# MODEL 3566

## Digital AC mΩ Meter

## Instruction Manual

**I-01529**

**TSURUGA ELECTRIC CORPORATION**

# Contents

# 1. Preface

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

**⚠ CAUTION**

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

## 1.1 ●Preparations prior to use

### 1.1.1 Inspection

When the meter is delivered, please check whether it conforms to the required specifications and has not been damaged in transit. If there is any damage on the meter or it does nor work in conformity with the specifications, please inform us of the model and product name.

### 1.1.2 Storage

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

## 1.2 ●Confirmation prior to use

### 1.2.1 Power supply

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

### 1.2.2 Power supply cable

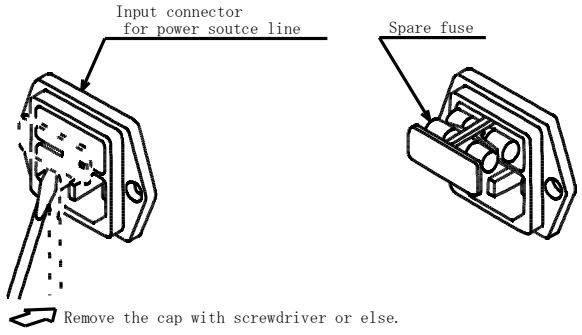
The plug of power supply cable connected to the meter is for 100VAC use. When the meter is used with 200VAC, replace the plug with appropriate one for 200VAC use. Please connect the power supply cable to the power supply connector on the real panel of the meter. The plug of power supply cable has 3 pins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

### 1.2.3 Setting of power supply frequency

The power supply frequency setting is necessary to eliminate the induced voltage of power supply. Setting the suitable power frequency of the power supply in instrument before use.

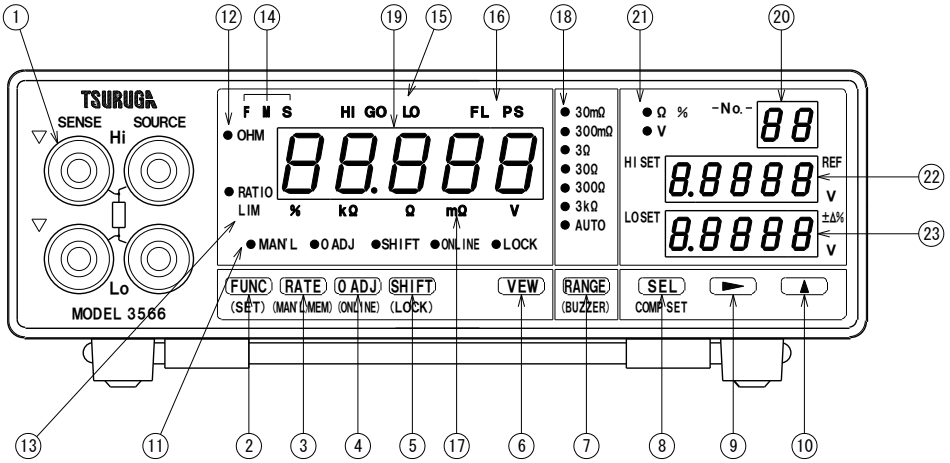
### 1.2.4 Replacement of fuse

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



# 2. Name of parts

## 2.1 ●Front panel




① Measuring terminals
SENSE Hi : Input terminal of resistance measurement and + terminal of voltage measurement.
SENSE Lo : Input terminal of resistance measurement and − terminal of voltage measurement.
SOURCE Hi : Current output terminal.
SOURCE Lo : Current output terminal (Connected to SENSE Lo at the voltage measurement.)

② FUNC key (SET)
Key to changeover the resistance/ratio display in resistance measurement.
At ratio display : RATIO lamp is lit up.
At resistance display : OHM lamp is lit up.
(In manual mode, the power source frequency and the limit can be set.)
(In memory mode, the setting of memory can be done.)

③ RATE key (MAN'L/MEM)
Key to select a sampling rate.
(Key to changeover the memory/manual mode. MAN'L lamp is lit up in manual mode.)

④ 0 ADJ key (ONLINE)
Key to ON/OFF the zero-adjust function.
0 ADJ lamp is lit up while the zero-adjust function is working.
(On-line key of the GP-IB, RS-485 and RS-232C.)

⑤ SHIFT key (LOCK)
Blue key becomes effective while the SHIFT lamp is lit up.
While the SHIFT lamp is lit up, it can be turned off by pressing this key.
(The key prohibits the key operation on the front panel. The pressing of the key for 3 seconds or more allows prohibition or cancellation. During the prohibition, the LOCK lamp is lit up.)

⑥ VEW key
Key to select the display mode.

⑦ RANGE key (BUZZER)
Key to select the range of resistance or voltage.
The resistance range 30mΩ ~ 3kΩ or AUTO range can be selected.
The voltage range 5V or 50V can be selected.
(Key to enter the setting of buzzer mode and sound volume.)

⑧ SEL key COMP SET
Key to changeover the setting items.

⑨ ▶ key
Key used for various setting.

⑩ ▲ key
Key used for various setting.

⑪ MAN'L lamp — Lit up in manual mode and turned off in memory mode.
0 ADJ lamp — Lit up while the zero-adjust is in working.
ONLINE lamp — Lit up when remote controlled.
LOCK lamp — Lit up while key-locked.
SHIFT lamp — Interlocked with SHIFT key. While the lamp is lit up, the key functions change to those of blue letters ( ).

⑫ OHM lamp — Lit up in resistance measurement.
RATIO lamp — Lit up in ratio display.

⑬ LIM lamp — Lit up when the limiter of open voltage is not limited to the peak 20mV.

⑭ F lamp — Displays in blinking when the sampling rate is FAST.
M lamp — Displays in blinking when the sampling rate is MEDIUM.
S lamp — Displays in blinking when the sampling rate is SLOW.
(The lamps become steady light during the hold status.)

⑮ HI lamp — Red LED is lit up when the measured resistance value is at high limit or above.
GO lamp — Green LED is lit up when the resistance measurement is good judgement.
LO lamp — Red LED is lit up when the measured resistance value is at low limit or below.

⑯ FL lamp — Red LED is lit up when the measured voltage value is at high limit or above or, low limit or below.
PS lamp — Green LED is lit up when the voltage measurement is good judgement.

⑰ Unit lamp — The unit of the data being indicated on the main display is lit up.
For resistance : kΩ, Ω, mΩ
For ratio : %
For voltage : V

⑱ Range lamp — In resistance display mode: The measuring range is lit up
The comparator range is lit up in blinking.
In voltage display mode: Turned off.
In resistance voltage display mode: The resistance measuring range is lit up.
AUTO lamp — Lit up in AUTO range measurement.

⑲ Main display section — The measured values and various characters are displayed.
In Rr mode : The measured resistance value is displayed.
In Vv mode : The measured voltage value is displayed.
In RV mode : The measured resistance value is displayed.

⑳ No. display — The memory number is displayed in memory mode.
During the setting of buzzer, power source frequency / limit, the characters being set are displayed.

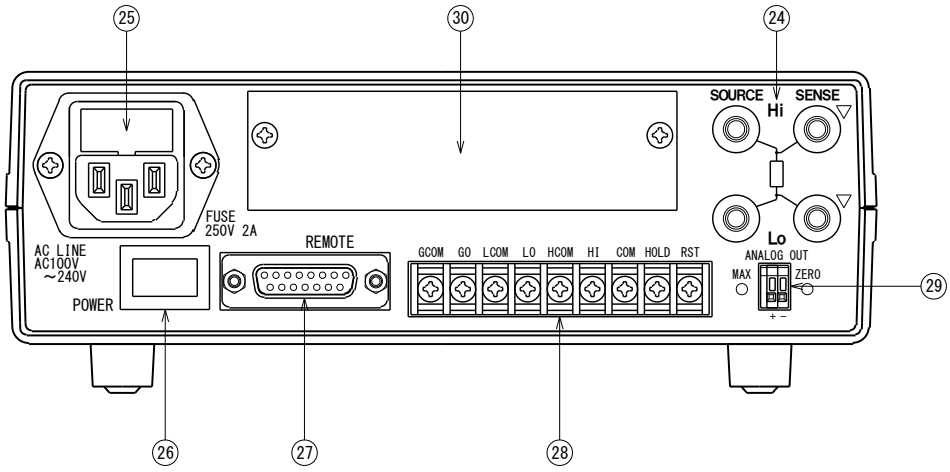
㉑ Ω% lamp — Lamp to inform the content of HI SET and LO SET display.
V lamp — Ω% lamp is lit up in Rr mode.
V lamp is lit up in Vv mode and RV mode.

㉒ HI SET display — The comparator's high limit and various characters are displayed.
In Rr mode : The high limit of resistance comparator or the referential resistance value of ratio measurement is displayed.
In Vv mode : The voltage comparator's high limit is displayed.
In RV mode : The voltage side measurement value is displayed.

㉓ LO SET display — The comparator's low limit and various characters are displayed.
In Rr mode : The low limit of resistance comparator or the range of ratio measurement is displayed.
In Vv mode : The voltage comparator's low limit is displayed.
In RV mode : Turns off.

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

## 2.2 ●Rear panel




㉔ Rear measuring terminals

Respectively common with:

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

㉕ Power supply connector — The attached power supply connector is to be used. Be sure to use the meter with the specified power source voltage and frequency. A fuse of 250V 2A must be used.

㉖ Power source switch — ON/OFF switch of the power supply.

㉗ REMOTE connector — Connector for the remote control.

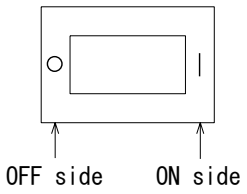
㉘ Input and output terminal blocks — Terminals for input of hold and reset, and for output of resistance comparator.

㉙ Analog output terminals — Terminals to output the DC voltage proportional to the measured value.
ZERO : ZERO volume of the analog output
MAX : MAX volume of the analog output

㉚ Inlet for interface board — Section to fit an optional interface board.

# 3. Operation

## 3.1 ●Power supply




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

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

## 3.2 ●Connection of measuring terminals

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

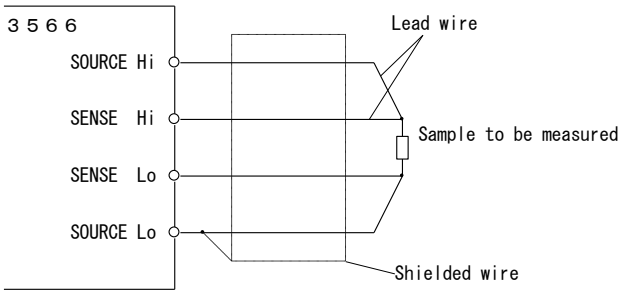



**Fig. 3.2.1**

**Note**: If the noise enters the measuring terminals, it may cause the display to widely fluctuate or the auto-range action to be unstable. Ensure to use the shielded wire and connect the shield side to the SOURCE Lo. If all 4 wires are not connected properly, the displayed value may be fluctuated.

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

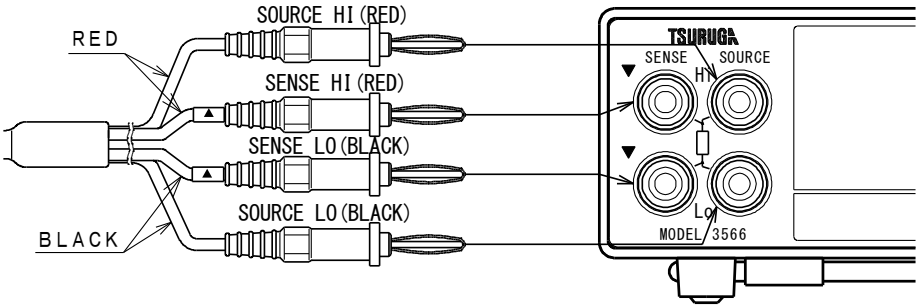



***Fig.3.2.2*** Connection of optional Kelvin clip (MODEL 5811-21B).

## 3.3 ●Cautions for measurement

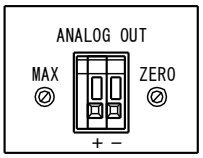
### 3.3.1 When overlaying the DC voltage

Apply the voltage 60VDC or less.
After the measurement, the capacitor inside the meter is charged with voltage, so let the probe short-circuit for a few seconds to discharge it.

