion function. TE lamp is lit up when selected.
(On-line key for GP-IB, RS-485, RS-232C.)

⑦ [SHIFT] key (LOCK)
Key to effectuate the blue key. SHIFT lamp is lit up when effectuated.
When the blue key is pressed with the lamp in lighting, the effectuation is released.
(Switch to prohibit switch operation on the front panel. When it is pressed continuously for 3 seconds or more, prohibition or release can be done.
During the prohibition, LOCK lamp is lit up.)

⑧ [RANGE] key (BUZZER)
Key to select range 300mΩ~300kΩ or AUTO range.
(Key to select buzzer operation and volume setting.)

⑨ [SEL] key COMP SET
Used for various setting.

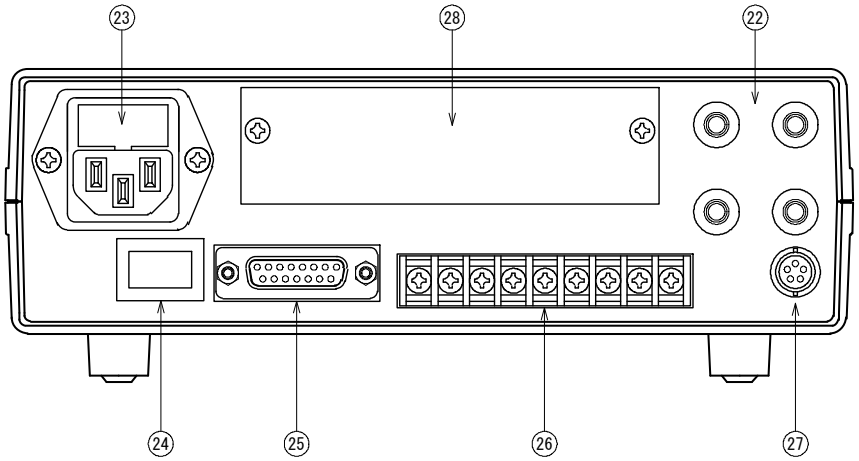
⑩ [►] key
Used for various setting.

⑪ [▲] key
Used for various setting.

⑫	0 ADJ Lamp	Lit up at zero adjustment operation.
	LOCK Lamp	Lit up at key lock.
	MAN'L Lamp	Lit up in manual mode and turned off in memory mode.
	ONLINE Lamp	Lit up when remote controlled.
	SHIFT Lamp	Linked with SHIFT key.
⑬	TEMP Lamp	Lit up in temperature measurement.
	OHM Lamp	Lit up in resistance measurement.
	T.C Lamp	Lit up in temperature compensation function.
	RATIO Lamp	Lit up in ratio display function.
	TE Lamp	Lit up in temperature conversion function.
⑭	F Lamp	Lit up at sampling rate 100 times/sec.
	M Lamp	Lit up at sampling rate 20 times/sec.
	S Lamp	Lit up at sampling rate 4 times/sec.
⑮	HI Lamp	Red LED is lit up when the measured value is higher than high limit.
	GO Lamp	Green LED is lit up with good judgement.
	LO Lamp	Red LED is lit up when the measured value is lower than low limit.
⑯	Unit Lamp	Lamp of the unit in measurement is lit up.
⑰	Range Lamp	Lamp of the measuring range is lit up.
	AUTO Lamp	Lit up when the auto range is selected.
⑱	Display Window	Measured value and characters are displayed.
⑲	NO Display	Memory No. of memory mode is displayed.
⑳	HI SET Display Window	High limit of comparator is displayed. Content of setting is displayed at buzzer setting.
	REF Display Window	Standard value in ratio display is displayed.
	℃ Display Window	Standard temperature in setting of temperature compensation is displayed.
㉑	LO SET Display Window	Low limit of comparator is displayed. Volume is displayed at buzzer setting.
	±△% Display Window	Deviation in ratio display is displayed.
	ppm Display Window	Temperature coefficient is displayed at setting of temperature compensation.

※ Keys in "blue characters" are effective during the SHIFT lamp is lighting.

2.2 ●Rear panel



㉒ Rear measuring terminals
SENSE Hi : Common with the measuring terminal (SENSE Hi) on the front panel.
SENSE Lo : Common with the measuring terminal (SENSE Lo) on the front panel.
SOURCE Hi : Common with the measuring terminal (SOURCE Hi) on the front panel.
SOURCE Lo : Common with the measuring terminal (SOURCE Lo) on the front panel.

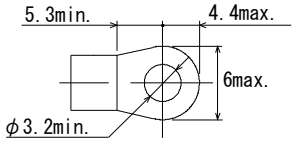
㉓ Power supply connector
Connect the attached power supply cord to this connector. Ensure to apply the power source voltage and frequency with the specified range. Fuse of 250V 2A is to be used.

㉔ Power supply switch
ON/OFF switch for power supply.

㉕ REMOTE connector
Connector for remote control.

㉖ Input, output terminal blocks
Terminals for input of hold and input, and output of comparator.

Terminal screws: M3
Fastening torque: 0.6~1.0N・m
Crimp terminal: As shown on the right.

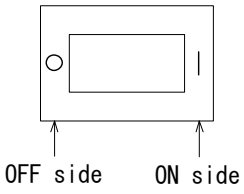


㉗ Pt100Ω connector
Connector for connection of 3-wire system Pt100Ω resistance bulb.

㉘ Inlet for interface board
Section to fit an optional interface board.

3. Operation

3.1 ●Power supply



After confirming that the power supply switch on the rear panel is OFF, connect the power supply plug to the plug receptacle and turn ON the power supply switch. Although the meter will immediately be in operating status, it is recommended to have a pre-heating time for 30 minutes or more.
The meter is provided with the function to retain the parameters, so it memories the status of the followings even after the meter is switched OFF.

(1) Measuring function and range.
(2) Set values of comparator (30 program memories).
(3) Standard temperature and temperature coefficient of temperature compensation function.
(4) Standard resistance value of ratio display function.
(5) Status of key lock.
(6) Status of buzzer.
(7) Status of zero adjustment.

3.2 ●Connection of measuring terminals

Make a connection to the measuring terminals on the front panel (or rear panel) as ***Fig.3.2.1***shows.

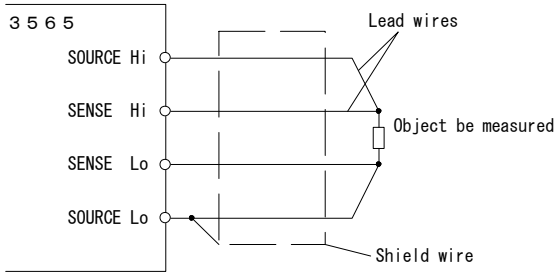


Fig.3.2.1

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

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

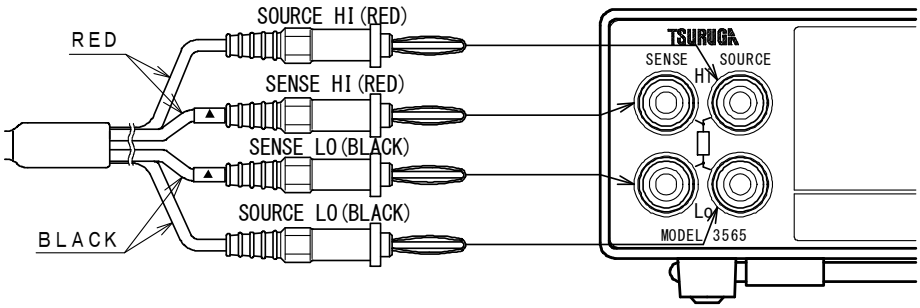
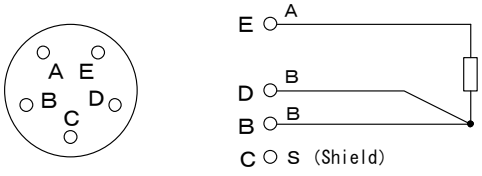


Fig.3.2.2 Connection of optional Kelvin clip (MODEL 5811-21B).

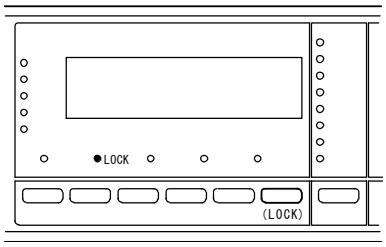
3.3 ●Connection of temperature sensor

When the functions of temperature measurement, temperature compensation or temperature conversion is used, connect an optional Pt100Ω sensor (MODEL 5803-11) to the Pt100Ω connector on the rear panel.



3.4 ●Key lock

This is the switch to prohibit the key operation on the front panel so that the measuring condition can not be carelessly altered.
LOCK lamp is lit up during the key locking. When required to operate other switch, do it after releasing the key lock.



To make key lock

Press SHIFT (LOCK) key for 3 sec. or more when LOCK lamp is turned off.

To release key lock

Press SHIFT (LOCK) key for 3 sec. or more when LOCK lamp is lighting

3.5 ●Change-over of measuring range

Select a measuring range (auto range or manual range) of resistance measurement.
This operation is disabled in memory mode and when the status is ONLINE or HOLD.

(1) Auto range
- The measuring range automatically steps up when the display value is 35000 (3500) or higher and steps down when the display value is less than 3000 (300).
- AUTO lamp and the lamp of the range automatically detected are lit up.

Note: Figures in the brackets ( ) are at F sampling.

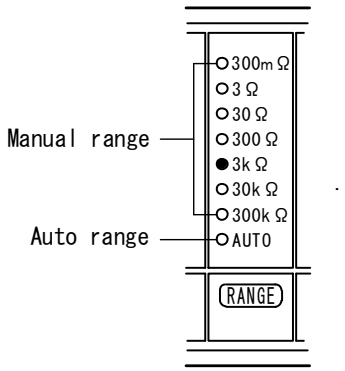
Selection of AUTO range

When the RANGE key is pressed at the 300kΩ range, AUTO lamp is lit up and the meter enters the auto ranging.

(2) Manual range
- The range is fixed at 300mΩ~300kΩ.
- The lamp of the selected range is lit up.

Change-over of range

Every time the RANGE key is pressed, the range lamp moves. Select the range intended.



3.6 ●Zero adjustment

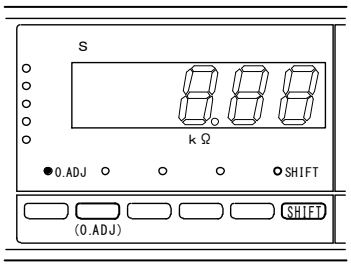
This is the function to suppress the resistance of tools and so on in resistance measurement.
The value currently measured is memorized as zero set value into the non-volatile memory and afterwards, the value from which the zero set value is suppressed is displayed.

Display value = Measured value - Zero set value

- This function is enabled in manual mode and memory mode of the resistance measurement, temperature compensation function, temperature conversion function and ratio display function.
- Zero set value is effective in all ranges.
- In case that the zero adjustment is made in the higher range, it may over-range in the lower range.
- Remote control is possible for this function.
- Remote control through the interface GP-IB, RS-232C or RS-485 is also possible.

Note: • This function can not be operated during the temperature measurement and the hold.
• Zero adjustment is not released even if the memory is changed in memory mode.

3.6.1 Key operation



① Press SHIFT key when 0 ADJ lamp is turned off.
SHIFT lamp is lit up.

② Press (0 ADJ) key.
0 ADJ lamp is lit up.
Zero adjustment becomes operating status.

③ To release the zero adjustment, do the operation ① and ② during the zero adjustment.

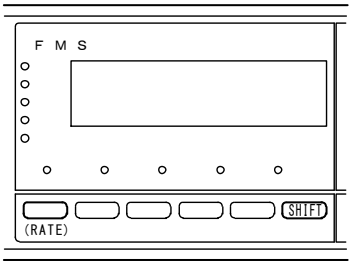
3.6.2 Remote operation

As long as the 0 ADJ pin of REMOTE connector on the rear panel is made ON, the 0 ADJ lamp is lit up and the zero adjustment function becomes operable.
When the pin is turned OFF, the function is released.
Note: Zero adjustment work set up with the key operation is released by making this pin OFF.

3.7 ●Selection of sampling rate

Make a choice of sampling rate with key operation on the front panel.

- Remote control through the interface GP-IB, RS-232C or RS-485 is possible.
- Selection is not possible during the hold function.



① Press SHIFT.
SHIFT lamp is lit up.

② Press (RATE) key.
Sampling rate changes.

③ Repeat ① and ②, and the rate changes in the order of:

S→M→F→S

S lighting : 4 times/sec.
M lighting : 20 times/sec.
F lighting : 100 times/sec.

Note: When the sampling rate is F, 100 times/sec., noise suppression for the power source frequency noises penetrated in the input does not function.

3.8 ●Comparator operation

This is a digital comparator to make a comparison between displayed value and high or low limit value. 30 pairs of high and low limit value (No.1~No.30) can be memorized.

- Memory can be selected by REMOTE connector.
- Selection of memory can also be done through the interface GP-IB, RS-232C or RS-485.

Note:
- During the setting of high or low limit and recalling of the memory, the sampling is stopped and the comparator output is held.
- Comparator does not operate at the temperature display.

3.8.1 Conditions for comparison

Display value ≧ High limit value (HI SET)	HI output
High limit (HI SET) ＞ Display value ＞ Low limit (LO SET)	GO output
Display value ≦ Low limit (LO SET)	LO output

Note: Comparator makes comparison with absolute value.
As an example, in case that the high limit is set to 100.00mΩ,
HI is output when 10.00Ω is displayed in the 300Ω range.

3.8.2 Comparator output

Open collector or relay contact output is output through the input/output terminals on the rear panel. (refer to the article 4.2)

Display : HI and LO : Red
GO : Green

3.8.3 Setting method

Comparator can not be set during the ONLINE, remote control through BCD data output interface and hold.

Adjustable range High limit : -19999~35000 **Note**: The unit and decimal point are
Low limit : -19999~35000 set by RANGE key.

This article explains the method how to set the high and low limit values for the resistance value in manual mode.

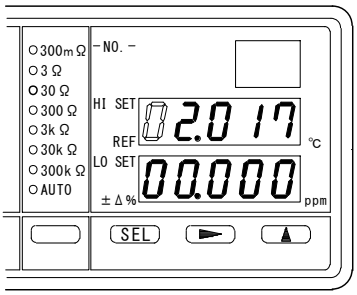
- Refer to the article 5.5 for the setting of ratio display function.
- Refer to the article 3.11.2 for the setting in memory mode.
- When no key operation has been done for about 5 minutes during the setting, the meter returns to measurement mode.

Change over to manual mode

① (refer to the article 3.10)

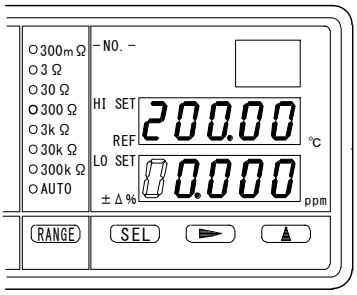
Selection of function

② Change to resistance measurement with [OHM] or [T.C] key.



Setting of high limit

③ Press [SEL] key.
The highest digit of HI SET display blinks.
Set a numeral with [►] and [▲] keys.
The digit selected with [►] key blinks.



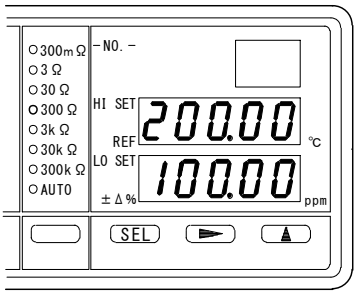
Setting of low limit

④ Press [SEL] key.
The highest digit of LO SET display blinks.
Set a numeral with [►] and [▲] keys.
The digit selected with [►] key blinks.

Setting of comparator range

⑤ Select with [RANGE] key.
The selected range lamp blinks.

Example shows HI SET from 02.017Ω to 200.00Ω.
LO SET from 00.000Ω to 100.00Ω.



Finish of setting

⑥ Press [SEL] key.

Note 1: When returned to the measurement mode and measuring range and comparator range are different with each other, the range lamp of comparator range blinks.

Note 2: When the H or L setting is out of adjustable range, blinking Err is displayed for the setting parameter in question for a while and returns to the setting ③ or ④.

3.8.4 Display mode of range lamps

The model 3565 is designed to display both selected measuring range and comparator set value. When the comparator set value is different from the selected measuring range, the comparator set value is displayed in blinking.

Examples:

1. When the measuring range and comparator set value are different.
   - Measuring range: 3kΩ range is selected.
   - Comparator set value: HIGH 300.00Ω LOW 100.00Ω (range is 300Ω)
   - Range display: 3kΩ steadily lighting, 300Ω blinking

2. When the measuring range and comparator set value are same.
   - Measuring range: 300Ω range is selected.
   - Comparator set value: HIGH 300.00Ω LOW 100.00Ω (range is 300Ω)
   - Range display: 300Ω steadily lighting

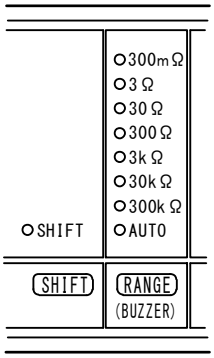
3. In AUTO range.
   - Measuring range: AUTO 3kΩ range is selected. (selected by input resistance)
   - Comparator set value: HIGH 300.00Ω LOW 100.00Ω (range is 300Ω)
   - Range display: AUTO 3kΩ steadily lighting, 300Ω blinking

3.9 ●Buzzer

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

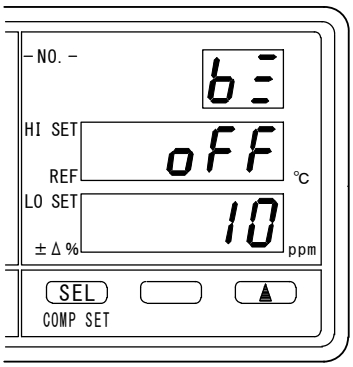
- During the setting of buzzer, the sampling is stopped and the comparator output is held.
- Setting is disabled during ONLINE and hold.
- When no key operation has been done for about 5 minutes during the setting, the meter returns to measurement mode.