### 3.3.2 Others

A big error may occur when the samples with inductance or capacitance is measured.
If the meter is used near the source of noise (high frequency furnace, high noise power line, inverter power source etc.), such noise may enter the input line and affect the measurement.
Avoid the use in such a site or keep the sufficient distance from the source of noise.

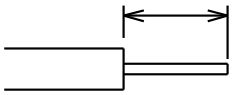
## 3.4 ●Connection of analog output




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

Make a connection of the cable to the analog output terminal, applying the cable end treatment as the **Fig. 3.4.1** shows.
Push down the release knob with a screwdriver or else and insert the cable to the terminal.

Length to cut = 9~10mm



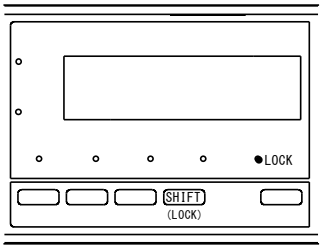
Applicable cable: AWG28~AWG32

**Fig. 3.4.1**

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

## 3.5 ●Key-lock

The key-lock is the function to prohibit the key operation on the front panel so that the measuring condition is not altered.
While the key-lock is in operation, the LOCK lamp is lit up.
To operate the other keys, cancel the key-lock first.
It is not operable in the ONLINE or HOLD status.




How to key-lock
While the LOCK lamp is turned off, press SHIFT (LOCK) key for 3 seconds or more.

Reset of key-lock
While the LOCK lamp is lit up, press SHIFT (LOCK) key for 3 seconds or more.

## 3.6 ●Changeover of display

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

### 3.6.1 Selection of display mode

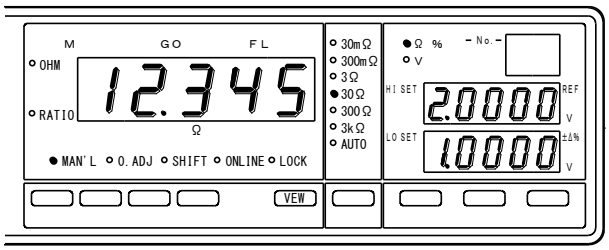
Changeover of function

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

Changeover of VEW

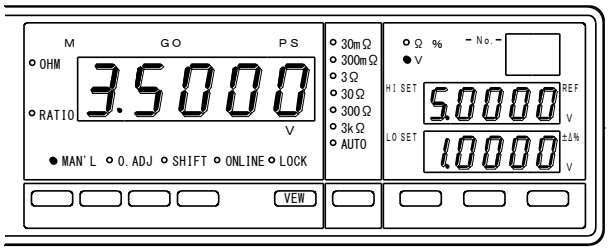
Every time the VEW key is pressed, the display changes over.

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



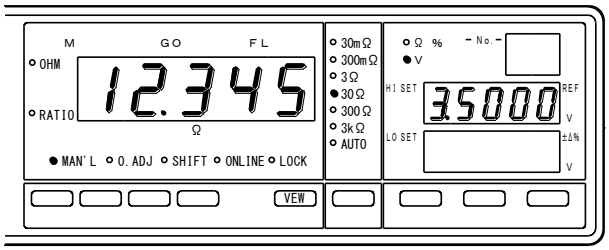

Rr mode

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




Vv mode

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




RV mode

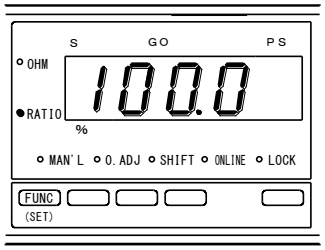
For the content of each display mode, refer to the **Table 3.6.1** below.

| Display mode | Main display | HI SET display | LO SET display | Ω % lamp | V lamp |
|---|---|---|---|---|---|
| Rr mode | Resistance measurement value | Resistance comparator High limit value | Resistance comparator Low limit value | Lit up | Turn off |
| (Ratio display) | Ratio display | Referential resistor | Deviation ±⊿% | | |
| Vv mode | Voltage measurement value | Voltage comparator High limit value | Voltage comparator Low limit value | Turn off | Lit up |
| RV mode | Resistance measurement value | Voltage measurement value | Turn off | Turn off | Lit up |

**Table 3.6.1**

### 3.6.2 Selection of ratio display

To changeover the ratio display and the resistance display.




Ratio display

Changeover of function

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

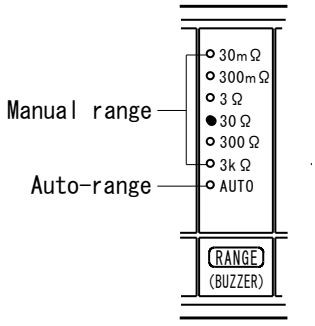
## 3.7 ●Changeover of resistance range

The measuring range (auto-range or manual range) of the resistance measurement is selected.
The operation is not allowed in the memory mode, ONLINE or HOLD status.

Selection of resistance measurement

Press the [VEW] key and select the Rr or RV mode.

Changeover of resistance range




(1) Auto-range
- When the measured resistance value is 35000 (3500) or above, the range goes up, and when the value is 3000 (300) or less, the range goes down.
- The AUTO lamp and the lamp of detected range are lit up.

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

Selection of auto-range
When pressed the [RANGE] key, the measuring range changes. Next to the 3kΩ range, the AUTO lamp is lit up and the range changes to the auto-range.

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

(2) Manual range
- The range is fixed range in between 30mΩ and 3kΩ.
- The lamp of selected range is lit up.

Selection of manual-range
Every time the [RANGE] key is pressed, the range lamp changes. Selected the required range.

## 3.8 ●Changeover of voltage range

The measuring range of the voltage measurement is selected.
The operation is not allowed in the memory mode, ONLINE or HOLD status.

Selection of voltage measurement

Press the [VEW] key and select the Vv mode.

Selection of voltage range

(1) Auto-range
- Make the setting of auto-range in the resistance measurement. The measuring range goes up when the measured voltage value is 50000 (5000) or more, and goes down when the measured value is 1000 (100) or less.

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

(2) Manual range
- The range is fixed range 5V or 50V.

Selection of range
Every time the [RANGE] key is pressed, the measuring changes, and the lit up position of the decimal point changes.
(It can not be changed in the auto-range.)
12345 ……. 5V range
12.345 ……. 50V range

## 3.9 ●Zero adjustment

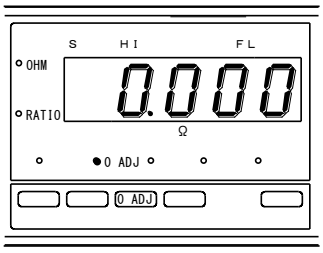
This is the function to suppress the resistance of the tool and so on used in the resistance measurement.
The data currently measured is memorized in the non-volatile memory as “zero adjustment value”, and afterwards, the value obtained by deducting the “zero adjustment value” from the measured value is displayed.

| Display value | = | Measured value | − | Zero adjustment value |
|---|---|---|---|---|

- It works in the resistance display and the resistance voltage display.
- The zero adjustment value works in every range.(It is memorized as the resistance value.)
- Remote operation is possible.
- External control by the interface of GP-IB, RS-232C or RS-485 is possible.

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

### 3.9.1 Key operation




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

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

**⚠ CAUTION**

- If [0ADJ] key is pressed at input open condition (∞Ω), it may cause the malfunction.
- If zero adjust is set at higher range, the measurement over might be caused in lower range.
- If [0ADJ] key is pressed on by mistake, the status can be recovered to normal stage by switching OFF the Zero adjustment function’.

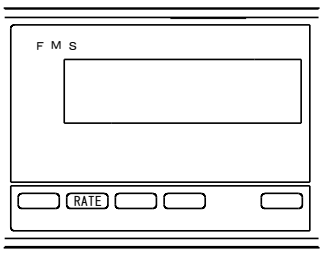
### 3.9.2 Remote operation

While the 0 ADJ pin and COM of the REMOTE connector on the rear panel is short-circuited, the 0 ADJ lamp is lit up and the zero adjustment is in operable condition.
The measured resistance data at the moment when the 0 ADJ pin is short-circuited is memorized as zero adjustment.
When released the 0 ADJ pin, its working is cancelled.

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

## 3.10 ●Selection of sampling rate

Selection of the sampling range is made by the key operation on the front panel.
The external control by the interface of GP-IB, RS-232C or RS-485 is possible
**Note**: This function is not operable during the HOLD status or setting.



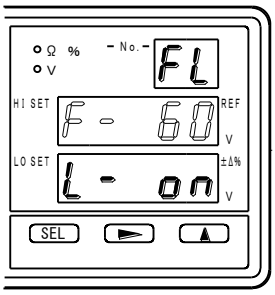

Key operation

Press the [RATE] key and the sampling rate changes.
S→M→F→S・・・

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

## 3.11 ●Setting of power source frequency

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



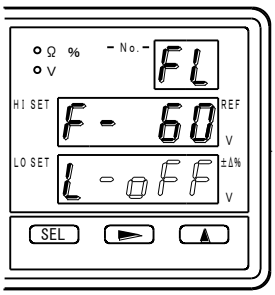

Press the [SHIFT] key, and the SHIFT lamp is lit up.
(Enters into the setting of power source frequency and voltage limit.)
Press (SET) key and the HI SET lamp blinks.
Adjust the power source frequency, pressing the [▲] key.
When the [SEL] key is pressed twice, the meter returns to the measurement.

| HI SET display | Action |
|---|---|
| F- 50 | Set to the power source frequency 50Hz |
| F- 60 | Set to the power source frequency 60Hz |

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

## 3.12 ●Setting of voltage limiter

By setting the voltage limiter to ON, it is possible to limit the voltage applied to the sample to be measured at the peak of 20mV. It protects the destruction of the oxide layer at the contact of the sample to be measured.
The operation is not allowed in the memory mode, ONLINE or HOLD status.
When no key operation is made for 5 minutes during the setting, the meter returns to the measurement.




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

| LO SET display | Action |
|---|---|
| L-oFF | Voltage limit set to OFF |
| L- on | Voltage limit set to ON |

## 3.13 ●Comparator action

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

The comparator compares the measured value and high/low limit, and output the judgement result.
A 30 pairs of the memory high and low limit values per pair can be memorized (No.1~No.30).
The judgement is output by open collector, simultaneously announcing by buzzer and lamp. (For the resistance comparator, a relay output can be provided at option.)
The memory can be selected by key operation or through remote connector.
The selection is also possible by the interface of GP-IB, BCD, RS-232C or RS-485.

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

### 3.13.1 Condition of comparison

Resistance comparator

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

**Note**: The comparator makes the comparison including the range.
Example:
In case that the high limit value is set to 100.00mΩ (300mΩ range), and when 10.00Ω is displayed in the measuring range is 300Ω, the HI output is given.

Voltage comparator

| | |
|---|---|
| Display value ≧ High limit value (HI SET) or<br>Display value ≦ Low limit value (LO SET) | FL output |
| High limit value (HI SET) > Display value > Low limit value (LO SET) | PS output |

### 3.13.2 Comparator output

Resistance comparator

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

Display: HI and LO: Red, GO: Green

Voltage comparator

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

Display: FL: Red, PS: Green

### 3.13.3 Setting method

No setting is possible during the ONLINE, when externally controlled by the BCD data output interface or in the HOLD status.
When no key operation is made for 5 minutes during the setting, the meter returns to the measurement.

Adjustable range:

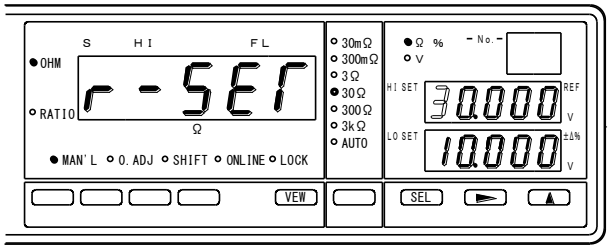
| | | | |
|---|---|---|---|
| High limit | Resistance | : | 0~35000 |
| | Voltage | : | -50000~50000 |
| Low limit | Resistance | : | 0~35000 |
| | Voltage | : | -50000~50000 |

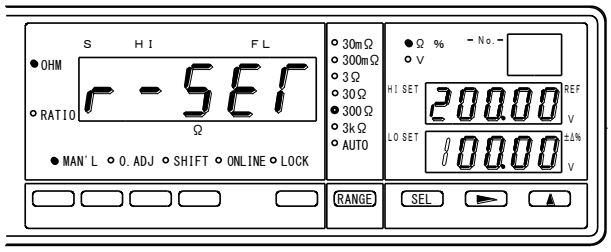
The unit and the decimal point are set with the [RANGE] key.
The content of the comparator setting is different depending upon the display mode.

| Display mode | Setting items |
|---|---|
| Rr mode | Resistance comparator, high and low limit |
| Vv mode | Voltage comparator, high and low limit |
| RV mode | Resistance comparator, high and low limit<br>Voltage comparator, high and low limit |

**Note**: When the setting is for the resistance comparator, in the ratio display mode, the items to set are deviation (±⊿%).

Setting of resistance comparator (Rr mode)




Changeover to manual mode

① (Refer to the article 3.15)

Changeover to resistance display

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

Setting of high limit value

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

Setting of low limit value

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

Setting of comparator range

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

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

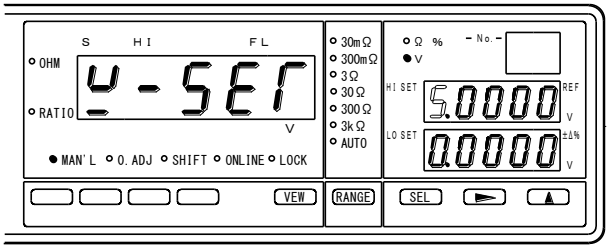
Finish of the setting

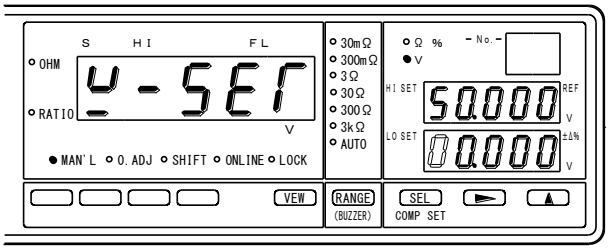
⑥ The setting can be finished by pressing the [SEL] key during the setting of low limit.

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

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

## Setting of voltage comparator (Vv mode)




### Changeover to voltage display

① Changeover to Vv mode with the [VEW] key.
(Refer to the article 3.6)

### Setting of high limit value

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

### Setting of low limit value

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

### Setting of comparator range

④ Set with the [RANGE] key
The selected range is known by the position of decimal point being lit up.
5V range : Decimal point at $10^4$ is lit up.
50V range : Decimal point at $10^3$ is lit up.

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

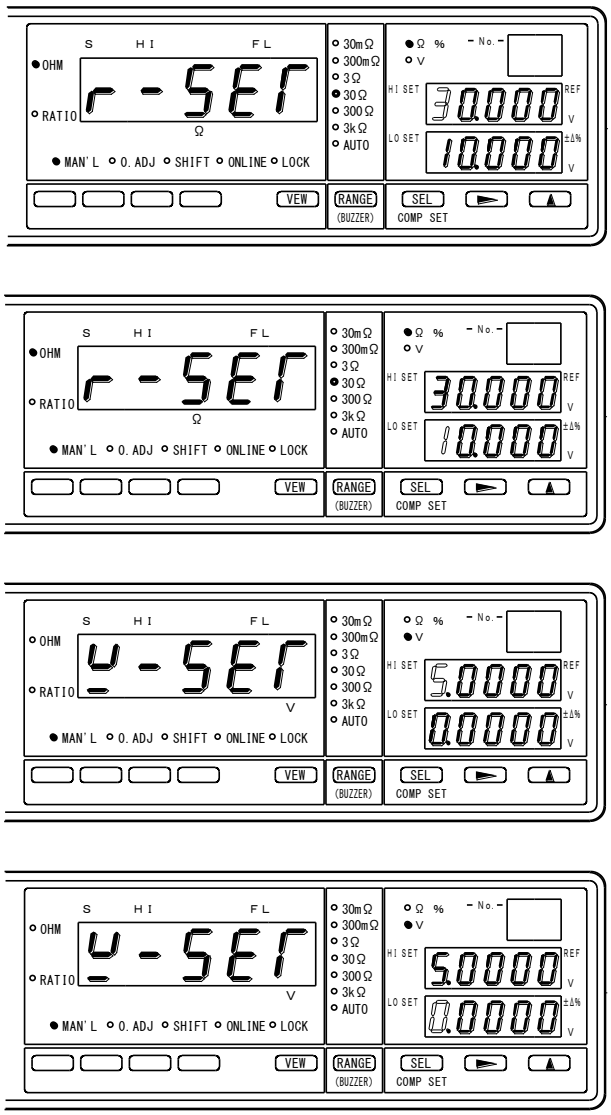
### Finish of the setting

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

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

## Setting of resistance voltage comparator (RV mode)

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




Setting of resistance comparator

Setting of HI SET

Setting of LO SET

Setting of voltage comparator

Setting of HI SET

Setting of LO SET

### 3.13.4 Display mode of range lamps

The model 3566 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

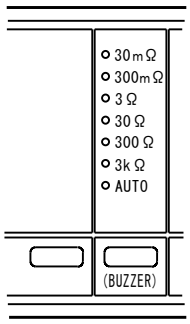
2. When the measuring range and comparator set value are same.
   - Measuring range: 300Ω range is selected.
   - Comparator set value: HIGH 300.00Ω LOW 100.00Ω (range is 300Ω)
   - Range display: 300Ω steadily lighting

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

## 3.14 ●Buzzer

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

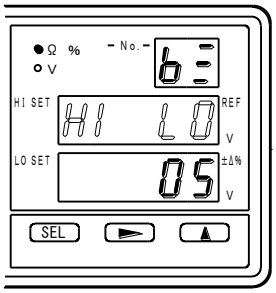
### 3.14.1 Setting method




Setting of buzzer action

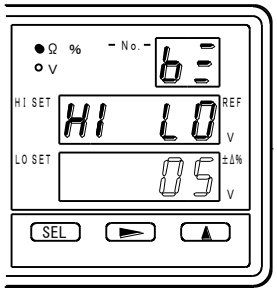
Press the [SHIFT] key.
The SHIFT lamp will then light up.
Press the (BUZZER) key.
It changes to the buzzer setting and bz is displayed on the No display, making HI SET blink.
The buzzer action is displayed on the HI SET, and the buzzer sound on the LO SET.

Selection of buzzer action




Select the buzzer action with the [▲] key.

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




Adjustment of sound volume

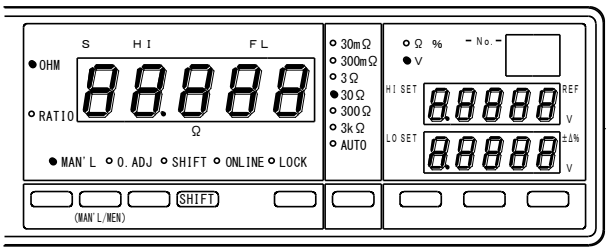
When the [SEL] key is pressed during the setting of buzzer action, it becomes the setting of buzzer sound level and the buzzer sounds.
By pressing the [▲] key, the sound level and its indication change.
The buzzer sound level is adjustable in 10 steps.

Finish

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

## 3.15 ●Manual mode

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




Operation

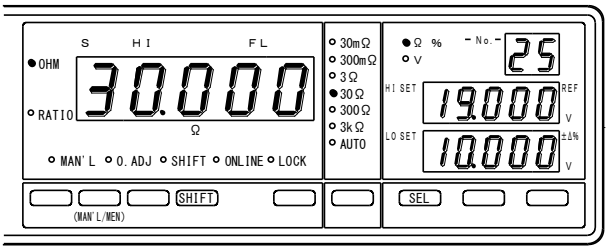
Press the SHIFT key and while the SHIFT lamp is lit up, changeover the manual mode / memory mode with the (MAN'L/MEM) key.
During the manual mode, MAN'L lamp is lit up and the No. display (indication of memory number) turns off.

## 3.16 ●Memory mode

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

### 3.16.1 Selection of memory

● Procedures on the front panel




Enter the memory mode

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

Call up of memory

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

Finish of the memory mode

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

● Procedures by remote operation

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

## 3.17 ●Setting of memory

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

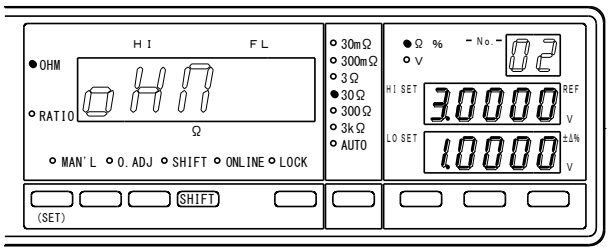
The items of the memory setting are following 4 items.

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

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

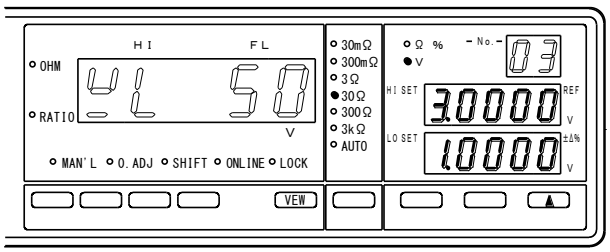
### Enter the memory mode

Enter the memory mode with the [SHIFT] and (MAN'L/MEM) key. (Refer to the article 3.16)




### Setting of memory

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



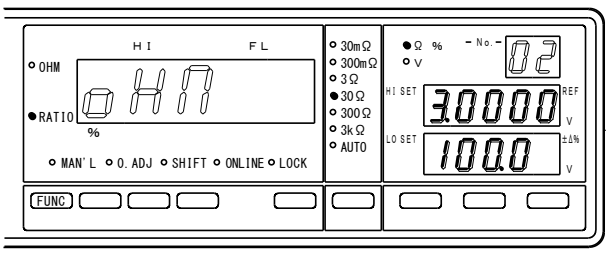

### Selection of memory No.

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

| | |
|---|---|
| oHA | Rr display |
| uL 50 | Vv display (50V range) |
| uL 5 | Vv display (5V range) |
| oH-uL | RV display |

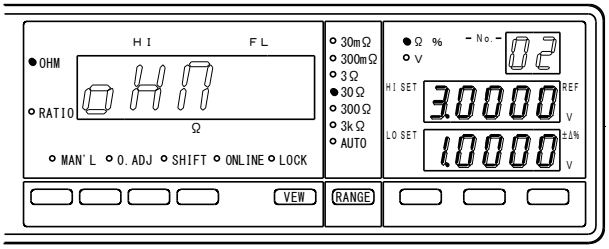
### Selection of display mode

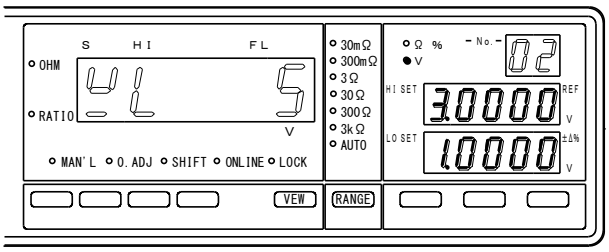
Select the display mode setting with the [VEW] key.
The display mode is indicated on the main display section. The measuring range is displayed together in the Vv mode.