3.9.1 Setting method



Setting of buzzer

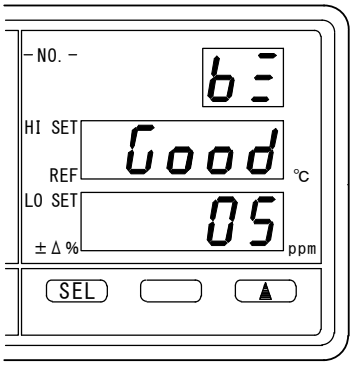
① Press [SHIFT] key.
SHIFT lamp blinks.
② Press (BUZZER) key.
HI SET display blinks.



Selection of buzzer operation

③ Select with [▲] key.
HI SET display blinks.

Display	Operation
Good	Buzzer sounds at GO output.
HI nG	Buzzer sounds at HI output.
Lo nG	Buzzer sounds at LO output.
nG	Buzzer sounds at HI and LO output.
oFF	Buzzer is turned OFF.



Adjustment of sound volume

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

Example shows the setting from buzzer OFF to GOOD, volume from 10 to 5.

Finish

⑥ Press [SEL] key.

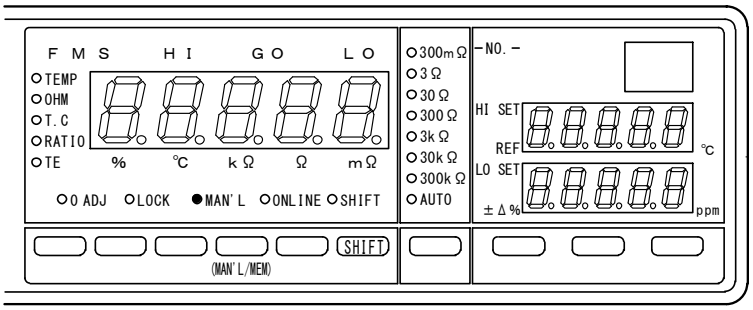
3.10 ●Manual mode

In this mode, the temperature measurement, temperature conversion function etc. can be operated.

- It is not possible to change over to manual mode when the ONLINE is lit up by remote operation.

Operating procedures

- Make a change of manual mode / memory mode with SHIFT key and (MAN'L/MEM) keys. During the manual mode, MAN'L lamp is lit up but the memory No. is not.

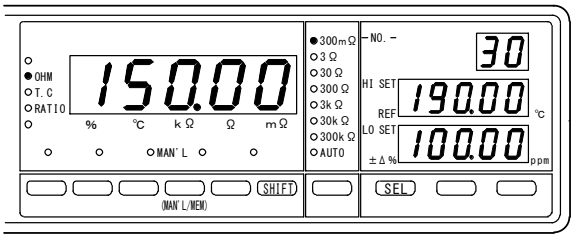


3.11 ●Memory mode

In this mode, the measurement with either one of 30 stored memories is possible.
The sampling rate is common in this case.

3.11.1 Selection of memory

● By means of operation on the front panel



To enter memory mode

① Press [SHIFT] key.
SHIFT lamp is lit up.
② Press (MAN'L/MEM) key.
Memory No. is displayed.

To recall memory

③ Press [SEL] key.
Select a memory No. and call it.

To finish memory mode

① Press [SHIFT] key.
SHIFT lamp is lit up.
② Press (MAN'L/MEM) key.

● By means of remote operation

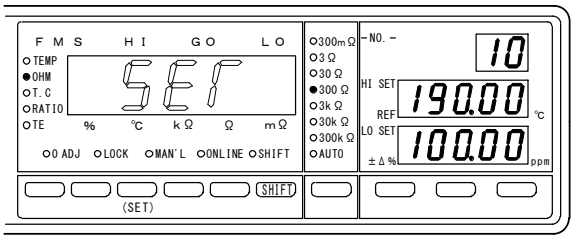
Refer to Remote Connector (article 4.1).

3.11.2 Setting of memory

Set the meter to memory mode. When the memory mode is engaged by MEM signal through REMOTE connector, the setting of memory is not allowed.
The parameters which can be memorized into the memory are following three:

- Function (temperature measurement and temperature conversion function can not be set).
- Comparator (high and low limit, REF of ratio display function, ±△%)
- Range of resistance measurement.

Note:
- Compensation temperature ℃ of temperature compensation function and temperature coefficient ppm of resistance can not be set. The values set in the manual mode remain as common value for the respective memory.
- Setting is not allowed in the ONLINE status.
- Setting is not allowed during the hold.
- During the setting, the sampling is stopped and the comparator output is held.
- When no key operation has been done for about 5 minutes during the setting, the meter returns to measurement mode.

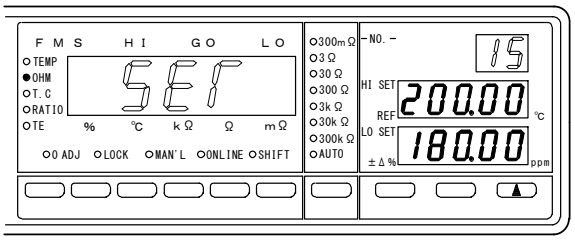


Enter memory mode

① (Refer to article 3.11.1)

To set memory

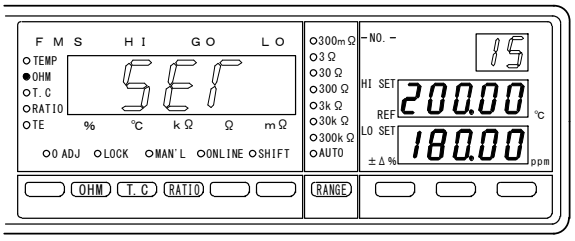
② Press [SHIFT] key.
SHIFT lamp is lit up.
Press (SET) key.
SET blinks on the display.



Selection of memory No.

③ Memory No. display blinks.
Select a memory No. with [▲] key.

Example shows the selection of memory No.15 when displayed is No.10.



Setting of function

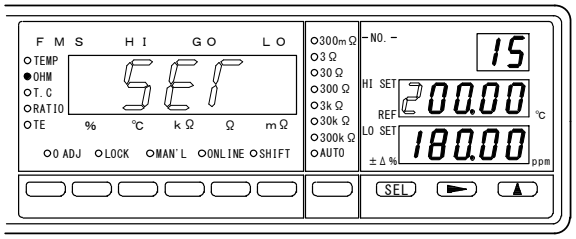
It can be set when the memory No. is blinking.

④ Select [OHM], [T.C] or [RATIO] with respective key.

Setting of measuring range

It can be set when the memory No. is blinking.

⑤ Select with [RANGE] key.

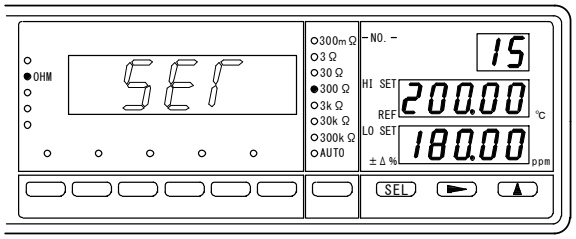


Setting of comparator, ratio display

⑥ Press SEL key.

HI SET display and the highest digit of REF display blink.

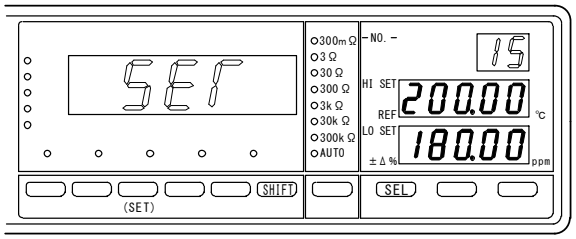
- When OHM or T.C is selected at ④, set a high limit of comparator. (Refer to the article 3.8.3)
- When RATIO is selected at ④, set a standard value of ratio display function. (Refer to the article 5.5.1)



⑦ Press SEL key.

LO SET display and the highest digit of ±△% display blink.

- When OHM or T.C is selected at ④, set a low limit of comparator. (Refer to the article 3.8.3)
- When RATIO is selected at ④, set a deviation of ratio display function. (Refer to the article 5.5.1)



Finish

⑧ Press SEL key.

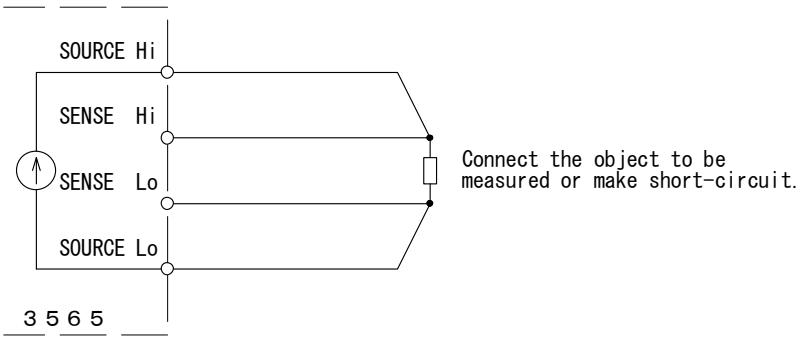
It can be finished with the memory No. display in blinking status.

⑨ Press SHIFT key.

SHIFT lamp blinks.
Press (SET) key.

3.12 ●Detection of broken line & self-check

Checking for broken line of the measuring leads of SOURCE and SENSE, and a diagnosis of fault in voltage regulator circuit can be done in this mode.
In case that an error is detected, CC ERR output is turned ON.
CC ERR output is also turned ON in such cases as the current does not flow due to open-circuit of SOURCE terminal and so on.
Note: During the operation, the sampling is stopped and the comparator output is held.

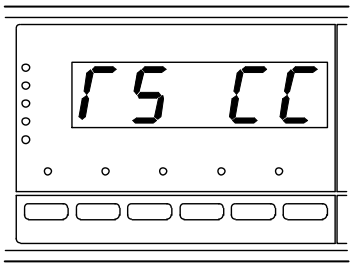


3.12.1 Operation

Preparation

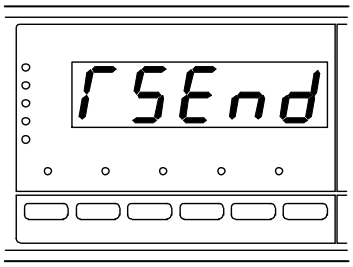
① Connect the measuring leads to the meter.
② Connect the object to be measured to another end of measuring leads or make short-circuit of them.

Start of broken line detection and self-check



③ Turn ON the SW input on REMOTE connector.
(Refer to the article 4.1.1)
rS CC is displayed on the display window.

Result of broken line detection and self-check



④ When no error is detected:
rSEnd is displayed.
⑤ When an error is detected, the symbols are displayed:
ErrSo : Broken line of SOURCE side lead wire.
ErrSE : Broken line of SENSE side lead wire.
Check the condition of lead wires.

Err in : Abnormality in voltage regulation circuit.
Breakdown of internal circuit is also considered.

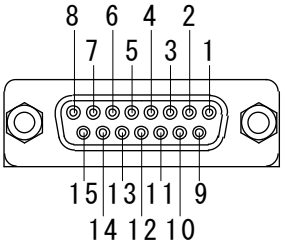
Finish of broken line detection and self-check

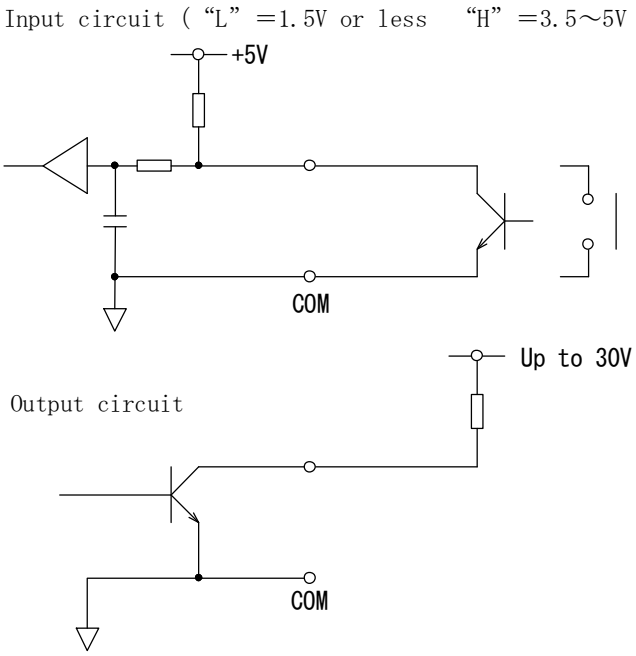
⑥ Turn OFF the SW input on REMOTE connector.

4. Remote control

4.1 ●Remote connector

4.1.1 Pin operation





(Dsub15pin)

Pin No.	Signal	Function
1	0 ADJ input	Zero adjustment is done by making this signal ON. (Refer to the article 3.6)
2	NC	Vacant pin.
3	MEM input	Memory mode is selected by turning this signal ON.
4	TRIG input	One shot sampling is done and the judgement result is output by making this signal ON during the hold, Min. ON time: 5 ms
5	SW input	Broken line detection & self-check is started by making this signal ON.
6	E0C output	Transistor output is turned ON when finished AD conversion.
7	CC ERR output	Transistor output is made ON when the current does not flow due to open circuit of SOURCE terminal, the error is detected in broken line detection & self-check and so on.
9 10 11 12 13	M-SEL0 M-SEL1 M-SEL2 M-SEL3 M-SEL4	Input a memory No. and recall memory in memory mode.
14	HOLD input	Same action as HOLD on input/output terminals is made. They are internally connected as common.
8, 15	COM	Common for input and output.

4.1.2 Remote operation of memory mode

① As long as MEM signal is kept ON, the mode is memory mode.
- When moved to the memory mode, ONLINE lamp is lit up.
- Memory No. being selected is displayed.

Note: In case that the code other than specified is selected, it is not allowed to enter the memory mode. Make an input of the code 1~30.

② Make an input of code of the memory No. and recall the memory.

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	16																

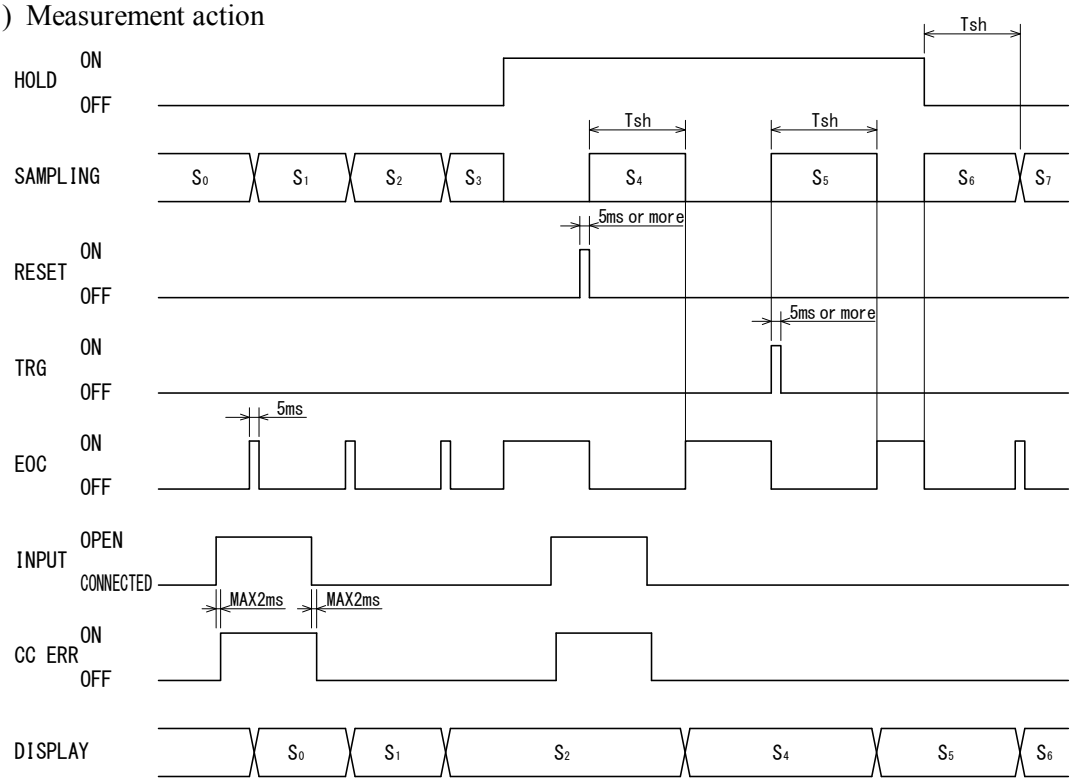
Signal	Weight	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
M-SEL0	1		○		○		○		○		○		○		○		○
M-SEL1	2			○	○			○	○			○	○			○	○
M-SEL2	4					○	○	○	○					○	○	○	○
M-SEL3	8									○	○	○	○	○	○	○	○
M-SEL4	16	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○

○ : Makes ON
Blank : Turns OFF
0, 31 : No change

② Turn OFF MEM signal.
- Moving to the manual mode, ONLINE lamp is turned OFF.
- Finishes the memory mode.