### Setting of ratio display

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




Setting of measuring range

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

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

Setting of comparator

Press the SEL key, and the highest digit of the HI SET blinks to make the comparator setting.
(Refer to the article 3.13.3)

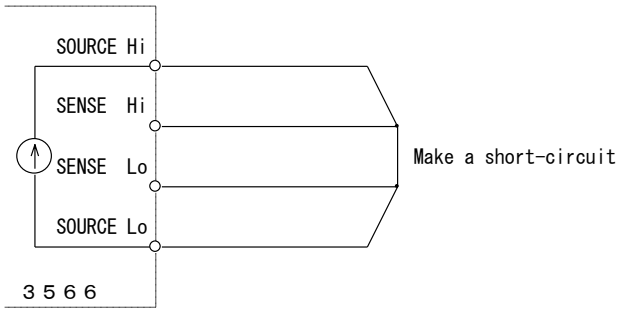
Finish

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

## 3.18 ●Detection of disconnection and self-check

Detection for the disconnection of the measuring lead SOURCE and SENSE is made.
When the disconnection is detected, the CC ERR output transistor turns ON.
The CC ERR output also turns ON when the measuring current does not flow due to open circuit etc.

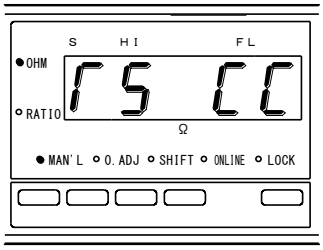
**Note**: During the detection of disconnection is in operation, the sampling is stopped and the comparator output is held.




### 3.18.1 Operation

Preparation

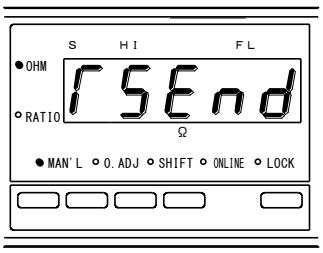
Connect the measuring lead to the meter.
Connect or short-circuit the sample to be measured to the tip of the measuring lead.




Start of detection of disconnection

Short-circuit the SW input on the REMOTE connector to COM.

The measurement display shows rS CC.




Result of detection of disconnection

When there is no error detected, rSEnd is displayed on the display section.
When the disconnection is detected, the following displays are given.

ErrSo : Disconnection of SOURCE side lead
ErrSE : Disconnection of SENSE side lead

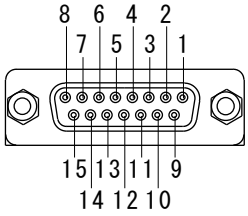
Finish of detection of disconnection

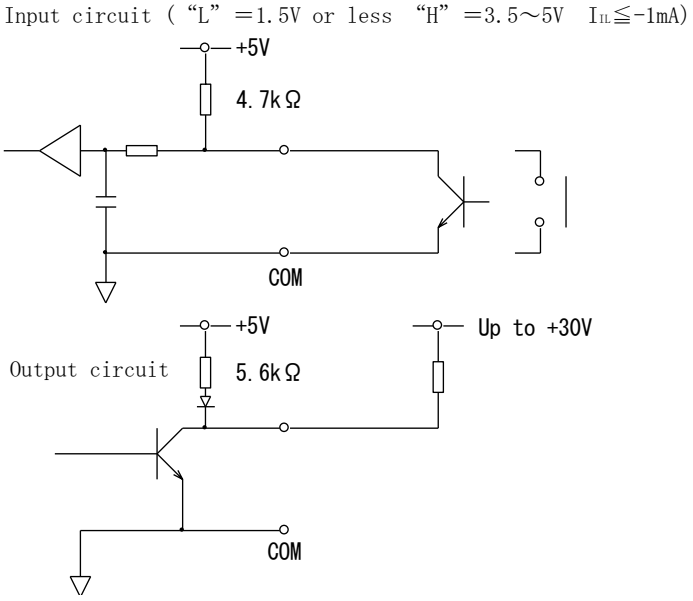
Open the SW input on the REMOTE connector.

# 4. Remote control

## 4.1 ●Remote connector

### 4.1.1 Pin operation




(D-sub 15 pin)

| Pin No. | Signal | Function |
|---|---|---|
| 1 | 0 ADJ input | By making it ON, the zero adjustment is done. (Refer to the article 3.9) |
| 2 | NC | Vacant pin. |
| 3 | MEM input | By making it ON, the memory mode is selected. |
| 4 | TRIG input | By making it ON once during the hold status, one sampling is made and the judgement result is output. Min. ON time: 5ms |
| 5 | SW input | By making it ON, the detection of disconnection and self-check are started. |
| 6 | EOC output | Transistor output becomes ON when the AD conversion is finished. |
| 7 | CC ERR output | When the current does not flow due to the opening etc. of SOURCE terminal, and when the error is detected in the detection of disconnection / self-check, the transistor output is made ON. |
| 8 | COM | Common for input and output. |
| 9<br>10<br>11<br>12<br>13 | M-SEL0<br>M-SEL1<br>M-SEL2<br>M-SEL3<br>M-SEL4 | Memory No. is input in the memory mode to call up the memory. |
| 14 | FL output | FL output of voltage comparator, makes the transistor output ON. |
| 15 | PS output | PS output of voltage comparator, makes the transistor output ON. |

### 4.1.2 Remote operation of memory mode

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

  **Note**: When the memory No out of the code is selected, it is not allowed to enter the memory mode. Make an input of the code 1~30.

② Input the code of memory No and call up the memory.

**Table of memory code**

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

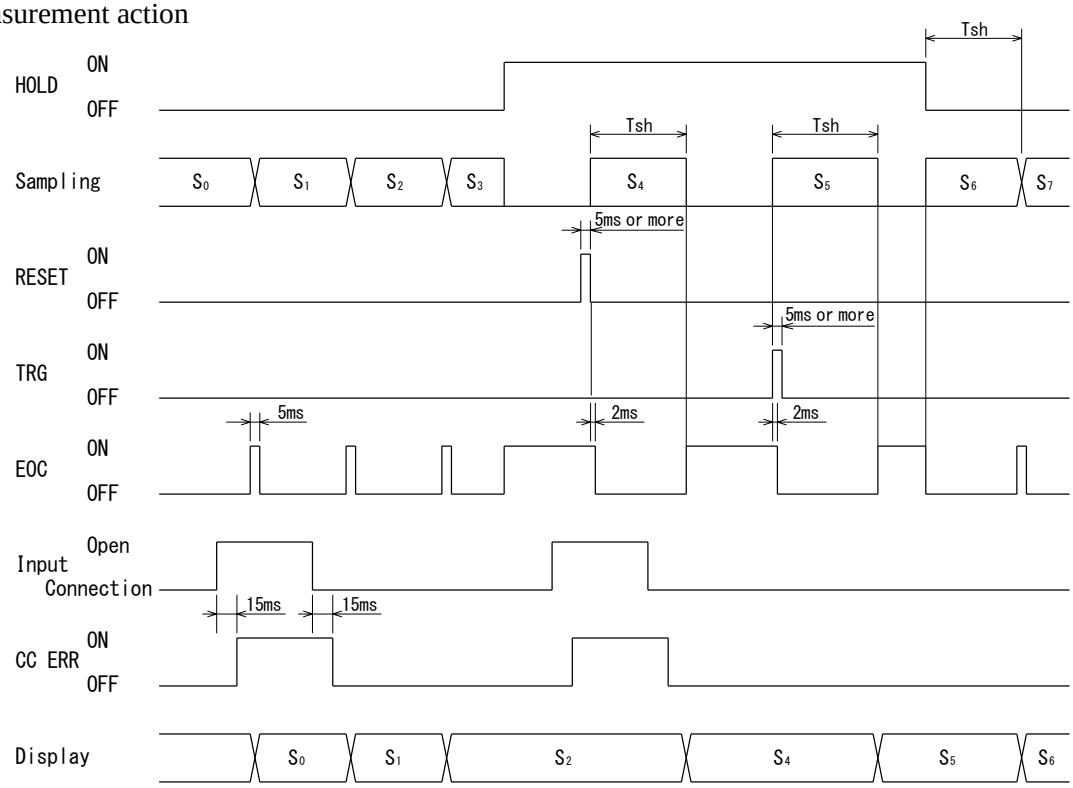
| Signal | Weight | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| M-SEL0 | 1 | | ○ | | ○ | | ○ | | ○ | | ○ | | ○ | | ○ | | ○ |
| M-SEL1 | 2 | | | ○ | ○ | | | ○ | ○ | | | ○ | ○ | | | ○ | ○ |
|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

○ : Makes ON.
Blank : Turns OFF.
**Note**: The input of 0 or 31 makes no change.

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

### 4.1.3 Timing chart of remote control

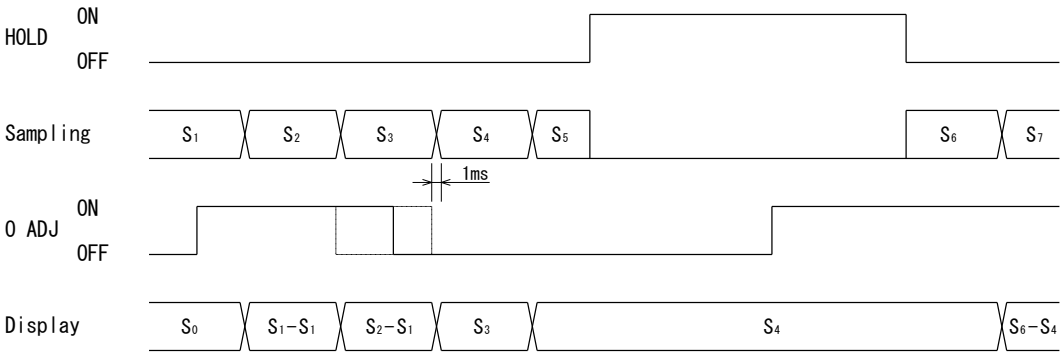
(1) Measurement action



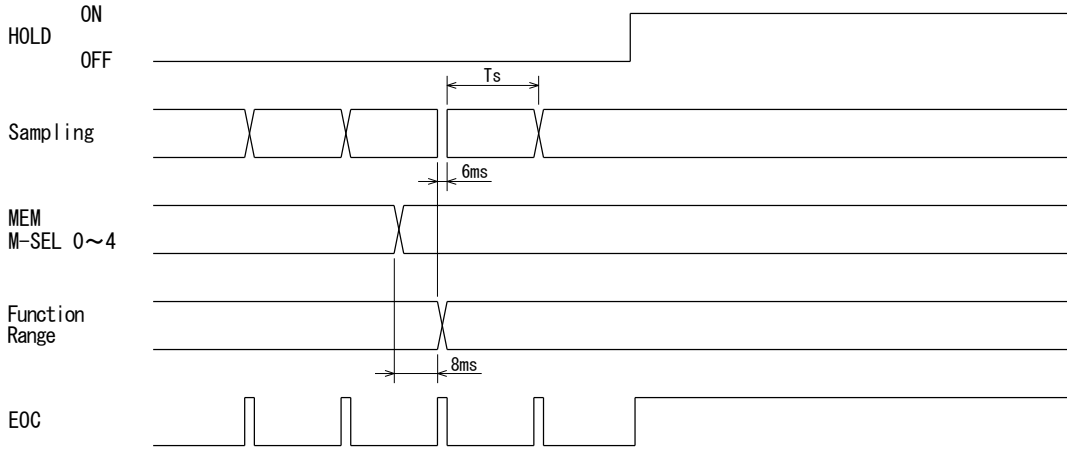

Tsh = Hold, trigger response time

| **Power source frequency set →**<br>**Sampling rate ↓** | **50Hz** | **60Hz** |
|---|---|---|
| F | 13~36ms | 12~28ms |
| M | 90~170ms | 70~143ms |
| S | 570~650ms | 485~540ms |

(2) Zero adjustment

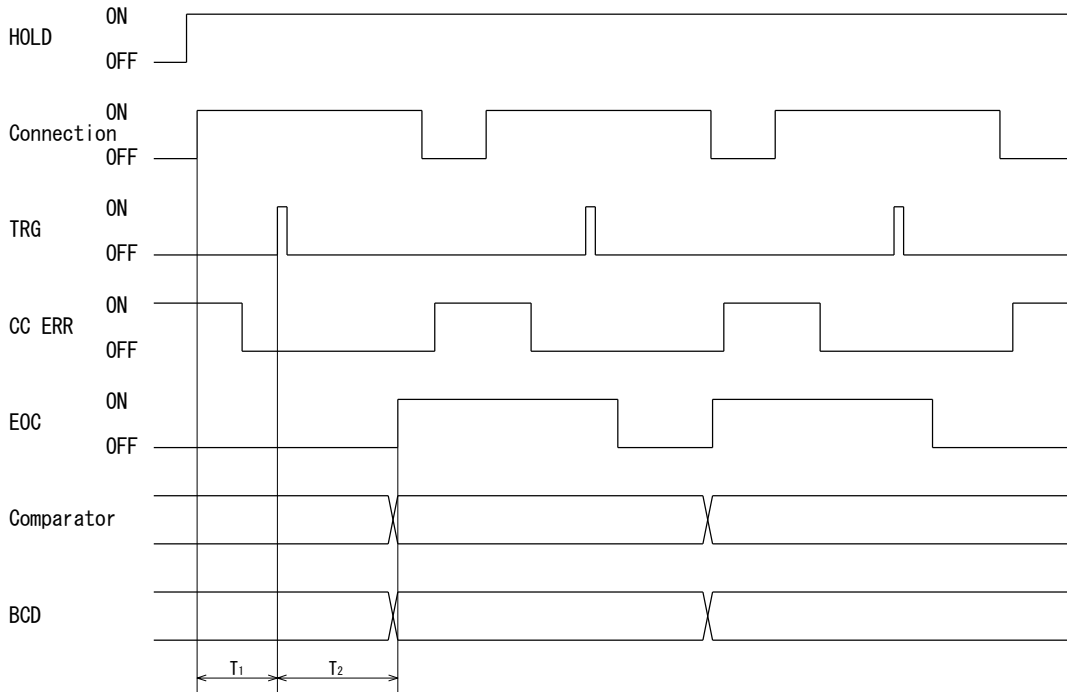


(3) Changeover of memory (changeover of memory/manual is same)




Ts = Sampling rate

(4) Response time



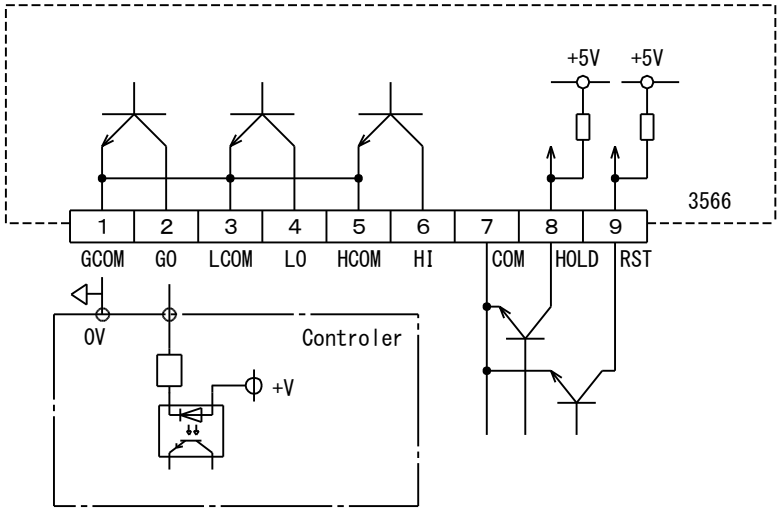

$T_1$ = Stabilization time
$T_2$ = Judgement time
Response time = $T_1 + T_2$

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

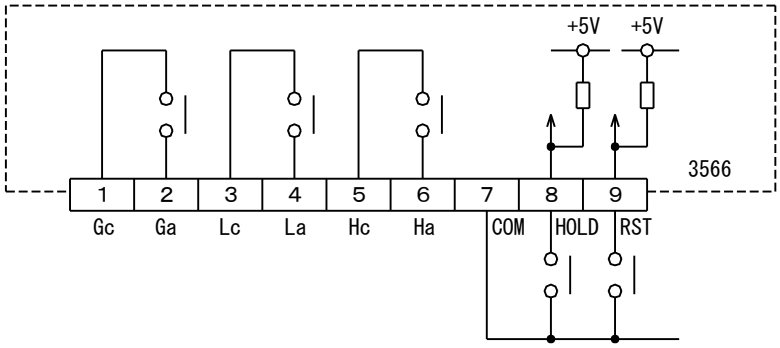
## 4.2 ●Remote control (input and output terminal blocks)

Terminal arrangement

**Open collector output**




**Relay contact output**




(1) HOLD terminal (Hold)
By short-circuiting the HOLD terminal on the rear panel to the COM terminal, the display value, comparator output and BCD data output are held. The hold operation prohibits the operation of all the keys.

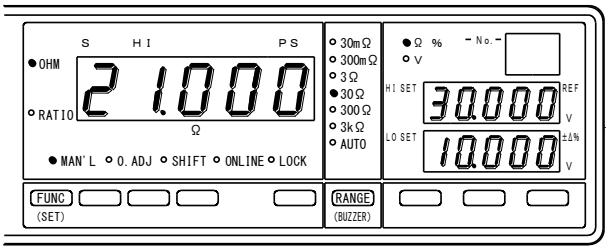
(2) Reset terminal (Reset)
By short-circuiting the RST terminal on the rear panel to the COM terminal, the comparator output is reset and the comparator display is turned OFF.

- One sampling hold action
  It is possible to do the one sampling hold with the HOLD being short-circuited and making ON/OFF of the RST. Do the one sampling hold with the manual range. In case of the auto-range, it may cause an error.

(3) Comparator output
Open collector output : HI, GO, LO, all sink type
30V 30mA max.
Relay contact output : HI, GO, LO, 1a contact for each
250VAC 1A resistive load

# 5. Setting method

## 5.1 ●Resistance measurement




Operating procedure

① Set the meter to manual mode.
(Refer to the article 3.15)

② Select the Rr mode with the VEW key.
(Refer to the article 3.6)

③ Select the resistance measurement with the FUNC key. When the resistance measurement is selected, the OHM on the function display is lit up. (RATIO is turned off.)
At this moment, the main display section displays the resistance value and either one of the measuring units kΩ, Ω or mΩ is lit up.

④ Select the measuring range with the RANGE key. Every time the RANGE key is pressed, the measuring range changes.
In the auto-range, AUTO lamp and the detected measuring range are lit up.
The decimal point is automatically lit up depending upon the selected range.

⑤ Make the setting of comparator.
(Refer to the article 3.13.3)

⑥ Connect the sample to be measured to the resistance measuring cable, then the measured resistance value is displayed.
In case that the measured resistance exceeds the measuring range (35000), ⊔⊔⊔⊔⊔ blinks to inform the over-range.
In case of the auto-range, the range goes up when exceeded the 35000. Also, the range goes down when the value becomes 3000 or less.

## 5.2 ●Ratio display function

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

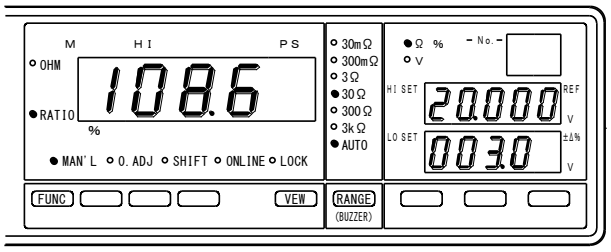
Display range : 0.0~199.9%
Adjustable range of deviation ($\pm\Delta$%) : 0.0~199.9%

Calculation formula

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

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

X : Ratio (%)
$R_S$ : Referential resistance value ($\Omega$)
$R_X$ : Measuring resistance value ($\Omega$)
$\Delta$ : Deviation (%)




Operating procedure

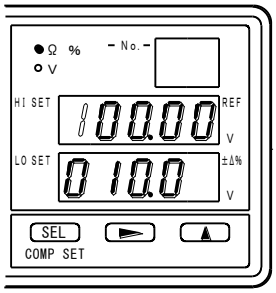
① Select the Rr mode with the VEW key. (Refer to the article 3.6)
② Select the resistance measurement with the FUNC key.
③ Select the measuring range with the RANGE key.
④ Connect the sample to be measured to the resistance measuring cable, then the measured resistance value is displayed.
⑤ Select the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

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

### 5.2.1 Setting of referential resistance value and deviation

Move to the ratio display function

① Refer to the operating procedure.

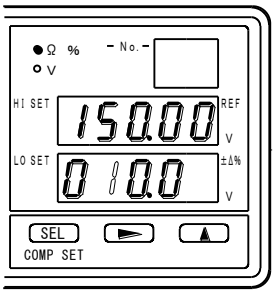



Setting of referential resistance value

② Press the [SEL] key.
The highest digit of the REF display section blinks.
Set the numeral with the [▶] and [▲] key.
The digit selected with the [▶] key blinks.

③ Set the range of referential resistance value with the [RANGE] key.

Adjustable range : 00000~35000




Setting of deviation (±⊿%)

④ Press the [SEL] key.
The highest digit of the deviation (±⊿%) display section blinks.
Set the numeral with the [▶] and [▲] key.
The digit selected with the [▶] key blinks.

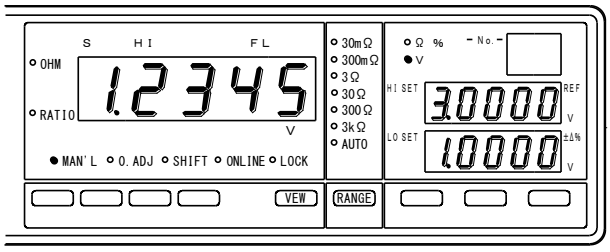
Adjustable range : 0.0~199.9%

Finish

⑤ Press the [SEL] key.

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

## 5.3 ●Voltage measurement




Operating procedure

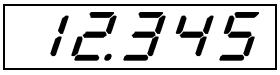
① Select the voltage measurement display with the VEW key.
(Refer to the article 3.6)

② Select the measuring range with the RANGE key. Confirm the measuring range with the position of decimal point.
**Note**: When the resistance measurement range is set to AUTO, the AUTO is lit up and the voltage measurement range also becomes auto-range operation.
At this moment, it is not possible to make the setting of range with key operation.