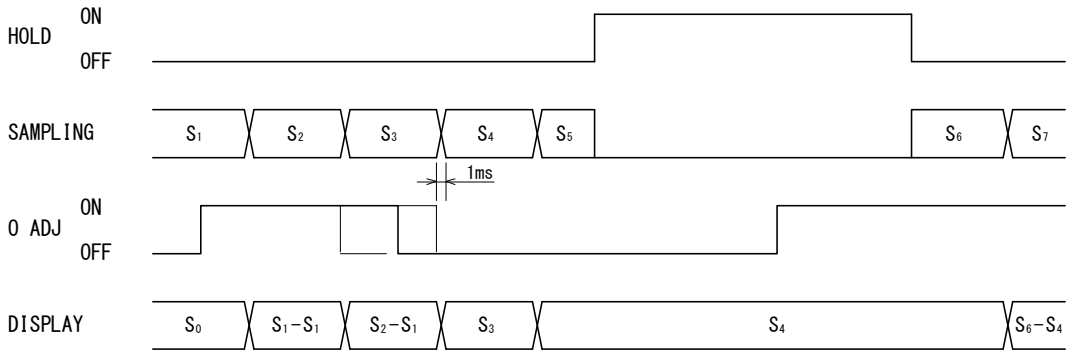
4.1.3 Timing chart of remote control

(1) Measurement action

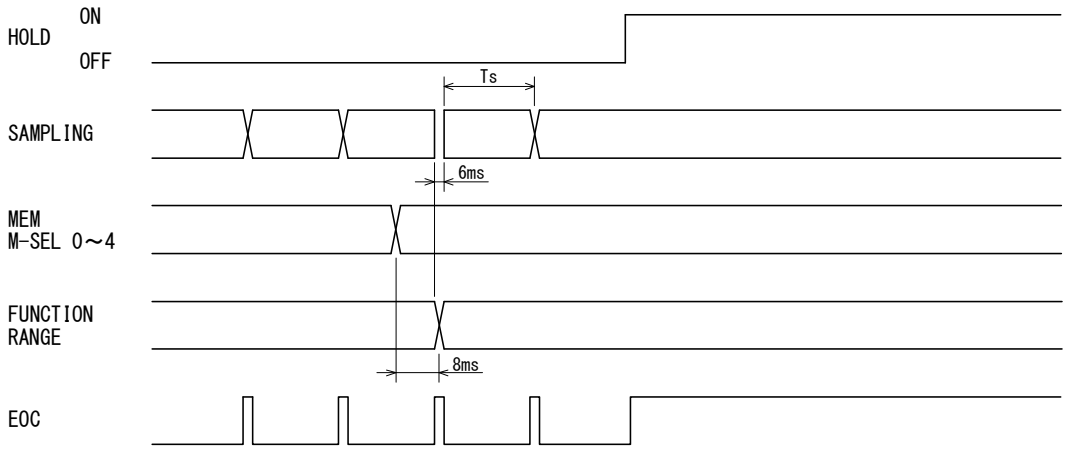


Tsh = Sampling rate + 3ms
Sampling rate: F = 10ms M = 50ms S = 250ms

(2) Zero adjustment



(3) Change-over of memory (change-over of memory/manual is the same)

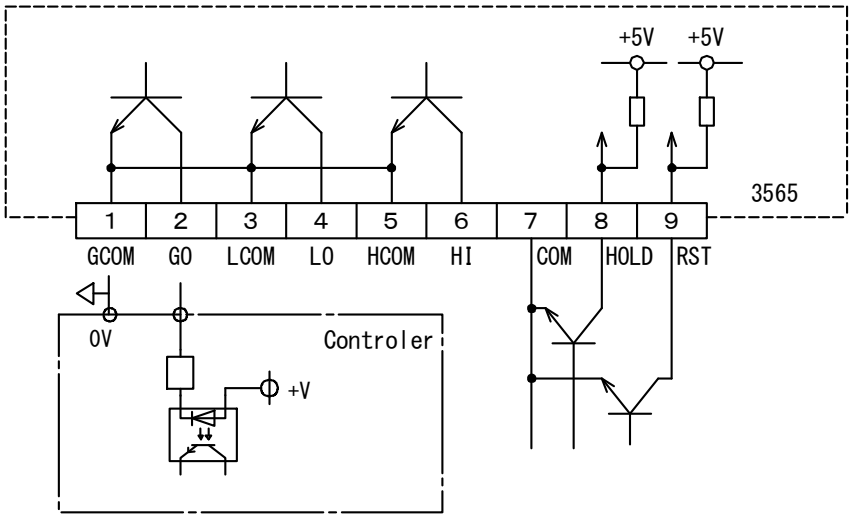


Ts = Sampling rate

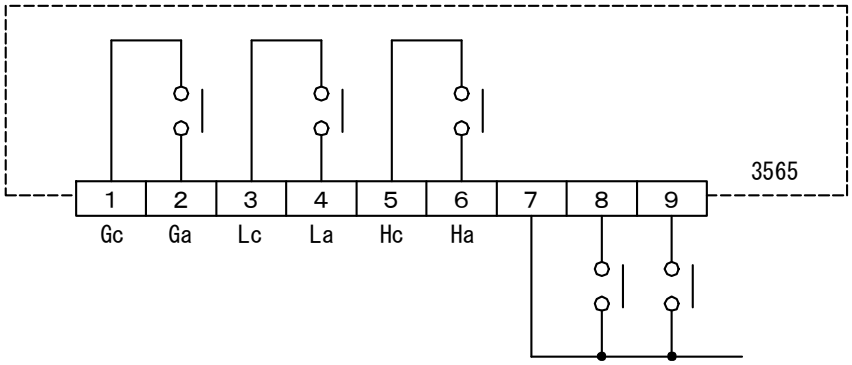
4.2 ●Remote control (input & output terminal block)

Terminal arrangement

Open collector output



Relay contach ouotput



(1) HOLD terminal (hold)
By short-circuiting the HOLD terminal on the rear panel to COM terminal, the display value, comparator output and BCD data output are held. During the hold operation, operation of all the switches is disabled.

(2) RST terminal (reset)
By short-circuiting the RST terminal on the rear panel to COM terminal, the comparator output is reset and the comparator display is turned OFF.

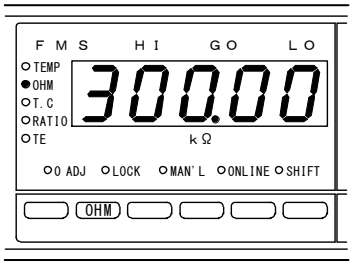
○ One shot sampling hold action
With the condition that HOLD is short-circuited, one shot sampling hold can be done by switching ON/OFF the RST. Do one shot sampling hold with the manual range. In case of auto range, it may cause an error.

(3) Comparator output

Open collector output	:	HI, GO, LO, one for each, sink type 30V 30mA Max.
Relay contact output	:	HI, GO, LO, one “a” contact for each 250VAC 1A resistive load

5. Setting Method

5.1 ●Resistance measurement

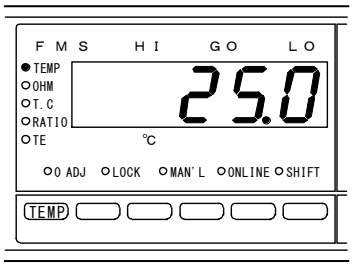


Operating procedures

① Set to manual mode (Refer to the article 3.10).
② Press [OHM] key.
OHM lamp is lit up.
③ Make various setting depending upon requirement.
Measuring range (Refer to the article 3.5)
Zero adjustment (Refer to the article 3.6)
Sampling rate (Refer to the article 3.7)
Comparator (Refer to the article 3.8.3)
④ Start measurement.

- Remote control by means of GP-IB, BCD data output, RS-232C or RS-485 interface is possible.
- Operation is disabled during the memory mode, on-line and holding

5.2 ●Temperature measurement



Operating procedures

① Connect a temperature sensor (Pt100Ω) to the rear panel connector.
② Set to manual mode (Refer to the article 3.10).
③ Press [TEMP] key.
TEMP lamp is lit up.
④ Starts measurement.

- Remote control by means of GP-IB, BCD data output, RS-232C or RS-485 interface is possible.
- Operation is disabled during the memory mode, on-line and holding
- Comparator does not operate.
- Setting of sampling rate is not possible.

5.3 ●Temperature compensation function

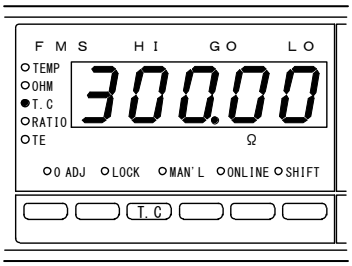
This function allows to convert the resistance of conductor, which is measured together with the ambient temperature, to the resistance value referred to the standard temperature and to display it. Standard temperature is adjustable in the range 0~149.9℃, and the temperature coefficient in the range 1000~4999ppm. In case of copper wire, for example, the standard temperature is set to 20℃ and the temperature coefficient at 3930ppm.
The ambient temperature is measured by connecting a Pt100Ω sensor.

Calculation formula

$$R_T = \frac{Rt}{1 + \alpha_T \times 10^{-6} (t - T)} \ (\Omega)$$

t : Ambient temperature (range 0~40 ℃).
R_T : Compensation resistance (Ω).
Rt : Resistance value (Ω) at ambient temperature t ℃.
α_T : Temperature coefficient (adjustable range 1000~4999ppm).
T : Standard temperature (adjustable range 0.0~149.9℃).
Accuracy : Add ±0.3% of rdg. to the accuracy of resistance measurement.

Operating procedures



① Connect a temperature sensor (Pt100Ω) to the rear panel connector.
② Set to manual mode (Refer to the article 3.10).
③ Press [T.C] key.
T.C lamp is lit up.

Note: When the temperature sensor is not connected or is over range due to broken line etc., Err-1 is displayed on the display and the comparator output HI or LO is simultaneously output.

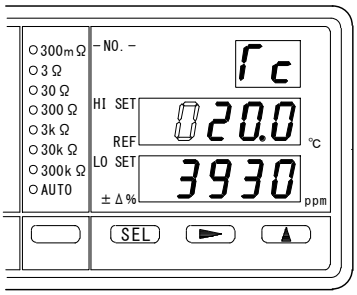
④ Make various setting depending upon requirement.
Measuring range (Refer to the article 3.5)
Zero adjustment (Refer to the article 3.6)
Sampling rate (Refer to the article 3.7)
Comparator (Refer to the article 3.8.3)
⑤ Start measurement.
⑥ To release the temperature compensation function, select other other function.

5.3.1 Setting of standard temperature and temperature coefficient

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

Move to temperature compensation function

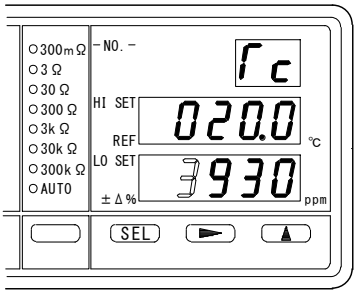
① Refer to the operating procedures.



Setting of standard temperature

② Press [SHIFT] key.
SHIFT lamp is lit up.
Press (SET) key.
The highest digit of ℃ display window blinks.
Set standard value with [►] and [▲] keys.
The digit selected with [►] key blinks.

Adjustable range: 0.0~149.9℃



Setting of temperature coefficient

③ Press [SEL] key.
The highest digit of ppm display window blinks.
Set a numeral with [►] and [▲] keys.
The digit selected with [►] key blinks.

Example the standard temperature is set to 20℃ and the temperature coefficient at 3930ppm.

Adjustable range: 1000~4999ppm

Finish

④ Press [SEL] key.

Note: When the setting is out of adjustable range, blinking Err is displayed for the setting parameter in question for a while and returns to the setting ③ or ④.

5.4 ●Temperature conversion function (Measurement of risen temperature of copper coil)

By measuring the resistance value of conductor coil at its initial condition and after its conductance test, the temperature of the conductor coil risen due to conductance is measured.

- Comparator can not be set.

Display range of risen temperature: 0~±199.9℃

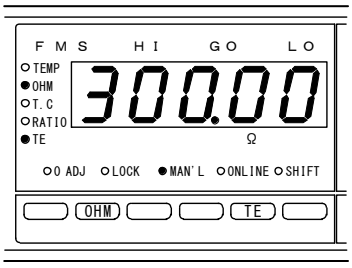
Calculation formula

$$T.E = \frac{R_2}{R_1}(235 + T_1) - 235 - T_2(℃)$$

T.E : Risen temperature value (℃).
T_1 : Ambient temperature at the start of temperature test (range 0~40 ℃).
T_2 : Ambient temperature at the end of test (range 0~40 ℃).
R_1 : Resistance value (Ω) of coil at temperature T_1.
R_2 : Resistance value (Ω) of coil at temperature T_2.

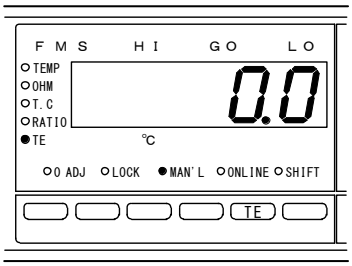
Operating procedures

Measuring mode of T_1, R_1



① Set to manual mode (Refer to the article 3.10).
② Press [T.E] key.
OHM lamp and TE lamp are lit up.
Note: When the temperature sensor is not connected or is over range due to broken line etc., Err-1 is displayed on the display and the comparator output HI or LO is simultaneously output.
③ Make various setting depending upon requirement.
Measuring range (Refer to the article 3.5)
Zero adjustment (Refer to the article 3.6)
Sampling rate (Refer to the article 3.7)
④ Connect a test sample with Kelvin clip.

Memory of T_1, R_1

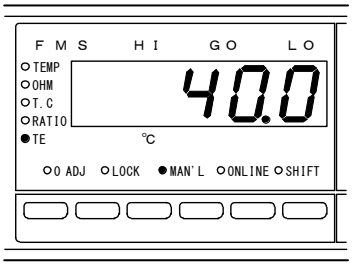


⑤ Press [T.E] key.
OHM lamp is turned off and TE lamp is lit up.
Memorizes T_1, R_1 and moves to measurement of T_2, R_2.
Display window shows the risen temperature.

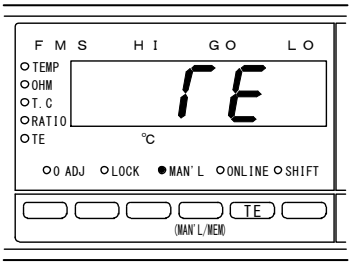
Conductance test of test sample

⑥ Remove the Kelvin clip from the test sample.
Perform the conductance test etc. of the test sample.
- When the power of the meter is turned off, it starts from ⑤.
- During the risen temperature is displayed, it is not allowed to switch over to other function.

Measurement of risen temperature



⑦ After completing the conductance test, connect the test sample with Kelvin clip and measure T_2, R_2.
Temperature risen due to the test is displayed.
Note: When R_1 is 0Ω (when made to 0 by zero adjustment), blinking Err-2 is displayed on the display and the comparator output HI or LO is simultaneously output.



Finish

⑧ Press T.E key.
rE is displayed.
(If T.E key is pressed again, it returns to ⑦.)
Select other function.

5.5 ●Ratio display function

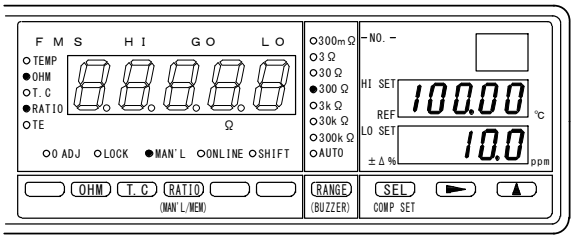
The measured resistance R_X is compared to the standard resistance value R_S and its ratio is displayed in percentage.
Also, a comparative judgement is possible with deviation (±△%)

Display range : 0.0~199.9%
Adjustable range of deviation value (±△%) : 0.0~±100.0%
Calculation formula:

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

$$\triangle = \left(\frac{R_X}{R_S} - 1 \right) \times 100\%$$

X : Ratio (%)
R_S : Standard resistance (Ω)
R_X : Measured resistance (Ω)
△ : Deviation (%)



Operating procedures

① Set to manual mode.
(Refer to the article 3.10)

② Select either function with OHM, or T.C key.

③ Press RATIO key.
RATIO lamp is lit up.

④ Make various setting depending upon necessity.
Measuring range (Refer to the article 3.5)
Zero adjustment (Refer to the article 3.6)
Sampling rate (Refer to the article 3.7)

⑤ Start measurement.

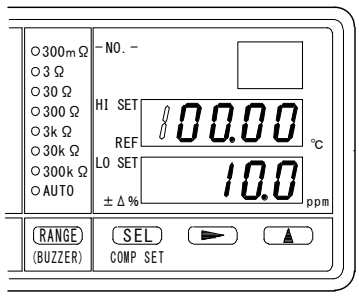
Finish

⑥ Select other function.

- Remote control by GP-IB or BDC data output interface is possible.
- In case of ratio display of resistance measurement, press RATIO key following the OHM key.
  OHM and RATIO lamps are lit up.
- In case of ratio display of temperature compensation, press RATIO key following the T.C key.
  T.C and RATIO lamps are lit up.

Display = ((measured resistance) × (temperature compensation calculation)) × Ratio calculation

5.5.1 Setting of standard value and deviation



Move to ratio display function

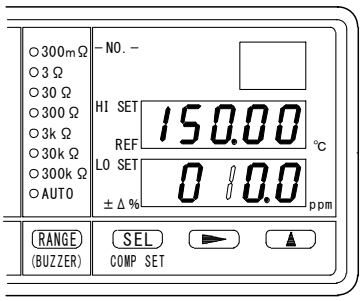
① Refer to the operating procedures.

Setting of standard temperature

② Press [SEL] key.
The highest digit of REF display window blinks.
Set a numeral with [►] and [▲] keys.
The digit selected with [►] key blinks.

③ Select the range of standard value with [RANGE] key.