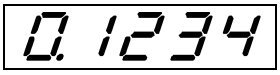
③ Make the setting of comparator.
(Refer to the article 3.13.3)

④ Connect the sample to be measured to the resistance measuring cable, then the measured voltage is displayed.
In case that the measured voltage exceeds the 50000, OUOUOU blinks to inform the over-range.
In case of the auto-range, the range goes up when exceeded the 50000. Also, the range goes down when the value becomes 1000 or less.

Examples of range display




At 50V range




At 5V range

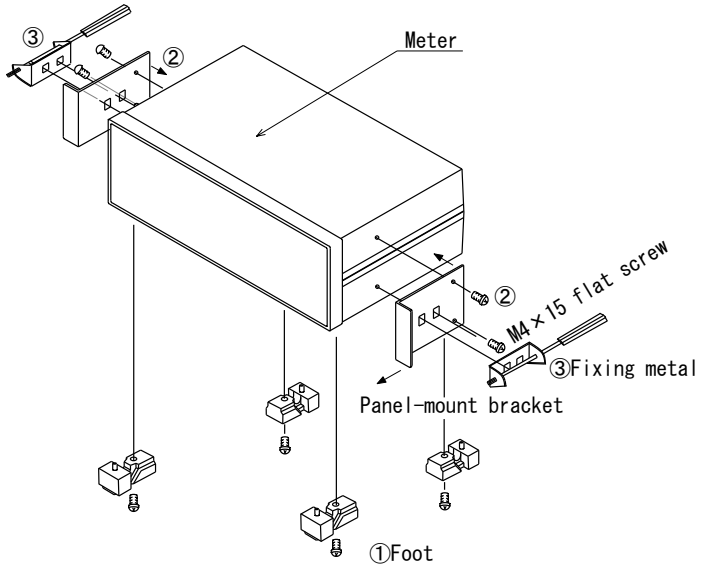
## 5.4 ●Character display

| Display | Name | Explanation |
|---|---|---|
| OUOUOU | Error 0 | When the measurement is over-range. |
| ErrSo | Error SO | At SOURCE open (disconnection being detected). |
| ErrSE | Error SE | At SENSE open (disconnection being detected). |
| SEt | Set | Setting of memory. |
| rS CC | Test CC | Start of detection of disconnection and self-check (disconnection being detected). |
| rSEnd | Test end | Finsihd of detection of disconnection and self-check (disconnection being detected). |
| Err | Setting error | Blinks for about 1 second when the setting item is out of the range. |
| r-SEt | R set | In process of setting of the resistance comparator. |
| V-SEt | V set | In process of setting of the voltage comparator. |

# 6. Use in panel-mount

## 6.1 ●Assembly drawing

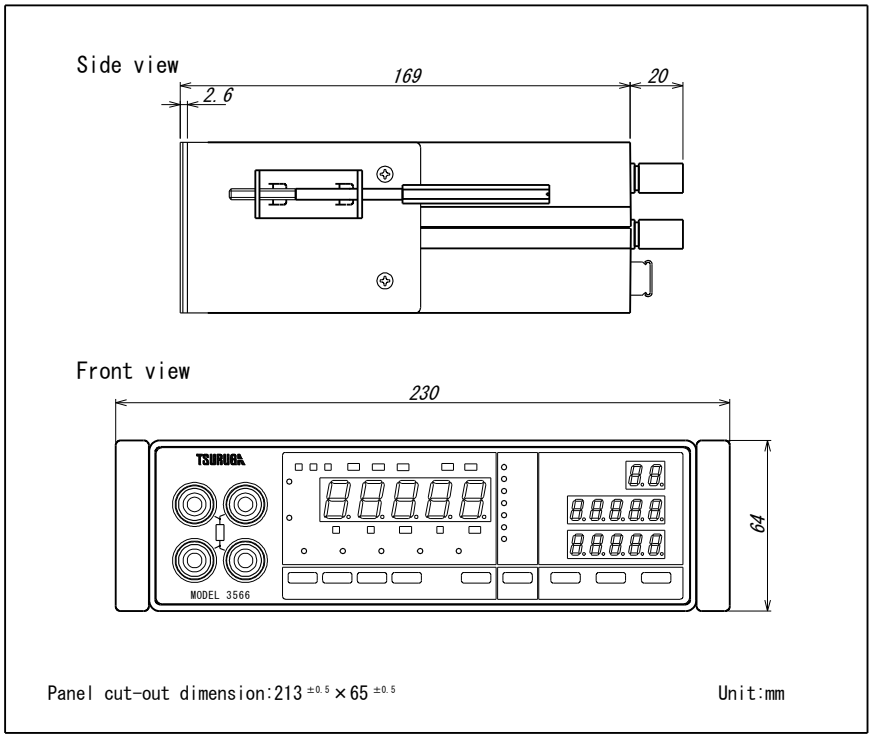
When the meter is used by panel-mounting, use the optional panel-mount bracket.




① Remove the feet (4 parts) at the bottom of the meter.
② Fix the panel-mount bracket to both side of the meter (M4 × 15 flat screw)
③ Insert the meter from the front of the panel and fix it to the panel with the fixing metal.

**Note**: In case that the meter is installed to the chassis, utilizing the bottom screw taps of the meters, keep the length of screw at 6mm + thickness of chassis (mm).

## 6.2 ●External dimensions when fitted with panel-mount bracket



# 7. Extension of lead wires

**●Cautions of the extension of lead wires**

① Make the extension by 4 terminals system (2 wires for SENSE, 2 wires for SOURCE). If the wiring is made by 2 wires, the wiring or contact resistance is included in the measured value, having caused an incorrect measurement value.

② Make the wiring so that the forked section of the lead is as short as possible.

③ Keep the measuring distant from the metallic part. If it is close to the metallic part, it may cause an inaccurate measurement due to the eddy current.

④ When the lead wire is extended, take care that the lead wire resistance does not exceed the tolerable range specified in the following table.

Tolerable range of lead wire resistance of SOURCE lead

| Resistance range | Voltage limit | |
|---|---|---|
| | ON | OFF |
| 30mΩ | 500mΩ | 2Ω |
| 300mΩ | 7Ω | 17Ω |
| 3Ω | 50Ω | 70Ω |
| 30Ω | 550Ω | 600Ω |
| 300Ω | 160Ω | 160Ω |
| 3kΩ | 150Ω | 150Ω |

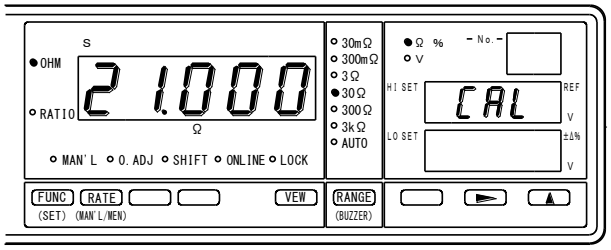
# 8. Calibration

## 8.1 ●Things to prepare

When calibrate the 3566, please prepare the following devices for the calibration.
Standard resistors for calibration of resistance measuring range:
30mΩ, 300mΩ, 3Ω, 30Ω, 300Ω, 3kΩ, 30kΩ
Standard voltage generator for calibration of voltage measuring range: 5V, 50V
Voltmeter for analog output
**Note**: Select the calibration devices whose accuracy satisfies the accuracy of 3566.

## 8.2 ●Calibration

### 8.2.1 Calibration of resistance measurement

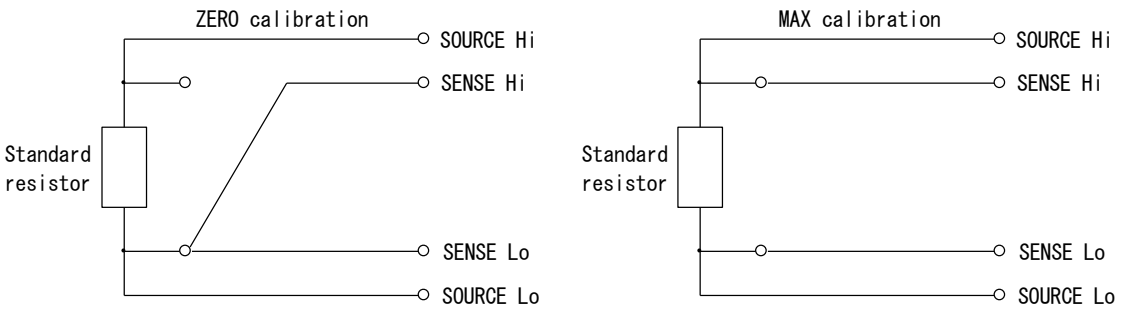



① Turn OFF the power supply switch, and keep pressing the [FUNC] key and the [RATE] key together, turn ON the power supply switch again. CAL is displayed on the HI SET display, and the meter enters the calibration mode.
② When entered the calibration, it is the resistance calibration. In the resistance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

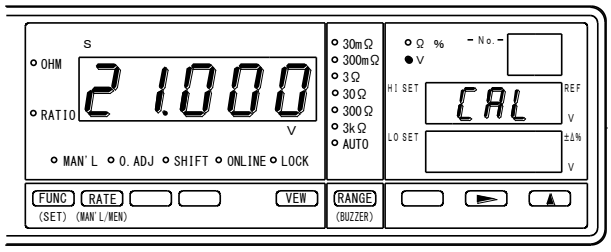
| Range | Standard resistance value | ZERO display value | Max display value |
|---|---|---|---|
| 30mΩ | 30mΩ | 0.000mΩ | 30.000mΩ |
| 300mΩ | 300mΩ | 0.00mΩ | 300.00mΩ |
| 3Ω | 3Ω | 0.0000Ω | 3.0000Ω |
| 30Ω | 30Ω | 0.000Ω | 30.000Ω |
| 300Ω | 300Ω | 0.00Ω | 300.00Ω |
| 3kΩ | 3kΩ | 0.000kΩ | 3.0000kΩ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

**Table 7.2.1**

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



### 8.2.2 Calibration of voltage measurement




① Turn OFF the power supply switch, and keep pressing the [FUNC] key and the [RATE] key together, turn ON the power supply switch again. CAL is displayed on the HI SET display, and the meter enters the calibration mode.

② When entered the calibration, it is the resistance calibration. The [VEW] key allows the changeover between the voltage calibration and the resistance calibration
For the voltage calibration, the V lamp is lit up.

③ Make a connection of the standard voltage generator with the lead wires as the figure shows. Connect the input voltage to suit each range.

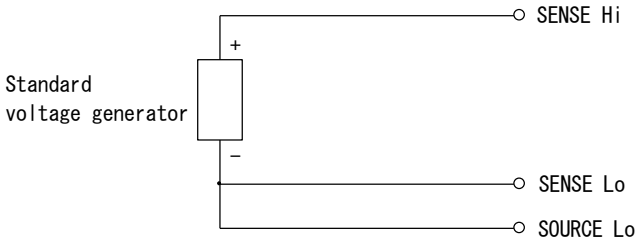
④ By pressing the [▶], ZERO is calibrated, and MAX by pressing the [▲] key. Calibrate each range selecting it by [RANGE] key.
When the calibration is properly made, CAL blinks on the display section for a while.
If the Err is displayed, it is exceeding the range which can be calibrated

⑤ The voltage to connect each range are as the **Table 7.2.2** shows.

| Range | ZERO calibration voltage | Max calibration voltage |
|---|---|---|
| 5V | 0.0000V | 5.0000V |
| 50V | 0.000V | 50.000V |

**Table 7.2.2**

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



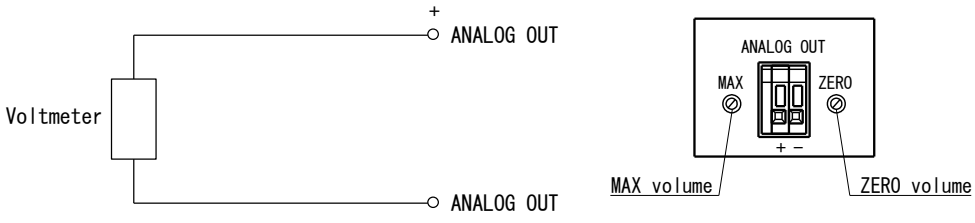

### 8.2.3 Calibration of analog output

① The analog output is calibrated in the resistance measurement.
Press the [VEW] key to make the Rr mode.