Adjustable range: -19999~35000



Setting of deviation

④ Press [SEL] key.
The highest digit of ±△% display window blinks.
Set a numeral with [►] and [▲] keys.
The digit selected with [►] key blinks.

Adjustable range: 0.0~100.0%

Finish

⑤ Press [SEL] key.

Note: When the setting is out of adjustable range, blinking Err is displayed for the setting parameter in question for a while and returns to the setting ③ or ④.

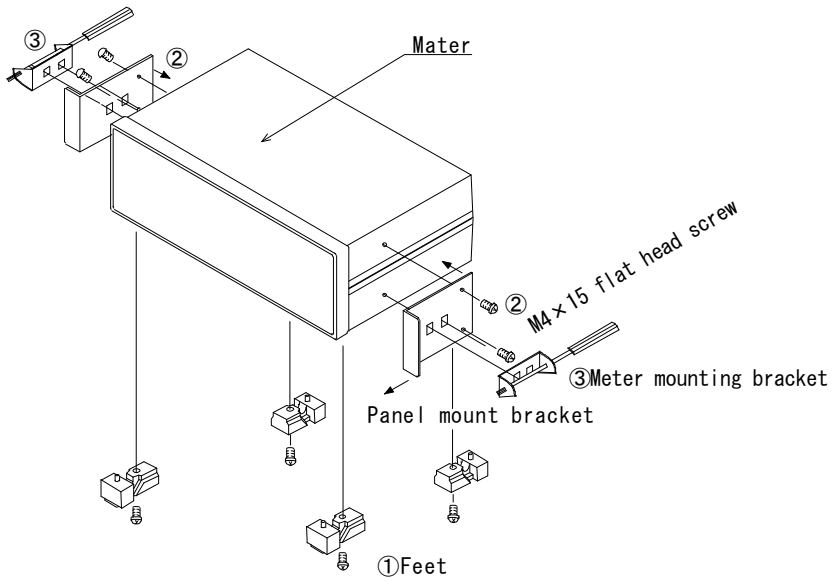
5.6 ●Character display

Display	Name	Explanation
uuuuu	Error 0	Over range measurement.
Err-1	Error 1	Over ranged temperature measurement in temperature compensation and temperature conversion function.
Err-2	Error 2	Calculation error.
ErrSo	Error SO	When SOURCE is open.
ErrSE	Error SE	When SENSE is open.
Err in	Error in	Error of regulated current.
SEr	Set	Memory setting.
rS CC	Test CC	Broken line detection, start of self-check.
rSEnd	Test end	Broken line detection, finish of self-check.
Err	Setting error	When setting parameter is out of range. Blinks for about 1 second.

6. Panel mount use

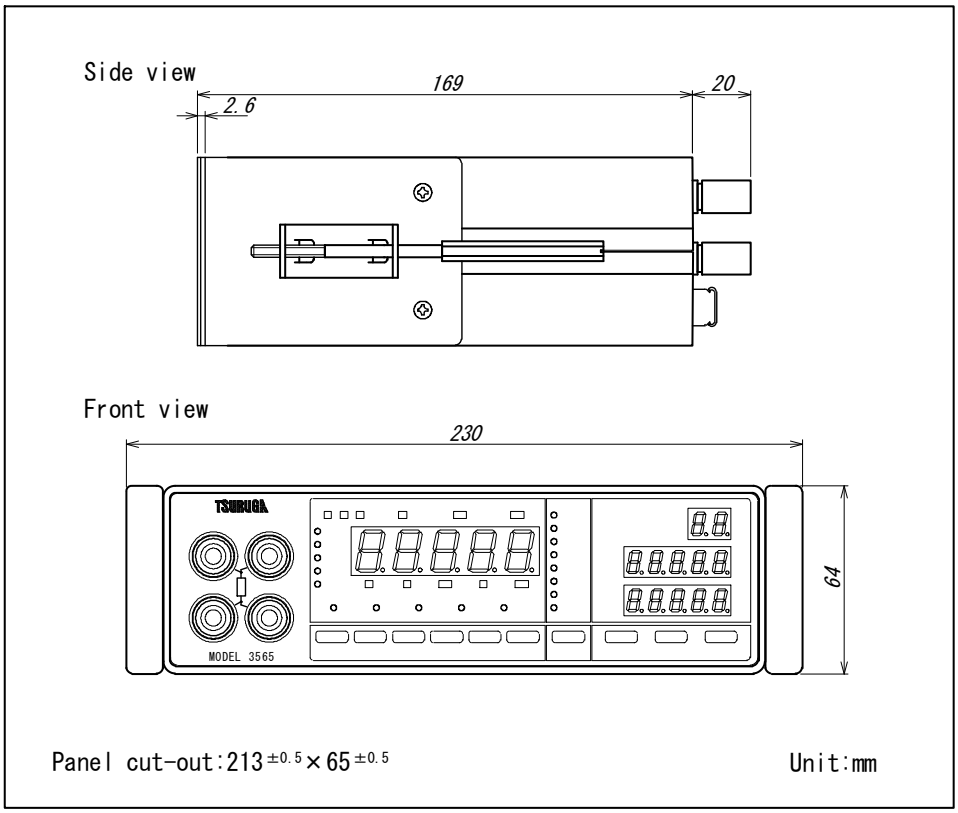
6.1 ●Assembly for mounting

When the meter is intended for panel mount use, use an optional mounting bracket.



①Remove the feet (4 parts) from the bottom of the meter.
②Fix the panel mount bracket to both sides of the meter (M4×15 flat head screws).
③Insert the meter from the front of the panel and fix it to the panel with meter mounting bracket.
Note: When the meter is installed to a chassis etc. utilizing the tap holes of the meter, use the screw of the length 6 + thickness of meter (mm).

6.2 ●External dimensions when fitting panel mount brackets



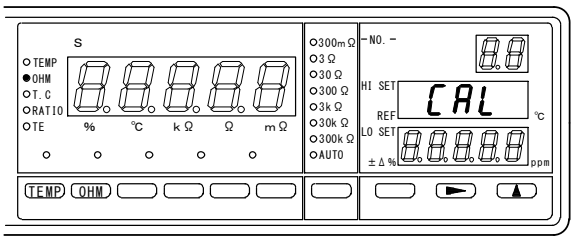
7. Calibration

7.1 ●Materials to prepare

To calibrate the 3565, prepare the following standard resistors for calibration.
For resistance measurement ranges: 300mΩ, 3Ω, 30Ω, 300Ω, 3kΩ, 30kΩ, 300kΩ
For temperature measurement ranges: 100Ω (0℃), 172.17Ω (190℃)
Note: Select the calibration resistors whose accuracy secures the same of 3565.

7.2 ●Calibration method

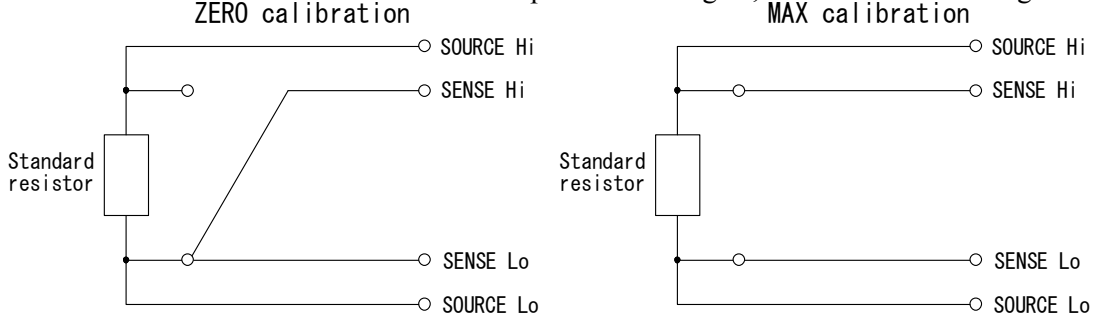
7.2.1 Calibration of resistance measuring range



① Turn off the power supply switch, then pressing [OHM] and [TEMP] keys simultaneously, switch ON the power supply. CAL is displayed on HI SET display window and the meter enters calibration mode.
② Press [OHM] key.
OHM Lamp is lit up.
③ Connect the standard resistor with lead wires as the figure below shows.
Select the standard resistor to suit each measuring range.
④ ZERO is calibrated by pressing [►] key, and MAX by [▲] key.
Make correct calibration for each range, Selecting it with [RANGE] key.
When the calibration is correctly done, CAL blinks for a while on the display.
In case that Err is displayed, it is out of the range to calibrate. Replace the resistor with that of correct value.
⑤ Standard resistance values for each range and display values are as follows.

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

⑥ When completed the calibration, turn OFF the power supply of the meter to release it from calibration mode. When the meter is powered ON again, it returns to measuring mode.

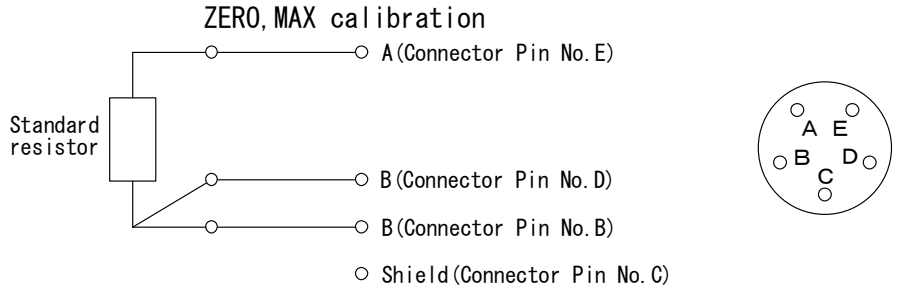


7.2.2 Calibration of temperature measuring range

① In the same manner as resistance measurement, press [TEMP] key, then the meter becomes calibration mode for temperature measurement ranges.
② Connect the standard resistor 100Ω as the figure below shows and press [►] key, then ZERO is calibrated.
③ In the same way, connect the resistor 172.17Ω and press [▲] key to calibrate MAX.
④ Display values at calibration is as follows.

ZERO **display value**	MAX **display value**
0.0℃	190.0℃

⑥ When completed the calibration, turn OFF the power supply of the meter to release it from calibration mode. When the meter is powered ON again, it returns to measuring mode.



8. Specifications

8.1 ●Model name

Model name	Description
3565 -☐	No data output
3565-01-☐	With GP-IB
3565-03-☐	With BCD data output (TTL level)
3565-04-☐	With BCD data output (open collector)
3565-05-☐	With RS-232C
3565-06-☐	With RS-485

☐ : Judgement output
Nil : Open collector NPN
RY : Relay output

8.2 ●Measuring range & accuracy

■Resistance measurement (at SLOW sampling)

Measuring range	300mΩ	3Ω	30Ω	300Ω	3kΩ	30kΩ	300kΩ
Resolution	10μΩ	100μΩ	1mΩ	10mΩ	100mΩ	1Ω	10Ω
Measuring current	100mADC		10mADC	1mADC		10μADC	
Max. measurement voltage applied	30mV	300mV			3V	300mV	3V
Accuracy ※	Note 1	±(0.08% of rdg.＋3 digits)					Note 2
Temperature coefficient	±(0.01% of rdg.＋0.5 digits) / ℃						
Open terminal voltage	7VDC Max.						

Note 1: ±(0.1% of rdg.＋8 digits)
Note 2: ±(0.1% of rdg.＋3 digits)
※Accuracy: Defined at 23℃±5℃, 45~75%RH.
When the sampling rate is MEDIUM, 3 digits are added to the accuracy at SLOW.

■Resistance measurement (at FAST sampling)

Measuring range	300mΩ	3Ω	30Ω	300Ω	3kΩ
Resolution	100μΩ	1mΩ	10mΩ	100mΩ	1Ω
Measuring current	100mADC		10mADC	1mADC	
Max. measurement voltage applied	30mV	300mV			3V
Accuracy ※	±(0.2% of rdg.＋5 digits)				
Temperature coefficient	±(0.01% of rdg.＋0.1 digit) / ℃				
Open terminal voltage	7VDC Max.				

※Accuracy: Defined at 23℃±5℃, 45~75%RH.

■ Temperature measurement

Measuring range	-19.9~199.9℃
Resolution	0.1℃
Accuracy ※	±(0.2% of rdg.＋0.2℃)
Temperature coefficient	±(0.02% of rdg.＋0.02℃) / ℃
Sensor	Pt100Ω 3-wire system (lead wire resistance 5Ω or less)
Measuring current	Approx. 1mA

※Accuracy: Defined at 23℃±5℃, 45~75%RH.

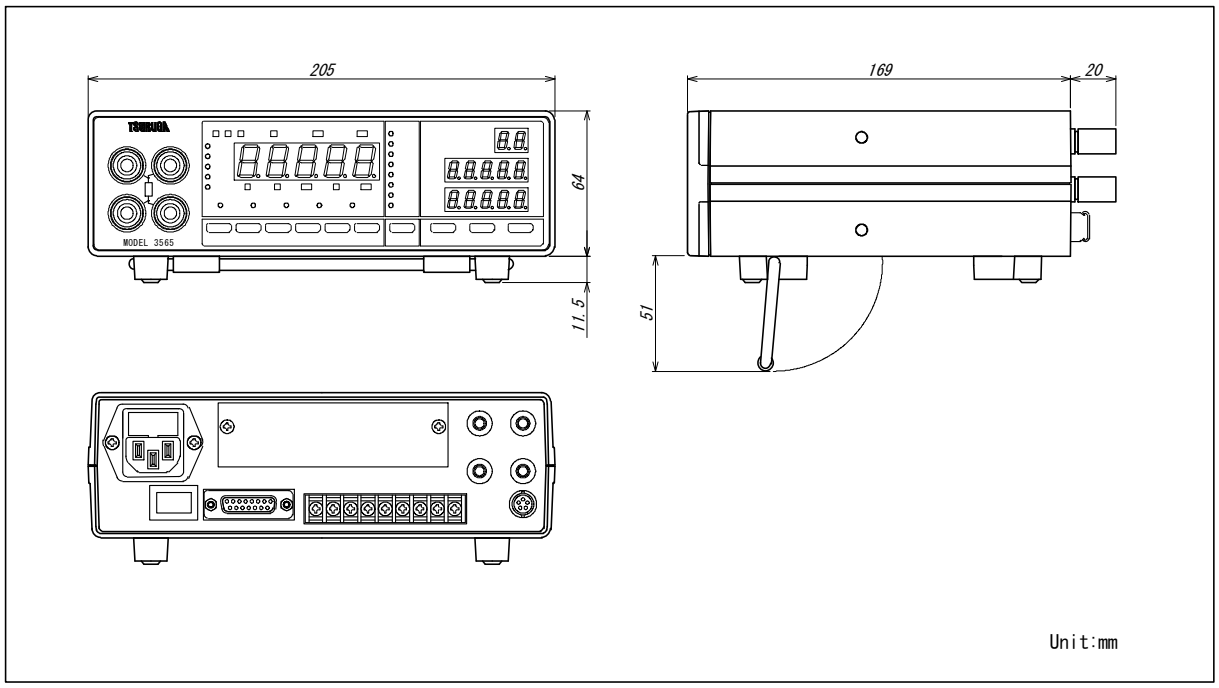
8.3 ●General specifications

Measuring system	:	4 terminals system (resistance measurement).
Tolerable max. apply voltage	:	100V, AC, DC for all ranges. (10VDC at temperature measuring rang)
Measuring cable resistance	:	5Ω or less.
Display	:	Green LED (character height 14.2mm). Resistance measurement : 35000 (3500 for FAST) Temperature measurement : 199.9 Provided with zero suppress function.
Over-range display	:	Blinking with ⊔⊔⊔⊔.
Unit display	:	mΩ, Ω, kΩ, %, ℃
Sampling rate	:	SLOW : (4 times/sec.) MEDIUM : (20 times/sec.) FAST : (100 times/sec.)
Response speed	:	SLOW : approx. 500ms MEDIUM : approx. 100ms FAST : approx. 50ms
Parameter retention	:	Function, ranges, values etc. are memorized in EEPROM. Re-writable times 100,000 times Retention period 10 years
Insulation resistance	:	Whole terminals – Enclosure 500VDC 100MΩ or more
Withstanding voltage	:	Whole terminals– Enclosure 1500V AC for 1 minute Power source – Enclosure 1500V AC for 1 minute Measuring terminals – Output terminals 500V AC for 1 minute
Power supply voltage	:	AC100~240V (50/60Hz)
Tolerance for supply voltage	:	AC90~250V (50/60Hz)
Power consumption	:	Approx. 13VA
Operating ambient temperature	:	0~50 ℃
Storage temperature	:	-20~70 ℃
Weight	:	Approx. 1kg.
Accessories	:	Power supply cable with 3P→2P conversion plug ….. 1 pc. Remote connector …… 1 pc. Instruction manual …….. 1 pc.

8.4 ●Table of initial set values (at delivery from factory)

Measuring range	300Ω
Memory 1~30	Resistance measurement, 300Ω range
Comparator	HI SET: 300.00Ω, LO SET: 000.00Ω
Ratio display function	Standard value: 300.00Ω ±△%: 010.0%
Temperature compensation function	Standard temperature: 020.0℃ Temperature coefficient: 3930ppm
Key lock	OFF
Buzzer	OFF setting, sound volume 5
Zero adjustment	OFF

8.5 ●External dimensions



8.6 ●Interface (option)

○Following optional interfaces are prepared for use with Model 3565.
For handling of each interface, please refer to respective instruction manual of these interface.