② Connect the voltmeter to the analog output terminal.
Connect also the Kelvin clip to the resistance measuring input.

③ Make the measurement display 0, and adjust the output voltage to 0.000V with the ZERO volume. (When the red and black clips are connected in the range 3Ω or 30Ω, the display becomes 0Ω.)

④ Make the measurement display 30000, and adjust the output voltage to 3.000V with the MAX volume. (For the over-range, 3.5000V is output.)



# 9. Specifications

## 9.1 ●Model name

| Model name | Content |
|---|---|
| 3566 -☐ | No data output |
| 3566-01-☐ | With GP-IB (Discontinued September 2014) |
| 3566-03-☐ | With BCD data output (TTL level) |
| 3566-04-☐ | With BCD data output (open collector) |
| 3566-05-☐ | With RS-232C |
| 3566-06-☐ | With RS-485 |

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

## 9.2 ●Measuring range and accuracy

■Resistance measurement (At SLOW and MEDIUM sampling)

| Measuring range | 30mΩ | 300mΩ | 3Ω | 30Ω | 300Ω | 3kΩ |
|---|---|---|---|---|---|---|
| Resolution | 1μΩ | 10μΩ | 100μΩ | 1mΩ | 10mΩ | 100mΩ |
| Measuring current | 7.4mA | 1mA | 100μA | 10μA | 5μA | 1.5μA |
| Accuracy ※ | ±(0.5% of rdg. + 8 digit) | | | | | |
| Temperature coefficient | ±(0.05% of rdg. + 0.8 digit)/℃ | | | | | |
| Open terminal voltage | Peak 20mV or less (with ON/OFF function) | | | | | |

※Accuracy : Defined at 23℃±5℃, 45~75%RH
For the accuracy of MEDIUM sampling rate, a 3 digit is to be added.

■Resistance measurement (At FAST sampling)

| Measuring range | 30mΩ | 300mΩ | 3Ω | 30Ω | 300Ω | 3kΩ |
|---|---|---|---|---|---|---|
| Resolution | 10μΩ | 100μΩ | 1mΩ | 10mΩ | 100mΩ | 1Ω |
| Measuring current | 7.4mA | 1mA | 100μA | 10μA | 5μA | 1.5μA |
| Accuracy ※ | **Note-1** | ±(0.5% of rdg. + 6 digit) | | | | |
| Temperature coefficient | **Note-2** | ±(0.05% of rdg. + 0.6 digit)/℃ | | | | |
| Open terminal voltage | Peak 20mV or less (with ON/OFF function) | | | | | |

Note-1 : ±(0.5% of rdg. + 8 digit)
Note-2 : ±(0.05% of rdg. + 0.8 digit)/℃
※Accuracy : Defined at 23℃±5℃, 45~75%RH

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

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

※Accuracy : Defined at 23℃±5℃, 45~75%RH
※For the accuracy of MEDIUM sampling rate, a 3 digit is to be added.
※For the accuracy of FAST sampling rate, a 5 digit is to be added.

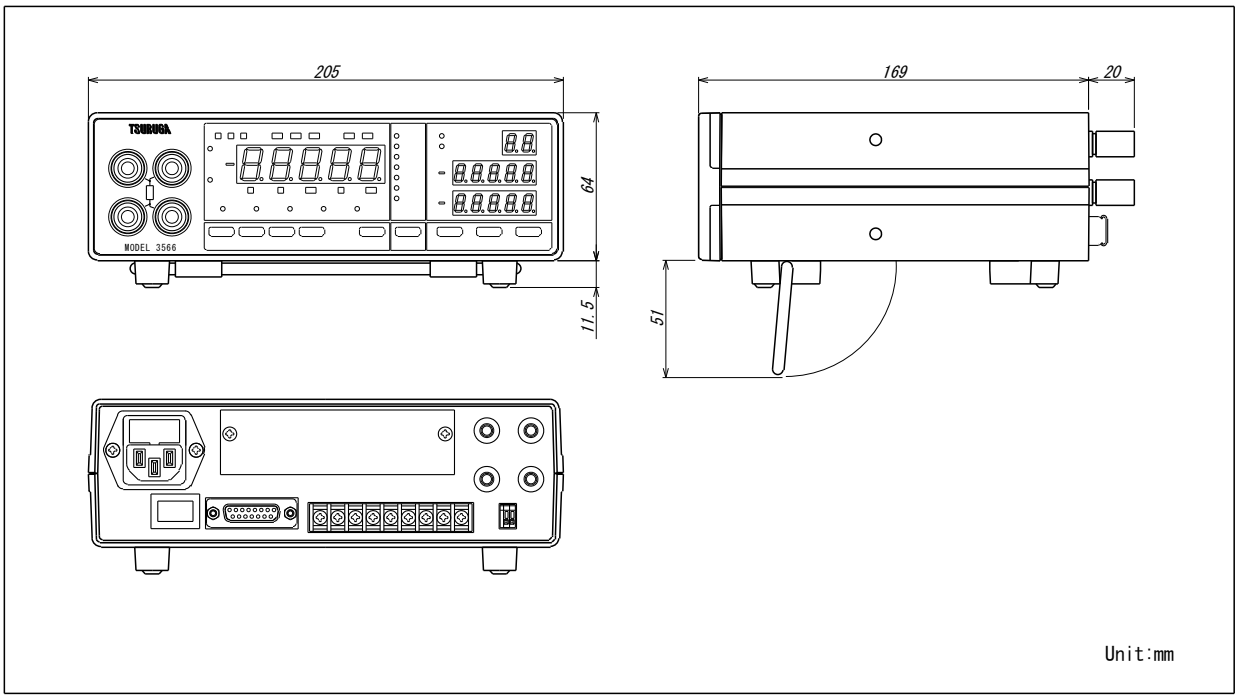
## 9.3 ●General specifications

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

## 9.4 ●Table of initial setting (at delivery from factor)

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

## 9.5 ●External dimensions




## 9.6 ●Option

○ For the model 3566, the following interfaces are prepared.
For the handling of each interface, please refer to the instruction manual of respective interface.

| | |
|---|---|
| GP-IB interface board | : Model 5811-01A (Discontinued September 2014) |
| BCD data output board (TTL) | : Model 5811-03A |
| BCD data output board (open collector) | : Model 5811-04A |
| RS-232C interface board | : Model 5811-05A |
| RS-485 interface board | : Model 5811-06A |

○ Others

| | |
|---|---|
| Kelvin clip | : 5811-21C |
| Lead wire for resistance calibration | : 5811-51 |
| Clip type lead | : 5811-22 |
| Pin type lead | : 5811-23A |
| Panel-mount bracket | : 5811-31 |

# 10. Maintenance and calibration

## 10.1 ●Cleaning

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

## 10.2 ●Problem solving

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

When breakdown goods are to be returned

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

When you think that there is a breakdown

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

## 10.3 ●Calibration

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

MEMO

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Instruction Manual
Interface of BCD Data Output

# MODEL 5811-03A,04A

**(for Model 3566)**

**I-01548**

**TSURUGA ELECTRIC CORPORATION**

# Contents

With use of the BCD output board, the measurement data of the model 3566 can be output, and also the measuring functions and measuring range can be externally controlled.

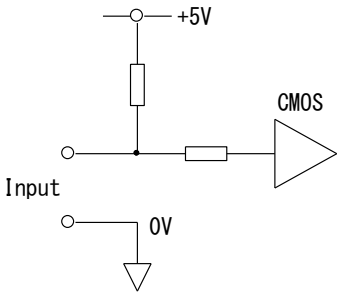
| ⚠ CAUTION |
|---|
| ● **Connect or disconnect the connector after turning off the power of instruments.**<br>● **Do not short-circuit the output or apply the voltage.** |

# 1. Specifications of BCD data input and output

## 1.1 ●Model 5811-03A (3566-03)

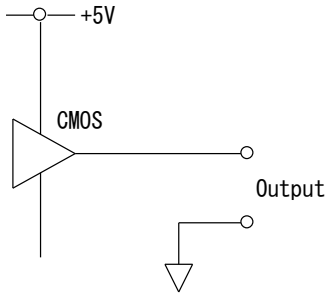
BCD data is output by TTL level.
Output system: BCD parallel code, positive logic
Outputs "L" level with logic "0", and "H" level with logic "1".

**●Input**




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

**●Output**

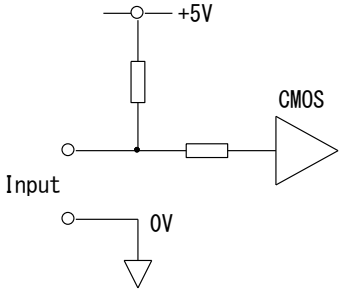



Output level: TTL level
Fo=2

## 1.2 ●Model 5811-04A (3566-04)

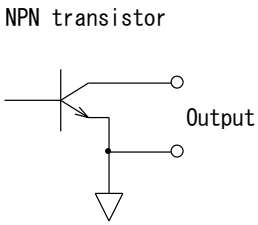
BCD data is output by open collector.
Output system: BCD parallel code
Outputs "OFF" with logic "0", and "ON" with logic "1".

**●Input**



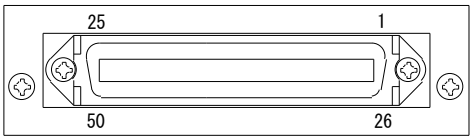

Input level: $I_{IL} \leqq$-1mA
"L"=0.8V or less
"H"=3.5~5V

**●Output**




Output capacity: 30VDC, 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 | $\overline{\text{STROBE}}$ | |
| $\times 10^4$ | 4 | 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 the NC pins as they are connected to the internal circuit.

# 3. Explanation of input and output signals

## 3.1 ●Output signal

### 3.1.1 Measurement data output: 1, 2, 4, 8 ($\times 10^0$~$\times 10^4$)

The measurement data is output by parallel BCD code.
**Note**: When the $\times 10^0$ digit is blank display (when the sampling rate is FAST and in the ratio measurement), 0 is output.

### 3.1.2 Unit output: UNIT

The output of the unit is output by 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 |
| % | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| V | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 0 |

### 3.1.3 Decimal point output: DP2~DP4

Decimal point corresponding with measurement range is output with code.

**Table of output code**

| Display | | Output | | |
|---|---|---|---|---|
| | | DP4 | DP3 | DP2 |
| 350.00 (350.0□) | | 1 | 1 | 0 |
| 35.000 (35.00□) | 50.000 (50.00□) | 1 | 0 | 1 |
| 3.5000 (3.500□) | 5.0000 (5.000□) | 0 | 1 | 1 |

### 3.1.4 Polarity output: POL

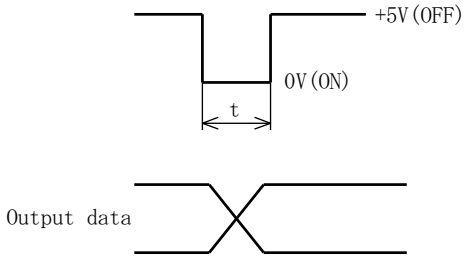
"1" is output at positive (plus) polarity.
"0" is output at negative (minus) polarity.

### 3.1.5 Over-range output: OVER

Error 0 : When the measurement data has exceeded 35000 (3500□) or the voltage measurement data has exceeded 50000 (5000□), OVER becomes "1" and the data 00000 is output.
Error 3 : When the data select code is other than the designated ones, OVER becomes "1" and the data 00003 is output.