GP-IB interface board	:	5811-01
BCD data output board (TTL)	:	5811-03
BCD data output board (open collector)	:	5811-04
RS-232C interface board	:	5811-05
RS-485 interface board	:	5811-06

○Others

(1) Kelvin clip	:	5811-21B 5803-24
(2) Lead for calibration of resistance	:	5811-51
Lead for calibration of temperature	:	5811-52
Temperature sensor	:	5803-11
Panel mount bracket	:	5811-31

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

Instruction Manual
Interface of BCD Data Output

MODEL 5811-03,04

(for Model 3565)

I-01278

TSURUGA ELECTRIC CORPORATION

Contents

With BCD data output board, this interface can perform the remote control of measuring function and measuring range as well as output measuring data of the model 3565.

⚠ CAUTION

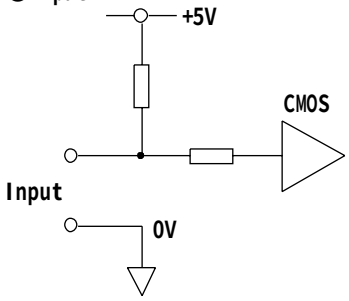
- **Switch OFF the power of the main unit and pull out the power cord plug.**
- **Do not short-circuit or apply voltage to output.**

1. Specifications of BCD data input & output

1.1 ●MODEL 5811-03 (3565-03)

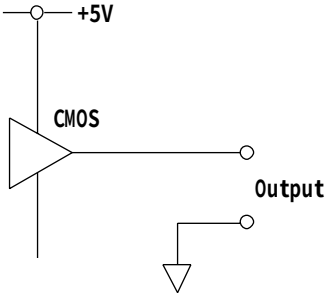
BCD data is output by TTL level.
Output system : Parallel BCD code, positive logic.
"L" level is output by logic "0", and "H" level by logic "1".

●Input



Input level : I_{IL}≦-1mA
"L"=0.8V or less
"H"=3.5～5V

●Output

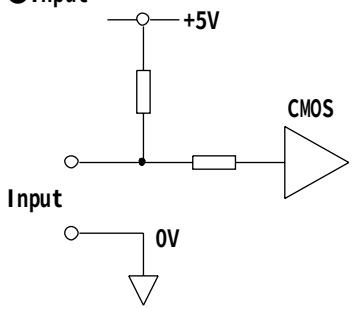


Output level : TTL level
Fo=2

1.2 ●MODEL 5811-04 (3565-04)

BCD data is output by open collector
Output system : Parallel BCD code.
"OFF" is output by logic "0", and "ON" by logic "1".

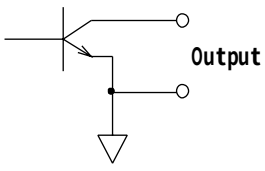
●Input



Input level : I_{IL}≦-1mA
"L"=0.8V or less
"H"=3.5～5V

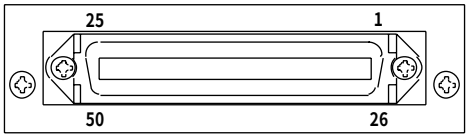
●Output

NPN transistor



Output capacity : DC30V、30mA

2. Arrangement of connector pins



Signal name		Pin No.		Signal name	
UNIT	0	1	26	4	UNIT
	1	2	27	5	
	2	3	28	6	
	3	4	29	7	
$\times 10^0$	1	5	30	1	$\times 10^1$
	2	6	31	2	
	4	7	32	4	
	8	8	33	8	
$\times 10^2$	1	9	34	1	$\times 10^3$
	2	10	35	2	
	4	11	36	4	
	8	12	37	8	
$\times 10^4$	1	13	38	POL	
OUTPUT ENABLE		14	39	OVER	
$\overline{\text{HOLD}}$		15	40	$\overline{\text{STROBE}}$	
DP1		16	41	1	SEL
DP2		17	42	2	
DP3		18	43	4	
DP4		19	44	2	$\times 10^4$
FUNCTION	1	20	45	1	RANGE
	2	21	46	2	
	4	22	47	4	
	8	23	48	NC	
INT. / $\overline{\text{EXT.}}$		24	49		
DATA COM		25	50	DATA COM	

Connector: (Anphenol) 57-30500

Note: Do not use NC pin as it is connected to the internal circuit.

3. Explanation of input/output signals

3.1 ●Output signals

3.1.1 Measuring data output : 1, 2, 4, 8 ($\times 10^0$~$\times 10^4$)
Measured data is output with parallel BCD code.
Note: When $\times 10^0$ digit is blank (or sampling rate is FAST), 0 is output.

3.1.2 Unit output : UNIT
"Unit" data is output with 8 bit code.

Table of unit code:

Unit	UNIT							
	7	6	5	4	3	2	1	0
mΩ	1	0	0	1	1	0	0	0
Ω	1	1	1	1	1	1	1	0
kΩ	0	1	1	0	0	1	0	1
°C	1	0	1	1	0	0	0	1
%	1	1	1	0	0	0	0	0

3.1.3 Decimal point output : DP1~DP4
Position of decimal point is output with 4 bit code.

Table of output code:

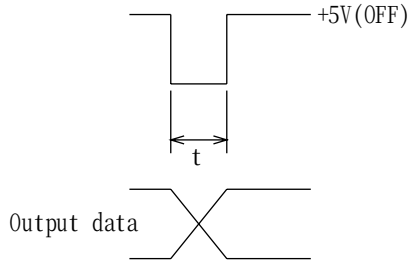
Display	Output			
	DP4	DP3	DP2	DP1
350.00(350.0□)	1	1	0	1
35.000(35.00□)	1	0	1	1
3.5000(3.500□)	0	1	1	1

※□ $\times 10^0$digit is blank.

3.1.4 Polarity output : POL
"1" is output for plus polarity.
"0" is output for minus polarity.

3.1.5 Over-range output : OVER
Error 0 : When the data exceeded 35000 (3500□) or the measured temperature exceeded the measuring range in temperature measurement, OVER becomes "1" and the data 00000 is output.
Error 1 : When the data exceeded the temperature measuring range in temperature compensation function and temperature conversion function, OVER becomes "1" and the data 00001 is output.
Error 2 : When the calculation is faulty, OVER becomes "1" and the data 00002 is output.
Error 3 : When the data selection input is out of the designated codes, OVER becomes "1" and the data 00003 is output.

3.1.6 Strobe output : $\overline{\text{STROBE}}$
At renewal of data, "L" pulse is output as the figure below shows.
Catching this rising point, transact the data.
Note: ON is output when the specifications are provided with the open collector output.



Sampling rate	t m s
FAST	Approx. 1ms
SLOW, MIDIUM	Approx. 10ms

3.2 ●Input signals

3.2.1 Data enable : OUTPUT ENABLE

All the output except $\overline{\text{STROBE}}$ become "high impedance" status at "L" level.

3.2.2 Remote hold input : $\overline{\text{HOLD}}$

At "H" level, sampling is done and the measuring data is sequentially output.
At "L" level, sampling is stopped and, the BCD data and display value are held.
During the hold, switch operation on the front panel is not accepted.

3.2.3 Data selection input : SEL

By making an input of selection code, in measurement of temperature compensation, temperature conversion or ratio display, the measuring data can also be output in addition to the displayed data.
When making the data selection, do it after getting the display value and data in hold status.

Note 1: If it is done without holding, the display value and output data may be different.
Note 2: Display remains unchanged even if the status becomes data selection status.

Example: The display value, during the temperature compensation function in operation, is the conversion value (R_T).
If the data output of ambient temperature (t) or resistance value (Rt) at the ambient temperature t℃ is necessary, select the output data by making an input of selection code.

How-to-select:
Make an input of selection code in the table and select the necessary data.

Table of data output & selection code

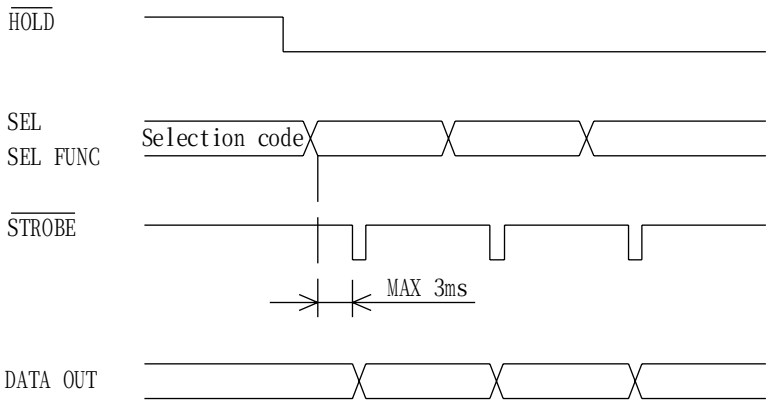
Function \ Selection code		4 2 1	4 2 1	4 2 1	4 2 1	4 2 1	4 2 1	4 2 1	4 2 1
		L L L	L L H	L H L	L H H	H L L	H L H	H H L	H H H
At resistance measurement		OHM	OHM	OHM	OHM	OHM	OHM	OHM	OHM
At temperature measurement		TEMP	TEMP	TEMP	TEMP	TEMP	TEMP	TEMP	TEMP
At temperature compensation		Err3	Rt	t	Err3	Err3	Err3	Err3	R_T
At ratio display		Err3	R_S	R_X	Err3	Err3	Err3	Err3	X
At temperature conversion	T_1 measurement	Err3	T_1	R_1	Err3	Err3	Err3	Err3	R_1
	T_2 measurement	Err3	Err3	Err3	T_2	R_2	Err3	Ter	R_2
	TE conversion	Err3	T_1	R_1	T_2	R_2	Err3	Ter	TE

Note 1:

Function	Display	Contents
At resistance measurement	OHM	Resistance value
At temperature measurement	TEMP	Temperature
At temperature compensation	R_t	Resistance value at ambient temperature (℃)
	T	Ambient temperature
	R_T	Compensation resistance
At ratio display	R_S	Standard resistance value
	R_X	Measuring resistance value
	X	Ratio
At temperature conversion	T_1	Ambient temperature at the start of the test
	R_1	Coil resistance at temperature T1
	T_2	Ambient temperature at the end of the test
	R_2	Coil resistance at temperature T2
	Ter	Increased temperature of coil by TE calculation is sequentially output.
	Te	Temperature increase of coil at switching to Te

Note 2:When the data selection input is out of the designated codes, "Error 3" signal is output.
(Err3: OVER signal becomes "1" and the data 00003 is output.)

○ Timing chart for data selection



3.2.4 Remote control input : INT. / EXT.

By making "L" level, the following operations can be remote-controlled.
In this case, the switch operation from the front panel is disabled.

- Selection of function
- Selection of range

Note: During the hold, no control is possible.
During the remote-controlled memory mode, no function or no range can be selected.

3.2.5 Input of function : FUNCTION

By designating a function code, each function can be remote-controlled. When inputting the function code, do it after setting INT. / EXT. input to "L" level.

Function		**8**	**4**	**2**	**1**
Resistance measurement		H	L	L	H
Temperature measurement		H	L	L	L
Temperature compensation		L	H	L	L
Ratio display	OHM RATIO	L	H	H	H
	T. C RATIO	L	H	L	H
Temperature conversion	Te CLR	L	L	H	H
	T_1	L	L	H	L
	T_2	L	L	L	H
	Te	L	L	L	L

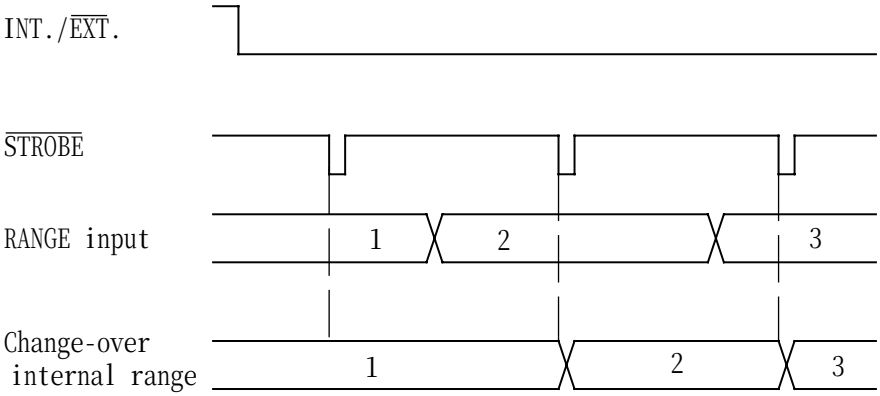
Note: Setting other than the above is ineffective.

3.2.6 Range input : RANGE

By making an input of range code, it is possible to remotely select a resistance.
When inputting the range code, do it after setting INT. / $\overline{\text{EXT.}}$ input to "L" level.

RANGE			Range
4	2	1	
L	L	L	Resistance measurement Auto range
L	L	H	Resistance measurement 300mΩ
L	H	L	Resistance measurement 3Ω
L	H	H	Resistance measurement 30Ω
H	L	L	Resistance measurement 300Ω
H	L	H	Resistance measurement 3kΩ
H	H	L	Resistance measurement 30kΩ
H	H	H	Resistance measurement 300kΩ

○ Timing chart for switching-over of range



4. Operation

4.1 ●Resistance measurement

Refer to the article 5.1 of this manual.

① Make the remote control input (INT. / $\overline{\text{EXT.}}$) "L" level.
② Input a resistance measurement code to the function (FUNCTION).
③ Input a range code to the range (RANGE) and select a resistance range.
④ Start measurement.

4.2 ●Temperature measurement

Refer to the article 5.2 of this manual.

① Make the remote control input (INT. / $\overline{\text{EXT.}}$) "L" level.
② Input a temperature measurement code to the function (FUNCTION).
③ Start measurement.

4.3 ●Temperature compensation

Refer to the article 5.3 of this manual.

① Make the remote control input (INT. / $\overline{\text{EXT.}}$) "L" level.
Note 1: Setting of standard temperature and temperature coefficient:
Make the remote control input (INT. / $\overline{\text{EXT.}}$) "H" level, and set with the switch on the front panel.
② Select a resistance range with the range (RANGE).
③ Input a temperature compensation code to the function (FUNCTION).
④ Start measurement.

4.4 ●Ratio display

Refer to the article 5.5 of this manual.

① Make the remote control input (INT. / $\overline{\text{EXT.}}$) "L" level.
Note : When making numeral setting of standard resistance value:
Make the remote control input (INT. / $\overline{\text{EXT.}}$) "H" level, and set with the switch on the front panel.
② Select a resistance range with the range (RANGE).
③ Input OHM RATIO or T.C RATIO code to the function (FUNCTION).
OHM RATI : Display of ratio at resistance measurement
T.C RATIO : Display of ratio at temperature compensation
④ Start measurement.

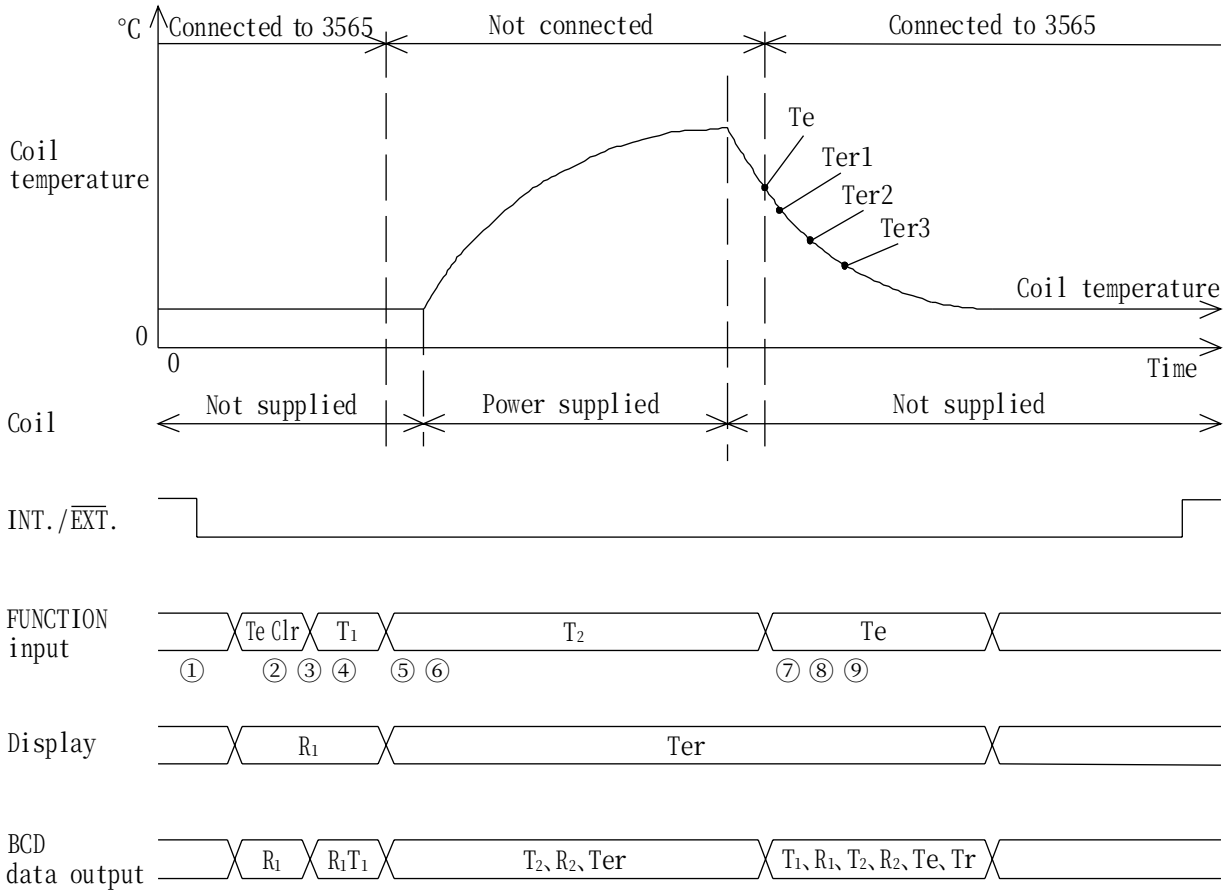
4.5 ●Temperature conversion

Refer to the article 5.4 of this manual.

① Make the remote control input (INT. / $\overline{\text{EXT.}}$) "L" level.
② Input the Te CLR code. (It clears internal memory.)
③ Connect a test sample to measuring input. The lamps of OHM and TE of the main unit turn ON.
④ Input the T_1 code.
⑤ Input the T_2 code.
T_1 and R_1 at input are memorized.
The OHM lamp turns off.
⑥ Disconnect the measuring input and make a conductance test.
⑦ After finishing the conductance test, connect the test sample to the measuring input.
⑧ Input the T.E code.
Temperature increase at input is memorized as Te.
⑨ Read-out of each data: After the finish of temperature conversion, the data T_1, T_2, R_1, R_2 and TE of each channel is output.

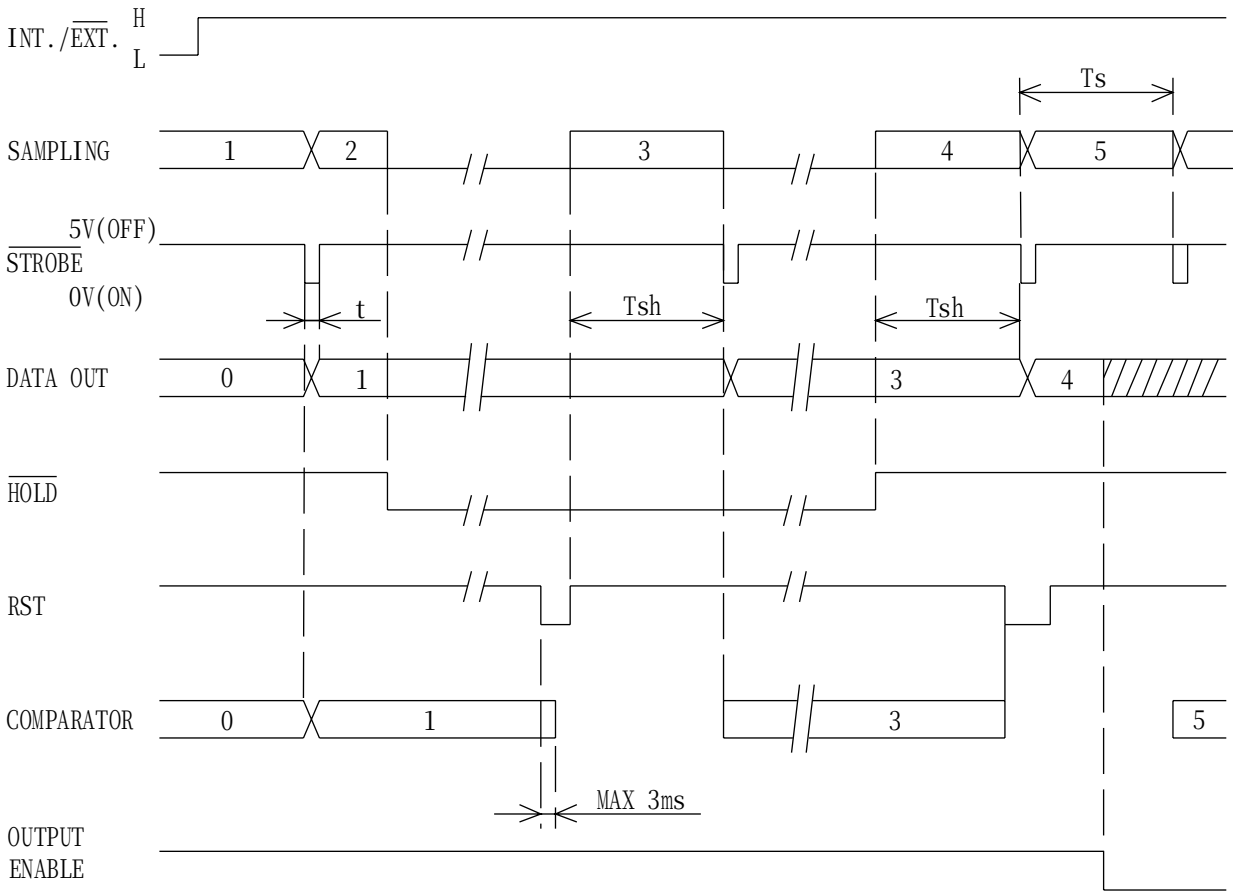
Note 1: Perform the measurement separately from the conductance test. If the test sample is in the condition being conducted, the measurement can not be made.
Note 2: Zero-adjustment function can not be used.

○ Performance



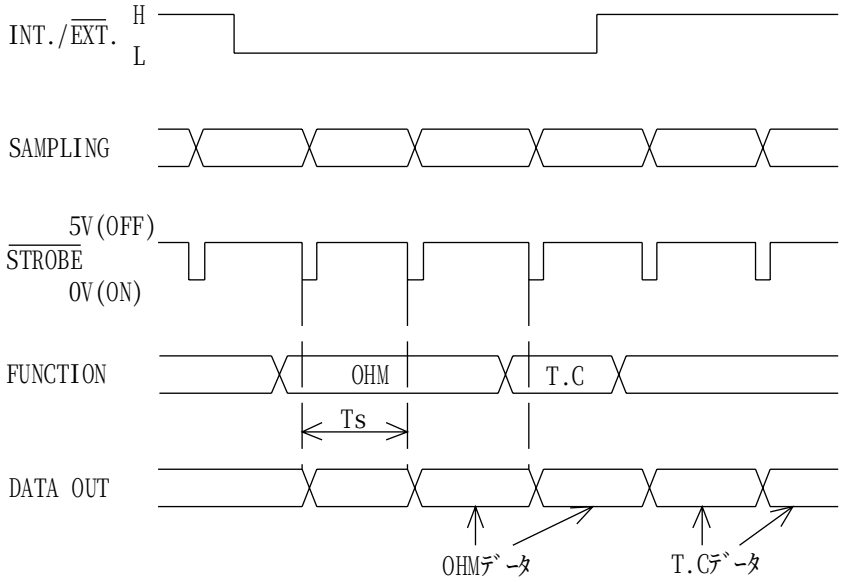
5. Timing chart

5.1 ●Data output



Ts : Sampling rate
(SLOW : 250ms MEDIUM : 50ms FAST : 10ms)
Tsh : Ts＋**3**ms
//// section High impedance

5.2 ●Timing chart for switching-over of function



Instruction Manual
Interface of GP-IB

MODEL 5811-01

(for Model 3565)

I-01324

TSURUGA ELECTRIC CORPORATION

Contents

1. FUNCTION

1.1 Interface

Table 1-1

Function	Description
SH1	All the receiver handshake functions are provided.
AH1	All the transmitter handshake functions are provided.
T8	Basic talker function.
	Talker release function with MLA.
L4	Basic listener function.
	Listener release function with MTA.
SR1	Service request function is provided.
RL0	No remote local function is provided.
PP0	No parallel pole function is provided.
DC1	Device clear function is provided.
DT1	Device trigger function is provided.
C0	No control function is provided.

1.2 BUS Driver System

Open collector driver (In accordance with IEEE488-1978)

1.3 Delimiter

When CR+LF or EOI "True" is received, it is recognized as delimiter.

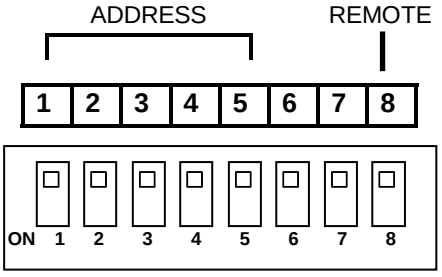
1.4 Address Setting

Table 1-2

Address	Dip switch				
	5	4	3	2	1
0	-	-	-	-	-
1	-	-	-	-	O
2	-	-	-	O	-
3	-	-	-	O	O
4	-	-	O	-	-
5	-	-	O	-	O
6	-	-	O	O	-
7	-	-	O	O	O
8	-	O	-	-	-
9	-	O	-	-	O
10	-	O	-	O	-
11	-	O	-	O	O
12	-	O	O	-	-
13	-	O	O	-	O
14	-	O	O	O	-
15	-	O	O	O	O

Address	Dip switch				
	5	4	3	2	1
16	O	-	-	-	-
17	O	-	-	-	O
18	O	-	-	O	-
19	O	-	-	O	O
20	O	-	O	-	-
21	O	-	O	-	O
22	O	-	O	O	-
23	O	-	O	O	O
24	O	O	-	-	-
25	O	O	-	-	O
26	O	O	-	O	-
27	O	O	-	O	O
28	O	O	O	-	-
29	O	O	O	-	O
30	O	O	O	O	-

Dip switched on the rear



Up to max. 15 units can be connected on the GP-IB, so it is necessary to set the address for each device. The address 31 can not be set. Even if it is set, it is internally transacted as 31.

Note: Make the address setting with the power off.

1.5 Remote Switch

When the dip switch No.8 on the rear panel is set to ON side, "GP-IB" LED on the front panel is lit up and the remote control with GP-IB and, the setting and readout of data are enabled. Control functions when the remote control is ON are as follows:

- Setting and readout of each set value are possible.
- Readout of working status and measured data are possible.

Note: When the remote control is ON, key operation from the front panel is disabled.

2. EXPLANATION OF COMMAND

2.1 Program Data

JIS punctuation point code is used for program data.

Example: RANGE=30kOHM [CR]+[LF]

COMMAND DELIMITER

1. Command Command to control 3565
2. Delimiter Code (delimiter) to inform 3565 of the end of transmission data block.

2.2 Detail of Program Data

2.2.1 BUZZ= (Setting of Buzzer)

Function To make a setting of OFF, GOOD, NG, HI, LO buzzer.

Structure BUZZ= OFF/GOOD/NG/HI/LO , Data

BUZZ= : Command to set the buzzer.

OFF/GOOD/NG/HI/LO : "OFF" designates buzzer OFF.
"GOOD" designates GOOD buzzer.
"NG" designates NG buzzer.
"HI" designates HI buzzer.
"LO" designates LO buzzer.

Note: Either one of buzzer setting can be made.

Data : Designates the buzzer volume.
Volume can be set in 9 steps from "01" to "10".

Note: Volume can not be set when the buzzer is set to OFF.

Transmission

Set GOOD buzzer at the volume 3.

BUZZ=GOOD, 03 [CR][LF]

2.2.2 BUZZ? (Readout of Buzzer)

Function To read out the mode and volume of buzzer.

Structure BUZZ?

Transmission

BUZZ? CR LF

Reply

BUZZ=GOOD, 03 CR LF
① ②

①Data of mode
②Data of volume 01~10

2.2.3 MODE= (Change of Mode)

Function To switch over memory mode or manual mode.

Structure MODE= MODE

MODE= : Command to change the mode.

MODE : "MEMORY" designates memory mode.
"MANUAL" designates manual mode.

Transmission

Designate the memory mode.

MODE=MEMORY CR LF

2.2.4 MEM=CALL (Call of Memory)

Function To call a memory designated by No.
Note: Make a setting after switching over to the memory mode.

Structure MEM=CALL NO.

MEM= : Command to set a memory number.

NO. : Designates the memory "01" ~ "30".

Transmission

Set to memory No.01, afterwards it actions as memory No.01.

MEM=CALL01 CR LF

2.2.5 MEM [No] ? (Readout of Memory Set Data)

[Function] To read out the memory data designated by No.
Note: Make a setting after switching over to the memory mode.

[Structure] MEM [No] ?

[NO.] : Designates the memory "01" ~ "30".

[Transmission]

MEM01? ⏎⏎

[Reply]

MEM=NO.01, OHM_____ , 300mOHM, H35.000_OHM, L100.00_OHM ⏎⏎
① ② ③ ④ ⑤

①Shows the memory number (Data length = 5)
②Shows the function (Data length = 10)
③Shows the range (Data length = 7)
④Shows HI data of the memory (Data length = 11)
⑤Shows LO data of the memory (Data length = 11)

2.2.6 MEM= (Setting of Memory Data)

Function — To set a memory data.
Note: Make a setting after switching over to the memory mode.

Structure — MEM= NO. , FUNC , RANGE , H HI SET , L LO SET

MEM= : Command to set the memory number.

NO. : Designates the memory number "01" ~ "30".

FUNC : Function "OHM", "OHM-RATIO", "TC-RATIO", "TC"

RANGE : Range, designates either one - "300mOHM", "3OHM", "30OHM", "300OHM", "3kOHM", "30kOHM", "300kOHM"

HI SET : Sets data for comparator's high limit value. (Range of adjustable numeral 0~35000)

LO SET : Sets data for comparator's low limit value. (Range of adjustable numeral 0~35000)

Note 1: HI SET and LO SET are to be set adding a unit and a decimal point.
Setting example: 35.000kOHM
Note 2: When the FUNC is RATIO, set the standard value for HI SET and deviation △ for LO SET.
Setting example: H100.00OHM, L10.0%
Note 3: Setting of a values for temperature compensation is made at "TC=" (article 2.2.25).

Transmission

● When the function is set to temperature compensation.
Set FUNC of memory No.1 to OHM, RANGE to 3kΩ, HI SET to 2.0000kΩ, LO SET to 1.5000kΩ respectively.

MEM=01, OHM, 3kOHM, H2.0000kOHM, L1.5000kOHM C_R L_F

● When the function is set to ratio display function.
Set FUNC of memory No.10 to OHM-RATIO, RANGE to 300mΩ, REF to 200mΩ, △ to 10.0% respectively.

MEM=10, OHM-RATIO, 300mOHM, H200.00mOHM, L010.0% C_R L_F

2.2.7 COMP= (Setting of Comparator)

Function To set high and low limit values and their unit of comparator.
Note: When the measuring function is RATIO (ratio display) or TE (temperature conversion), setting is not allowed.

Structure COMP= H [HI SET] , L [LO SET]

COMP= : Command to set a comparator.

[HI SET] : Sets a data for comparator's high limit value. (Range of adjustable numeral 0~35000)

[LO SET] : Sets a data for comparator's low limit value. (Range of adjustable numeral 0~35000)

Note 1: HI SET and LO SET are to be set adding a unit and decimal point.
Setting example: 35.000kOHM
Note 2: Set the same unit and decimal point for HI SET and LO SET.

Transmission

Set HI SET to 2.0000kΩ and LO SET to 1.5000kΩ respectively.

COMP=H2.0000kOHM, L1.5000kOHM CR LF

2.2.8 COMP? (Readout of Comparator Data)

Function To read out high and low limit values and their unit of comparator.
Note: When the measuring function is RATIO (ratio display) or TE (temperature conversion), read-out is not possible.

Structure COMP?

Transmission

COMP? CR LF

Reply

COMP=H300.00kOHM, L100.00kOHM CR LF
① ② ③

①Shows comparator data output (Data length = 4)
②Shows comparator HI data (Data length = 11)
③Shows comparator LO data (Data length = 11)

2.2.9 DATA1? (Readout of Measured Data)

Function To read out measured data.

Structure DATA1?

DATA1? : Command to output the measured data.

Transmission

DATA1? CR LF

Reply

Note 1: _ is space ($2O_H$), CR is carriage return ($0D_H$), LF is line feed ($0A_H$).
Note 2: Data are all JIS punctuation point code.

● Resistance measurement

OHM_ _ _ :350.00_kOHM,LF
① ②

①Shows the resistance measurement output (Data length = 6)
②Measured data (Data length = 11)
In case of over-range measurement (blinking with 00000), "_ _OVER" is output.

● Temperature measurement

TEMP_ _ : _ _100.0_'C_ ,LF
①

①Shows the temperature measurement output (Data length = 6)
②Measured data (Data length = 11)
In case of over-range measurement (blinking with 00000), "_ _OVER" is output.

● Ratio measurement

RATIO_ :123.45_%_ _ _ , _R _ _ _ _ _: 123.45_mOHM,_set_ _ _:100.00_mOHM, LF
① ② ③ ④ ⑤ ⑥

①Shows the measurement data output (Data length = 6)
②Ratio measurement data (Data length = 11)
In case of over-range measurement (blinking with 00000), "_ _OVER_mOHM" is output.
In case of measurement error (Err2 display), "_ERR2_ _mOHM" is output.
③Shows the resistance measurement value (Data length = 7)
④Resistance measurement data (Data length = 11)
In case of over-range measurement (blinking with 00000), "_ _OVER_OHM" is output.
⑤Shows the standard value output (Data length = 7)
⑥Standard the value data (Data length = 11)

● Temperature compensation measurement

TC_ _ _ _ :127.76_ _OHM, _R _ _ _ _ _: 130.02_ _OHM,_T_ _ _ _ _ : _ _24.5_’ C_ _ , ↵
① ② ③ ④ ⑤ ⑥

①Shows the output of temperature compensation measurement value (Data length = 6)
②Data of temperature compensation measurement (Data length = 11)
In case of over-range measurement (blinking with 00000), “_ _OVER_ _OHM” is output.
In case of measurement error (Err1 display), “_ERR1_ _ _OHM” is output.
③Shows the output of resistance measurement value (Data length = 7)
④Resistance measurement data (Data length = 11)
In case of over-range measurement (blinking with 00000), “_ _OVER_ _OHM” is output.
⑤Shows the output of temperature measurement value (Data length = 7)
⑥Temperature measurement data (Data length = 11)
In case of over-range measurement (blinking with 00000), “_ _OVER_ _OHM” is output.

● Temperature conversion measurement (T1)

R1_ _ _ _ :130.62_ _OHM, _T1 _ _ _ _ : _ _24.5_’ C_ _ , ↵
① ② ③ ④

①Shows the output of temperature conversion (T1) measurement value (Data length = 6)
②Data of temperature conversion (T1) measurement (Data length = 11)
In case of over-range measurement (blinking with 00000), “_ _OVER_ _OHM” is output.
In case of measurement error (Err1 display), “_ERR1_ _ _OHM” is output.
③Shows the output of temperature measurement value (Data length = 7)
④Temperature measurement data (Data length = 11)
In case of over-range measurement (blinking with 00000), “_ _OVER_ _OHM” is output.

● Temperature conversion measurement (T2)

R2_ _ _ _ :1.2345_ kOHM, _T2 _ _ _ _ : _ _24.5_’ C_ _ , ↵
① ② ③ ④

①Shows the output of temperature conversion (T2) measurement value (Data length = 6)
②Data of temperature conversion (T2) measurement (Data length = 11)
In case of over-range measurement (blinking with 00000), “_ _OVER_ _OHM” is output.
In case of measurement error (Err1 display), “_ERR1_ _ _OHM” is output.
③Shows output of temperature measurement value (Data length = 7)
④Temperature measurement data (Data length = 11)
In case of over-range measurement (blinking with 00000), “_ _OVER_ _OHM” is output.

● Temperature conversion calculation (T, E)

Te_ _ _ _ : _ _ 14.3_’ C _ _ , _R2 _ _ _ _ : 1.2345_ _OHM, _T2 _ _ _ _ : _ _24.5_’ C_ _ , _
① ② ③ ④ ⑤ ⑥

R1_ _ _ _ : 130.66_ _ OHM, _T1 _ _ _ _ : _ _ 24.5_ ‘ C_ _ , ↵
⑦ ⑧ ⑨ ⑩

①Shows the output of temperature conversion calculation (Data length = 6)
②Measurement data (Data length = 11)
In case of over-range measurement (blinking with 00000), “_ _OVER_ _OHM” is output.
In case of measurement error (Err1 display), “_ERR1_ _ _OHM” is output.
In case of measurement error (Err2 display), “_ERR2_ _ _OHM” is output.
③Shows the output of temperature conversion (T2) measurement value (Data length = 7)
④Shows the temperature conversion (T2) measurement data (Data length = 11)
In case of over-range measurement (blinking with 00000), “_ _OVER_ _OHM” is output.
⑤Shows the temperature measurement value output (Data length = 7)
⑥Temperature measurement data (Data length = 11)
In case of over-range measurement (blinking with 00000), “_ _OVER_ _OHM” is output.
⑦Shows the output of temperature conversion (T1) measurement value (Data length = 7)
⑧Shows the temperature conversion (T1) measurement data (Data length = 11)
In case of over-range measurement (blinking with 00000), “_ _OVER_ _OHM” is output.
⑨Shows the temperature measurement value output (Data length = 7)
⑩Temperature measurement data (Data length = 11)
In case of over-range measurement (blinking with 00000), “_ _OVER_ _OHM” is output.

Note:③,④,⑤ and ⑥ output the measurement data of T2.
⑦,⑧,⑨ and ⑩ output the measurement data of T1.

2.2.10 DATA? (Designation of Data Output, 3573 Compatible)

Function To designate the measured data as the data to be read in GP-IB.

Structure DATA?

DATA? : Command to output the measured data.

Transmission

DATA? CR LF

Reply

①Resistance measurement
OHM=199.99kOHM, JUDGE=HIGH LOW CR LF

②Temperature measurement
TEMP=0100.0 ’ C CR LF

③Ratio measurement
RATIO=0123.4%, Rs=1.0000_OHM, Rx=1.2345_OHM, JUDGE=GOOD CR LF

④Temperature compensation measurement
T.C=127.76mOHM, R=130.02mOHM, TEMP=0024.5 ’C, JUDGE=GOOD CR LF

⑤Temperature conversion T1 measurement
R1=130.66kOHM, T1=0024.5 ’C, JUDGE=NULL CR LF

⑥Temperature conversion T2 measurement
R2=130.66kOHM, T2=0024.5 ’C, JUDGE=NULL CR LF

⑦Temperature conversion T.E calculation
T.E=0014.3 ’C, R1=130.66kOHM, T1=0024.5 ’C, R2=123.45kOHM, T2=0024.5 ’C, JUDGE=NULL CR LF

Note: JUDGE output

At GO	:	JUDGE=GOOD
At HI	:	JUDGE=HIGH
At LO	:	JUDGE=LOW
No judgement output	:	JUDGE=NULL
At Err1, Err2	:	JUDGE=HIGH LOW

2.2.11 FUNCTION= (Measuring Function)

Function To designate a measuring function.

Structure FUNCTION = Function Code

FUNCTION = : Command to set the measuring function.
Function Code : As the Table 2-1 shows.

Measuring function can also be designated with the following structure.

Structure M Data

M = : Command to set the measuring function.
Data : Designates a function with "0" ~ "9".

Table 1-2

Function Code	Data	Measuring Function
OHM	M0	Resistance measurement
TEMP	M1	Temperature measurement
OHM-RATIO	M2	Ratio measurement
TC-RATIO	M3	Ratio standard value measurement
TC	M5	Temperature compensation measurement
TE-CLEAR	M6	Data clear of temperature conversion measurement
TE	M7	Temperature conversion (T.E) calculation
T1	M8	Temperature conversion (T1) measurement
T2	M9	Temperature conversion (T2) measurement

Transmission

Set the resistance measurement to measuring function.

FUNCTION=OHM CR LF
M0 CR LF

2.2.12 FUNC? (Readout of Function)

Function To read out the type of measuring function.

Structure FUNC?

FUNC? : Command to output the measuring function.

Transmission

FUNC? CR LF

Reply

FUNCTION=OHM CR LF
① ②

①Shows output of function data (Data length = 8).
②Shows measuring function data.

2.2.13 HOLD= (Setting of Hold)

Function To set start and release of the hold.

Structure HOLD = ON/OFF

HOLD = : Command to set the hold.

ON/OFF : Stops sampling and holds with “ON”.
Designates the release of hold with “OFF”.

Measuring function can also be designated with the following structure.

Structure H0/H1

H1 : Stops sampling and holds.
H0 : Designates the release of hold.

Transmission

Set hold to ON.
HOLD=ON CR LF

2.2.14 HOLD? (Readout of Hold Status)

Function To read out the setting status of hold.

Structure HOLD?

Transmission

HOLD? CR LF

Reply

HOLD=ON CR LF
① ②

①Shows the data output of hold (Data length = 4)
②Shows the setting status of hold.

2.2.15 RANGE= (Setting of Measuring Range)

Function To set the range of resistance measurement.

Structure RANGE = Range

RANGE = : Command to set the measuring range.
Range : Sets the range 300mΩ~300kΩ in resistance measurement.

When the auto range is required, set AUTO.

Range of resistance and voltage measurement can also be designated with the following structure.

Structure R Data

R : Command to set the measuring range.
Data : Designates a range with "0" ~ "9".

Table 2-2

Range Code	Data	Measuring Range
300mOHM	R0	300mΩ
3OHM	R1	3Ω
30OHM	R2	30Ω
300OHM	R3	300Ω
3kOHM	R4	3kΩ
30kOHM	R5	30kΩ
300kOHM	R6	300kΩ
AUTO	R9	Auto range

Transmission

Set the measuring range to 30Ω.

RANGE=30OHM [CR][LF]

2.2.16 RANGE? (Readout of Measuring Range)

Function To read out the set measuring range.

Structure RANGE?

Transmission

RANGE?[CR][LF]

Reply

RANGE=30kOHM [CR][LF]
① ②

①Shows data output of range (Data length = 5)
②Shows setting status of range.

2.2.17 RATIOSTD= (Setting of Ratio Referential Value)

Function — To set the referential and deviation value of the ratio display.
Note: When the measuring function is other than ratio display function, the setting is not possible.

Structure — RATIOSTD = Ref , ±△

RATIOSTD = : Command to set the ratio referential value.

REF : Referential resistance value.

±△ : Deviation △% data (00.0~100.0%)

Transmission

Set the referential resistance to 30Ω and deviation △% to 20.0%

RATIOSTD=10.00kOHM, 20.0%[CR][LF]

2.2.18 RATIOSTD? (Readout of Ratio Referential Value)

Function — To read out the data of ratio referential value.

Structure — RATIOSTD?

Transmission

RATIOSTD?[CR][LF]

Reply

RATIOSTD =100.00kOHM, 020.0%[CR][LF]
① ② ③

①Shows the output of ratio standard data(Data length = 8)
②Shows the referential value data (Data length = 10)
③Shows the deviation △% data (Data length = 6)

2.2.19 RST= (Reset of Judgement)

Function To make ON/OFF of reset for the comparator judgement.
(Resets the comparator output and makes the comparator display OFF.)

Structure RST = ON/OFF

RST = : Command to set the reset of judgement.

ON/OFF : Designates the reset of judgement output with “ON”.
Designates the release of reset with “OFF”.

Reset can also be designated with the following structure.

Structure C0/C1

C0 : Releases reset.
C1 : Resets judgement.

Transmission

Resets the output of comparator judgement.

RST=ON CR LF

- One shot sampling hold
  During the hold status of 3565, one shot sampling hold can be made with reset OFF following the reset ON.

2.2.20 RST? (Readout of Judgement Reset Status)

Function To read out the reset status of comparator judgement.

Structure RST?

Transmission

RST? CR LF

Reply

RST =OFF CR LF
① ②

①Shows the output of reset data. (Data length = 3)
②Shows the status of reset.

2.2.21 SAMPLING= (Setting of Sampling Rate)

Function To set a sampling rate.
Sampling rate of temperature measurement is fixed at 4 times/sec. and not changeable.

Structure SAMPLING = SLOW/MEDIUM/FAST

SAMPLING = : Command to set a sampling rate.

SLOW/MEDIUM/FAST : Designates 4 times/sec. with "SLOW".
Designates 20 times/sec. with "MEDIUM".
Designates 100 times/sec. with "FAST".

Structure S Data

S : Command to set a measurement sampling rate.
Data : Designates the sampling rate with "0" ~ "2".

Table 2-3

	Code	Sampling rate
SLOW	S0	Low speed (4 times/sec.)
MEDIUM	S1	Medium speed (20 times/sec.)
FAST	S2	Fast speed (100 times/sec.)

Transmission

Set the sampling rate to low speed (4 times/sec).

SAMPLING=SLOW C_R L_F

2.2.22 SAMPLING? (Readout of Sampling Rate)

Function To read out the status of sampling rate.

Structure SAMPLING?

Transmission

SAMPLING?C_R L_F

Reply

SAMPLING =SLOW C_R L_F
① ②

①Shows the output of sampling data. (Data length = 8)
②Shows the status.

2.2.23 SRQ= (Setting of Service Request)

Function — To set a service request.
When it is set to ENABLE, SRQ=TRUE is output at the end of sampling.
Note: Service request is in DISABLE when the power supply is ON.

Structure — SRQ = ENABLE/DISABLE

SRQ = : Command to set a service request.

ENABLE/DISABLE : Designates permission with “ENABLE”.
Designates prohibition with “DISABLE”.

Transmission

Sets the service request permission.

SRQ=ENABLE CR LF

2.2.24 SRQ? (Readout of Service Request Status)

Function — To read out the status of service request.

Structure — SRQ?

Transmission

SRQ? CR LF

Reply

SRQ=ENABLE CR LF
① ②

①Shows the output of service request data. (Data length = 3)
②Shows the status.
“ENABLE” shows permission.
“DISABLE” shows prohibition.

2.2.25 TC= (Setting of T.C Standard Temperature, Temperature Coefficient)

Function — To set the T.C referential temperature, temperature coefficient.

Structure — TC = [Temperature data] 'C, [α data] ppm

TC = : Command to set the T.C referential temperature, temperature coefficient.

[Temperature data] : Designates the referential temperature. Adjustable range 0.0~149.9°C.

[α data] : Designates the temperature coefficient (α). Adjustable range 1000~4999.

Transmission

Set the referential temperature and temperature coefficient respectively to 25.0 °C, 0.00393.

TC=25.0'C , 3930ppm [CR][LF]

2.2.26 TC? (Readout of T.C Standard Temperature, Temperature Coefficient)

Function — To read the data of T.C referential temperature, temperature coefficient.

Structure — TC?

Transmission

TC?[CR][LF]

Reply

TC=025.0 'C , 3930ppm [CR][LF]
① ② ③

①Shows the output value of T.C referential temperature (Data length = 2).
②Shows the referential temperature data (Data length = 7)
③Shows the temperature coefficient data (Data length = 7)

2.2.27 ZEROADJ= (Setting of Zero Adjustment)

Function — To set a zero adjustment.
Zero adjustment is the function to memorize the measured value at the time of receiving ZEROADJ=ON, as zero set value, and to display the value obtained by reducing the zero set value from the measured value by the time when received ZEROADJ=OFF.

Structure — ZEROADJ = ON/OFF

ZEROADJ = : Command to set a zero adjustment,

ON/OFF : Designates to be valid with “ON”.
Designates release with “OFF”.

Transmission

Set the zero adjustment to ON.

ZEROADJ=ON [CR][LF]

2.2.28 ZEROADJ? (Readout of Zero Adjustment Status)

Function — To read the status of zero adjustment.

Structure — ZEROADJ?

Transmission

ZEROADJ?[CR][LF]

Reply

ZEROADJ=OFF [CR][LF]
① ②

①Shows the output of zero adjustment status (Data length = 7).
②Shows the status of zero adjustment.

3. SERVICE REQUEST

After receiving SRQ=ENABLE and at the finish of measurement sampling, 3565 makes the service request to SRQ=True (makes the bit6 of status byte to 1) and makes a service request to a controller.
The controller receiving the service request can know the device which transmitted the service request by reading the status byte with serial pole.
SRQ=True is cleared by the controller's serial pole.

3.1 Status Byte

Format of the status byte to transmit in serial pole is as table below:

bit	7	6	5	4	3	2	1	0
	0	SRQ	HOLD	0	0	HIGH	GOOD	LOW

1. SRQ (bit6) : When the output of service requested is permitted, it outputs True ("1") at the when 3565 finishes the measurement.
   SRQ=True is released by the serial pole from the host.
   When the power supply is ON, or when the output of service request is prohibited, FALSE ("0") is always output.

2. HOLD (bit5) : When 3565 is in hold action and the sampling is stopped, it becomes "1".
   When 3565 is in measuring action, it becomes "0".

3. HIGH (bit2) : When 3565 is in HI judgement output, it becomes "1".

4. GOOD (bit1) : When 3565 is in GO judgement output, it becomes "1".

5. LOW (bit0) : When 3565 is in LO judgement output, it becomes "1".

Note 1) bit7, bit4 and bit3 are fized at "0".
Note 2) When the judgement is reset by judgement reset control, HIGH (bit2), GOOD (bit1) and LOW (bit0) become "0".

4. DEVICE CLEAR FUNCTION

When 3565 received the device clear (DCL, SDC), it initiates the system and becomes in status of power supply ON.

Note: After the device clear, each parameter of 3565 needs to be set again.
When ONLINE is made by the front panel key, the online becomes off after the device clear. Make the online again with the key.
(In case that the ONLINE is made by with dip switch on GP-IB board, the status is continuously be online even after the device clear.)

5. DEVICE TRIGGER FUNCTION

When 3565 received the device trigger (GET) during the hold status, it makes one shot sampling.

Instruction Manual
Interface of RS-232C

MODEL 5811-05

(for Model 3565)

I-01777

TSURUGA ELECTRIC CORPORATION

Contents

1. Specifications

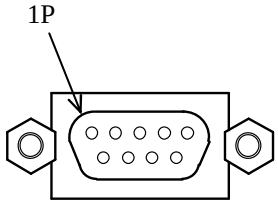
Table 1.1

Transmission system	Start-stop synchronous duplex transmission
Transmission speed	9600, 4800, 2400bps (Set to 9600bps 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	LF (0AH)
Xon/Xoff	Controllable (Xon at delivery from factory)
Connector	Sub-D 9 pin (male)

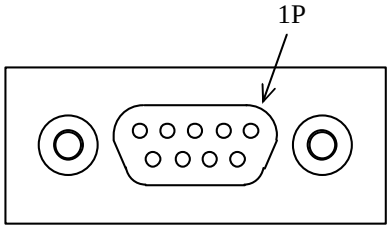
2. Connection

2.1 ●Connector and signal

Meter connector D-sub9pin



Attached connector: D-sub9pin plug type



XM2D-0901 (OMRON)

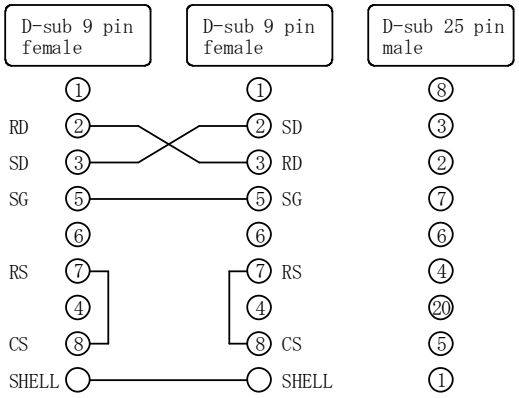
Pin No.	Meter signal JIS (RS-232C)	Direction	Name
①			Not in use
②	RD (RXD)	Input	Receiving data
③	SD (TXD)	Output	Transmission data
④			Not in use
⑤	SG (GND)		Ground for signal
⑥			Not in use
⑦	RS (RTS)	Output	Request for transmission
⑧	CS (CTS)	Input	Transmittable
⑨			Not in use

2.2 ●Xon/Xoff control

Soft handshake: The transmission is stopped when Xoff is received and re-started when Xon is received.
(Xon: 11H (ASCII), Xoff: 13H (ASCII)

2.3 ●Connection cable

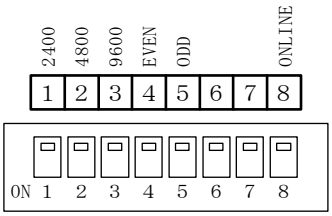
No hardware handshake



2.4 ●Setting of communication

Setting of the communication speed and parity bit can be done by the dip switch on the rear panel.

Arrangement of dip switch on the rear panel.



Setting of communication speed
Set the speed with the dip switch 1, 2 and 3.

Communication speed	1	2	3
2400bps	○	×	×
4800bps	×	○	×
9600bps	×	×	○

Set the switch marked ○ to ON
Set the switch marked × to OFF

Setting of parity bit
Set the parity with the dip switch 4 and 5.

Parity bit	4	5
Even number	○	×
Odd number	×	○
Nil	×	×

Set the switch marked ○ to ON
Set the switch marked × to OFF

Note: Make the setting of the dip switch with the power supply switched OFF.

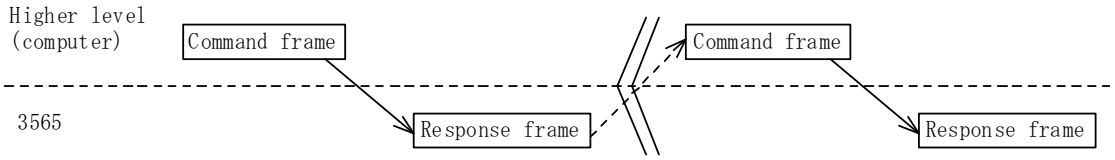
2.5 ●ONLINE switch

By setting the dip switch No.8 on the rear panel to ON side, the ONLINE on the front panel is lit up, and it is enabled to do a remote control by RS-232C and to read-out the data setting.
The control functions in ONLINE are as follows.

- Setting of each setting parameter is possible.

Note:
- In the ONLINE status, the key operation from the front panel is not allowed.
- Read-out of the measurement data and working status is possible both in OFFLINE and ONLINE.

3. Explanation of communication



Response frame:

When the effective setting command is received, the content of setting is returned.
When the effective output command is received, the designated data is output.
When the ineffective command is received, the “Command Error” is returned.

Example: In case of effective command: FUNCTION=OHM [CR][LF],
Response: FUNCTION=OHM [CR][LF]
In case of ineffective command: FUNCTION=MACHIGAI [CR][LF],
Response: Command Error [CR][LF]

4. Explanation of command

4.1 ●Program data

JIS punctuation code is used for the command data.

Example:

RANGE=30kOHM [CR][LF]

Command Delimiter

1. Command Command to control the 3565.
2. Delimiter Code (delimiter) to inform the 3565 of the finish of transmission data block.
   [LF] judged as delimiter when received the (0AH).

Table of character code

	0	1	2	3	4	5	6	7
0			SP	0	@	P	`	p
1			!	1	A	Q	a	q
2			”	2	B	R	b	r
3			#	3	C	S	c	s
4			$	4	D	T	d	t
5			%	5	E	U	e	u
6			&	6	F	V	f	v
7			’	7	G	W	g	w
8			(	8	H	X	h	x
9			)	9	I	Y	i	y
A			•	:	J	Z	j	z
B			+	;	K	[	k	{
C			,	<	L	¥	l	|
D			-	=	M	]	m	}
E			.	>	N	^	n	~
F			/	?	O	_	o	

Blank code is undefined.

4.2 ●Detail of program data

4.2.1 BUZZ= (setting of buzzer)

Function — Make the setting of buzzer for OFF, GOOD, NG, HI and LO.

Structure — BUZZ= OFF/GOOD/NG/HI/LO , Data

BUZZ= : Buzzer setting command

OFF/GOOD/NG/HI/LO :

"OFF" designates the buzzer OFF.
"GOOD" designates the buzzer at GOOD.
"NG" designates the buzzer at NG.
"HI" designates the buzzer at HIGT.
"LO" designates the buzzer at LOW.

Note: Either one of the buzzer setting is possible.

Data : Designates the buzzer sound volume.
Sound volume can be set in 9 steps "01" ~ "10".
Note: When the setting is buzzer OFF, the designation for buzzer sound volume is disregarded.

Transmission

Set GOOD buzzer sound level to 3.

BUZZ=GOOD, 03 [CR][LF]

4.2.2 BUZZ? (read-out of buzzer data)

Function — The mode and the sound volume of buzzer are read out.

Structure — BUZZ?

Transmission

BUZZ? [CR][LF]

Response

BUZZ=GOOD, 03 [CR][LF]
① ②

① The data of buzzer mode. (data length = 4)
② The sound volume data 01～10. (data length = 2)

4.2.3 MODE= (changeover of mode)

Function — Changeover of memory mode, manual mode.

Structure — MODE=[Mode]

MODE= : Mode changeover command

[Mode] : "MEMORY" designates the memory mode.
"MANUAL" designates the manual mode.

Transmission

Designate to the memory mode.

MODE=MEMORY [CR][LF]

4.2.4 MEM=CALL (call-up of memory)

Function — The memory designated by the No. is called up.
Note: Make the setting after changing to the memory mode.

Structure — MEM=CALL[No.]

MEM= : Memory number setting command.

[No.] : Designate the memory "01" ~ "30".

Transmission

Designates to the memory No.01 and works afterwards as the memory No.01.

MEM=CALL01 [CR][LF]

4.2.5 MEM [No.]? (read-out of memory setting data)

Function — Read out the memory data designated by the No.
Note: Make the setting after changing to the memory mode.

Structure — MEM[No.]?

[No.] : Designate the memory "01" ~ "30".

Transmission

MEM01?[CR][LF]

Response

MEM=01,OHM_ _ _ _ _ _ _,300mOHM,H35.000_OHM,L100.00_OHM [CR][LF]
① ② ③ ④ ⑤

① Shows the memory number (data length = 4).
② Shows the resistance measurement function (data length = 10).
③ Shows the resistance measurement range (data length = 7).
④ Shows the HI data of memory (data length = 7).
⑤ Shows the LO data of memory (data length = 7).

4.2.6 MEM= (setting of memory data)

Function — Set the memory data.
Make the setting after changing to the memory mode.

Structure — MEM=[No.], [FUNC], [RANGE], H [HI SET], L [LO SET]

MEM= : Data setting command of the memory.

[No.] : Designate the memory number "01" ~ "30".

[FUNC] : Function table "OHM", "OHM-RATIO", "TC-RATIO", "TC".

[RANGE] : Designates either one of the range
"300mOHM", 3OHM", "30OHM", "300OHM", "3kOHM",
"30kOHM", "300kOHM".

[HI SET] : High limit value data of the comparator.
(Adjustable range of numeral: 0~35000)

[LO SET] : Low limit value data of the comparator.
(Adjustable range of numeral: 0~35000)

Note-1: [HI SET] and [LO SET] are to be set adding the unit and decimal point.
Example of setting: 35.000kOHM
Note-2: When the FUNC is RATIO, HI SET: Standard value,
LO SET: Deviation △ are to be set.
Example of setting: H100.000HM, L10.0%
Note-3: The constant of temperature compensation is set by "TC=" (4.2.22)

Transmission

●When the function is set to temperature compensation.
For the memory NO.1, respectively set FUNC to OHM, RANGE to 3kΩ, HI SET to 2.0000kΩ and LO SET to 1.5000kΩ.

MEM=01, OHM, 3kOHM, H2.0000kOHM, L1.5000kOHM [CR][LF]

●When the function is set to ratio display.
For the memory NO.10, respectively set FUNC to OHM-RATIO, RANGE to300mΩ, REF to200mΩ and △ to10.0%.

MEM=10, OHM-RATIO, 300mOHM, H200.00mOHM, L010.0% [CR][LF]

4.2.7 COMP= (setting of comparator)

Function — Set the high and low limit value and the unit of the comparator.

Note: It can not be set when the measurement function is RATIO (ratio display) and TE (temperature conversion).

Structure — COMP=H [HI SET], L [LO SET]

COMP= : Comparator setting command

[HI SET] : High limit set value of the comparator (Adjustable range of numeral 0~35000)

[LO SET] : Low limit set value of the comparator (Adjustable range of numeral 0~35000)

Note-1: HI SET and LO SET are to be set adding the unit and decimal point.
Example of setting: 35.000kOHM

Note-2: Adjust the unit and decimal point of HI SET and LO SET to the same.

Transmission

Set the HI SET of to 2.0000kΩ and the LO SET to 1.5000kΩ.

COMP=H2.0000kOHM,L1.5000kOHM [CR][LF]

4.2.8 COMP? (read-out of comparator data)

Function — Read out the high and low limit value of the comparator.

Note: It can not be read out when the measurement function is RATIO (ratio display) and TE (temperature conversion).

Structure — COMP?

Transmission

COMP? [CR][LF]

Response

COMP=H300.00kOHM,L100.00kOHM [CR][LF]
① ② ③

① Shows the data output of comparator. (data length = 4)
② Shows the HI data of the comparator. (data length = 10)
③ Shows the LO data of the comparator. (data length = 10)

4.2.9 DATA? (read-out of measurement data)

Function — Designate the data to read out to the measurement data.

Structure — DATA?

DATA? : Measurement data output command

Transmission

DATA? CR LF

Response

1. Resistance measurement.

   OHM=199.99kOHM, JUDGE=HIGH LOW CR LF

2. Temperature measurement.

   TEMP=0100.0'C CR LF

3. Ratio measurement.

   RATIO=0123.4%, Rs=1.0000_OHM, Rx=1.2345_OHM, JUDGE=GOOD CR LF

4. Temperature compensation measurement.

   T.C=127.76mOHM, R=130.02mOHM, TEMP=0024.5' C, JUDGE=GOOD CR LF

5. Temperature conversion T1 measurement.

   R1=130.66kOHM, T1=0024.5'C, JUDGE=GOOD CR LF

6. Temperature conversion T2 measurement

   R2=130.66kOHM, T2=0024.5'C, JUDGE=NULL CR LF

7. Temperature conversion T.E calculation

   T.E=0014.3' C, R1=130.66kOHM, T1=0024.5' C, R2=123.45kOHM,
   T2=0024.5'C, JUDGE=NULL CR LF

Note: JUDGE output

At GO	: JUDGE=GOOD
At HI	: JUDGE=HIGH
At LO	: JUDGE=LOW
At No judgement output	: JUDGE=NULL
At Err1, Err2	: JUDGE=HIGH LOW

4.2.10 FUNCTION= (measuring function)

Function　Designate the measuring function.

Note: Change over from temperature measurement to other function than resistance measurement is not possible.

Structure　FUNCTION=[Function code]

FUNCTION= : Measuring function setting command

[Function] : Refer to the table below.

Function code	measuring function
OHM	Resistance measurement
TEMP	Temperature measurement
OHM-RATIO	Ratio measurement (resistance)
TC-RATIO	Ratio measurement (temperature compensation)
TC	Temperature compensation measurement
TE-CLEAR	Data clearance of temperature conversion measurement
TE	Temperature conversion (T.E) calculation
T1	Temperature conversion (T1) measurement
T2	Temperature conversion (T2) measurement

Transmission

Set the measuring function to the resistance measurement.

FUNCTION=OHM [CR][LF]

4.2.11 FUNC? (read-out of function data)

Function　Read out the type of measuring function.

Structure　FUNC?

FUNC? : Measuring function output command

Transmission

FUNC?[CR][LF]

Response

FUNCTION=OHM [CR][LF]
① ②

① Shows the function data output. (data length = 9)
② Shows the measuring function data.

4.2.12 HOLD= (setting of hold)

Function — Set the start and cancellation of the hold.

Structure — HOLD= ON/OFF

HOLD= : Hold setting command.

ON/OFF : Stop the sampling and hold the data with "ON". Designate the cancellation of hold with "OFF".

Transmission

Set the hold to ON.

HOLD=ON [CR][LF]

4.2.13 HOLD? (read-out of hold status)

Function — Read out the status of hold.

Structure — HOLD?

Transmission

HOLD? [CR][LF]

Response

HOLD=ON_ [CR][LF]
① ②

① Shows the hold data output. (data length = 4)
② Shows the status data of the hold.

4.2.14 RANGE= (setting of measuring range)

Function — Set the range of resistance measurement.
Note: No setting is possible in the temperature measurement.

Structure — RANGE=[Range]

RANGE= : Measuring range setting command

[Range] : For the resistance measurement, set the range among 300mΩ ~ 300kΩ.

To make the auto-range, set AUTO.

Table 4.1

Range code	Measuring range
300mOHM	300mΩ
3OHM	3Ω
30OHM	30Ω
300OHM	300Ω
3kOHM	3kΩ
30kOHM	30kΩ
300kOHM	300kΩ
AUTO	Auto-range

Transmission

Set the resistance measurement range to 30Ω.

RANGE=30OHM [CR][LF]

4.2.15 RANGE? (read-out of measuring range)

Function — Read out the setting condition of the measuring range.

Structure — RANGE?

Transmission

RANGE? [CR][LF]

Response

RANGE=30kOHM [CR][LF]
① ②

① Shows the range data output .(data length = 4)
② Shows the data of setting condition of the range.

4.2.16 RATIOSTD= (setting of standard ratio value)

Function — Set the standard value and deviation of the ratio display.
Note: The setting is not possible when the measuring function is other than the ratio display function.

Structure — RATIOSTD=[REF], [±△]

RATIOSTD : Setting command of the ratio standard value.

[REF] : Standard resistance value.
[±△] : ±△ deviation data (00.0~100.0%)

Transmission

Set the 10.000kΩ to the standard resistance value, and 20.0% to the deviation △%.

RATIOSTD=10.00kOHM,20.0% [CR][LF]

4.2.17 RATIOSTD? (read-out of standard ratio value)

Function — Read the data of ratio standard value.

Structure — RATIOSTD?

Transmission

RATIOSTD? [CR][LF]

Response

RATIOSTD=100.00kOHM,020.0% [CR][LF]
① ② ③

① Shows the data output of the ratio standard.
② Shows the data of standard value. (data length = 10)
③ Shows the deviation data △%. (data length = 6)

4.2.18 RST= (judgement reset)

Function — Make ON/OFF of reset for the comparator judgement.
(Reset the comparator output and turn OFF the ratio display.)

Structure — RST=[ON/OFF]

RST= : Setting command of the judgement reset.

[ON/OFF] : Designate the reset of judgement output with "ON".
Designate the cancellation of reset with "OFF".

Transmission

Reset the comparator judgement output.

RST=ON [CR][LF]

- One sampling hold
  While the 3565 is in hold status, and when the reset is made ON and afterward turned OFF, one sampling hold can be done.

4.2.19 RST? (read-out of judgement reset status)

Function — Read out the status of comparator judgement reset.

Structure — RST?

Transmission

RST? [CR][LF]

Response

RST=OFF [CR][LF]
① ②

① Shows the data output of reset.
② Shows the status of reset.

4.2.20 SAMPLING= (setting of sampling rate)

Function　Set the sampling rate.

The temperature measurement is at the fixed sampling rate 4 times/sec. and it can not be changed.

Structure　SAMPLING= SLOW/MEDIUM/FAST

SAMPLING=　: Setting command of the sampling rate.

SLOW/MEDIUM/FAST　:

SLOW　: 4 times/sec.
MEDIUM　: 20 times/sec.
FAST　: 100 times/sec.

	sampling rate
SLOW	Low speed (4 times/sec)
MEDIUM	Inside velocity (20 times/sec)
FAST	High speed (100 times/sec)

Transmission

Set the measuring sampling rate to low speed (4 times/sec).

SAMPLING=SLOW [CR][LF]

4.2.21 SAMPLING? (read-out of sampling rate)

Function　Read out the status of sampling rate.

Structure　SAMPLING?

Transmission

SAMPLING? [CR][LF]

Response

SAMPLING=SLOW [CR][LF]
　①　②

① Shows the sampling data output.
② Shows the status.

4.2.22 TC= (Setting of T.C reference temperature and temperature coefficient)

Function — Set the reference temperature and temperature coefficient.

Structure — TC= [temperature date] ’ C, [α data] ppm

TC= : Setting command of T.C reference temperature and temperature coefficient.

[Temperature data] : Designates the reference temperature.
Adjustable range 0.0~149.9℃.

[α data] : Designates the temperature coefficient (α)
Adjustable range1000~4999

Transmission

When 25.0℃ is set to reference temperature and 0.00393 to temperature coefficient.

TC=25.0’C, 3930ppm [CR][LF]

4.2.23 TC? (Read out of reference temperature and temperature coefficient data)

Function — Read out the reference temperature and temperature coefficient data

Structure — TC?

Transmission

TC? [CR][LF]

Response

TC=025.0’C, 3930ppm [CR][LF]
① ② ③

① Shows the T.C reference temperature output value. (data length = 2)
② Reference temperature data (data length = 7)
③ Temperature coefficient data (data length = 7)

4.2.24 ZEROADJ= (setting of zero adjustment)

Function — Make the setting of zero adjustment.
The zero adjustment action is that the measured value at the moment when the ZEROADJ=ON is received is memorized as the zero set value, and the value deducted the zero set value from the measured value is displayed and output until the ZEROADJ=OFF is received.

Structure — ZEROADJ=[ON/OFF]

ZEROADJ= : Zero adjustment setting command.

[ON/OFF] : Designate the effect with "ON".
Designate the cancellation with "OFF".

Transmission

Set the zero adjustment to ON.

ZEROADJ=ON [CR][LF]

4.2.25 ZEROADJ? (read-out of zero adjustment)

Function — Read out the status of zero adjustment.

Structure — ZEROADJ?

Transmission

ZEROADJ? [CR][LF]

Response

ZEROADJ=OFF [CR][LF]
① ②

① Shows the status of zero adjustment output. (data length = 7)
② Shows the status of zero adjustment.

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