### 3.1.6 Strobe output: $\overline{\text{STROBE}}$

At the renewal of data, the "L" pulse is output as the following figure shows.
Transact the data taking the rising point of this pulse.
**Note**: When the tester is of open collector, ON is output.




| Sampling rate | t |
|---|---|
| FAST | Approx. 1ms |
| SLOW, MEDIUM | Approx. 10ms |

## 3.2 ●Input signal

### 3.2.1 Data enable: OUTPUT ENABLE

At "L" level, all the output except $\overline{\text{STROBE}}$ become "high impedance" status.

### 3.2.2 External hold input: $\overline{\text{HOLD}}$

The sampling is made with "H" level and the measurement data is output each time.
The sampling is stopped with "L" level and the BCD data and displayed value are held.
During the hold, the switch operation on the front panel is not accepted.

### 3.2.3 Data select input: SEL

With the input of select code, the measurement data other than the displayed data can be output. When doing the data select, make the display and the data hold status in advance.

**Note-1**: If the data select is done without holding, the displayed value and the data output may sometimes be different.

**Note-2**: The display does not change even if the data select is done.

Data select procedure
Make an input of the select code in the table and select the necessary data.

**Table of data output and select code**

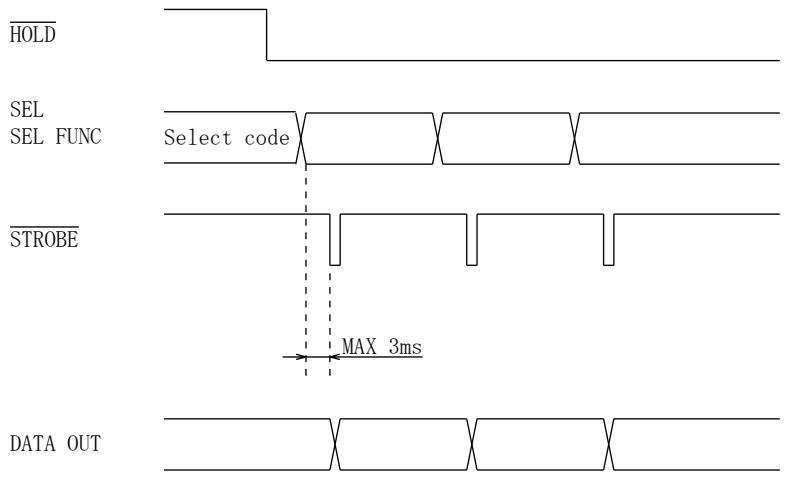
| **Select code** | 4 | 2 | 1 | 4 | 2 | 1 | 4 | 2 | 1 | 4 | 2 | 1 | 4 | 2 | 1 | 4 | 2 | 1 | 4 | 2 | 1 | 4 | 2 | 1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Function** | L | L | L | L | L | H | L | H | L | L | H | H | H | L | L | H | L | H | H | H | L | H | H | H |
| At resistance measurement | VOLT | | | OHM | | | OHM | | | OHM | | | OHM | | | OHM | | | OHM | | | OHM | | |
| At ratio display | VOLT | | | Rs | | | Rx | | | Err3 | | | Err3 | | | Err3 | | | Err3 | | | X | | |

**Note-1**:

| Function | Symbol | Content |
|---|---|---|
| At resistance measurement | OHM<br>VOLT | Resistance value<br>Voltage value |
| At ratio display | Rs<br>Rx<br>X<br>VOLT | Standard resistance value<br>Measured resistance value<br>Ratio<br>Voltage value |

**Note-2**: When the select code is other than specified input, the signal "Error 3" is output. (Err3: The over-range output is "1" and the data output is 00003.)

○Timing chart of the data select



### 3.2.4 External control input: INT./$\overline{\text{EXT.}}$

By making "L" level, the following operations can be externally controlled.
In this case, the operation by the switches on the front panel is disabled.

- Selection of function
- Selection of range

**Note**:
- The external control is not possible during the hold.
- No selection of the function or range is possible while the remote operation of the memory mode.

### 3.2.5 Function input: FUNCTION

By designation of the function code, each function can be externally controlled.
When making an input of the function code, make the INT./$\overline{\text{EXT.}}$ input "L" level in advance.

| **Function** | 8 | 4 | 2 | 1 |
|---|---|---|---|---|
| Resistance measurement | H | L | L | H |
| Ratio display | L | H | H | H |

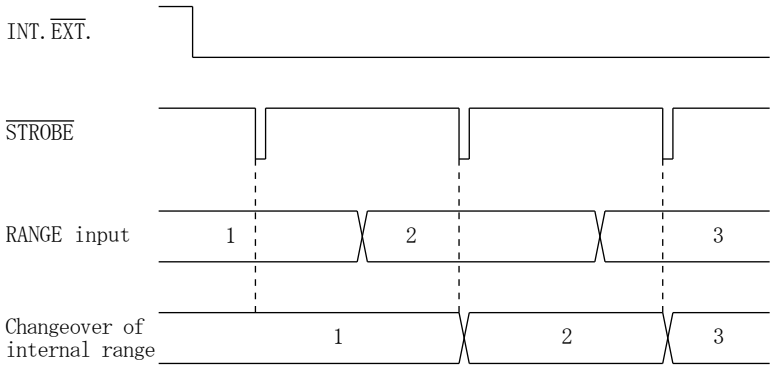
**Note**: The setting other than the above is invalid.

### 3.2.6 Range input: RANGE

By making an input of a range code, the resistance range can be externally selected.
When making an input of the range, make the INT./$\overline{\text{EXT.}}$ input "L" level in advance.

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

○Timing chart of the changeover of range



# 4. Operation

## 4.1 ●Resistance measurement

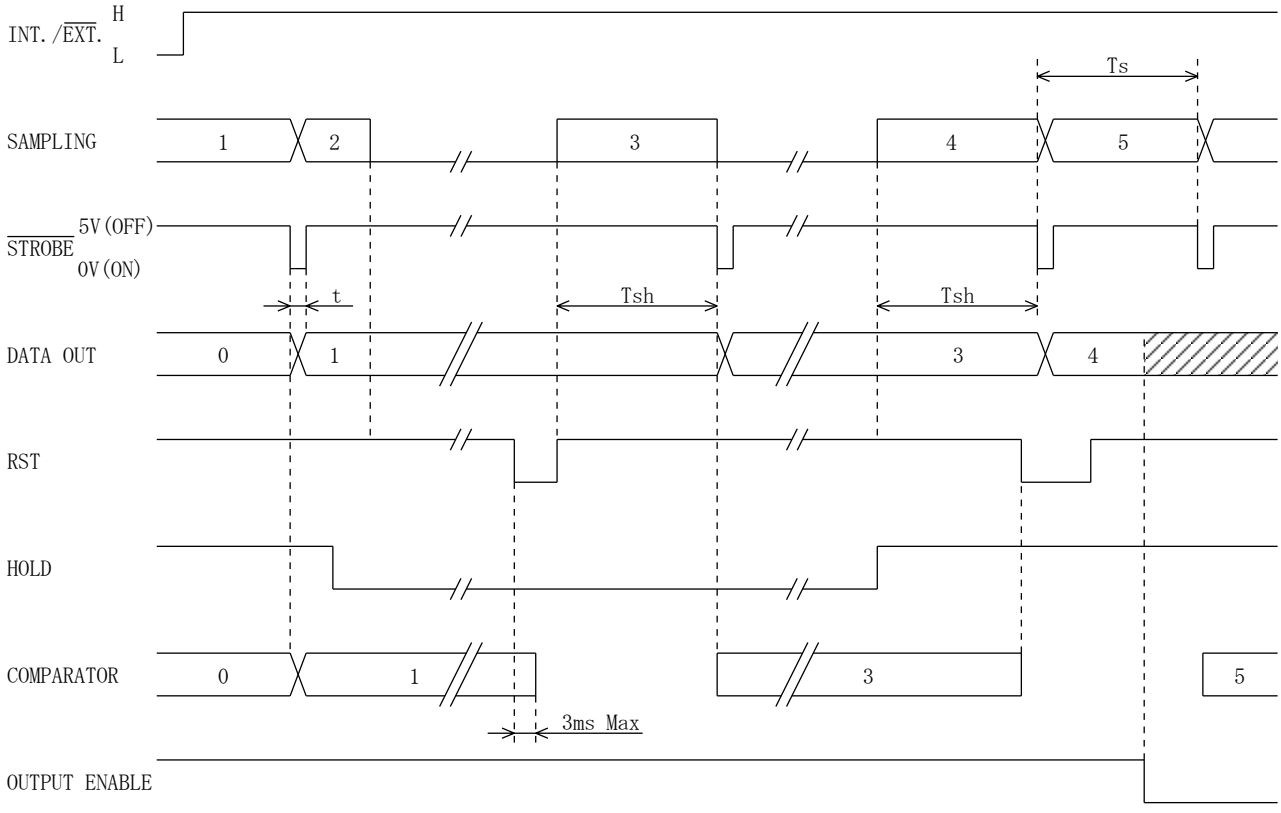
Please refer to the article 5.1 of the tester main unit.
① Make the external control input (INT./$\overline{\text{EXT.}}$) “L” level.
② Input the resistance measurement code to the function (FUNCTION).
③ Input the range code to the range (RANGE) and select the resistance range.
④ Start the measurement.

## 4.2 ●Ratio display

Please refer to the article 5.5 of the tester main unit.
① Make the external control input (INT./$\overline{\text{EXT.}}$) “L” level.
**Note**: When setting the numeral of the standard resistance value, make the INT./$\overline{\text{EXT.}}$ “H” level and set with the switch on the front panel.
② Select the resistance range with the range (RANGE).
③ Input the OHM RATIO or T.C RATIO code range code to the function (FUNCTION).
OHM RATIO : Displays the ratio in the resistance measurement.
T.C RATIO : Displays the ratio in the temperature compensation.
④ Start the measurement.

# 5. Timing chart

## 5.1 ●Data output

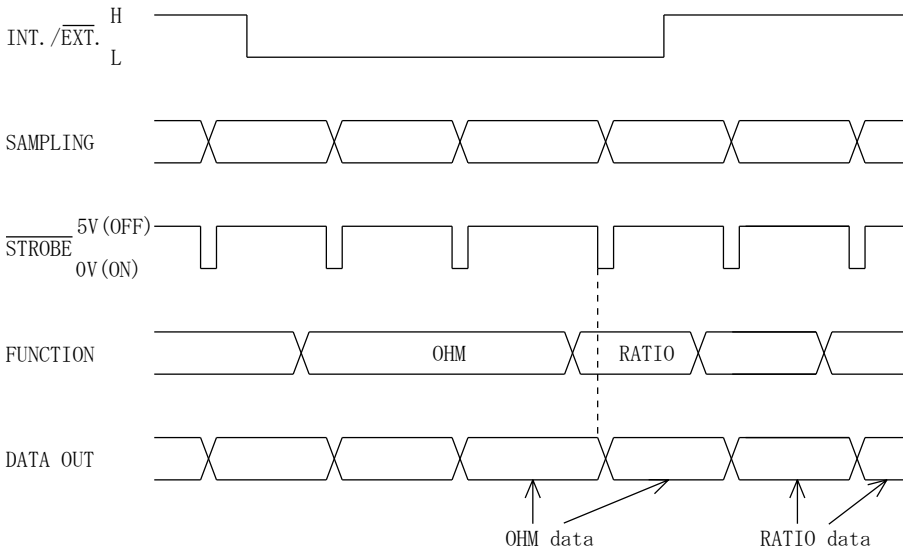



Tsh: Ts+3ms
Ts: Sampling time

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

//////// section High impedance

## 5.2 ●Timing chart for changeover of function





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Instruction Manual
Interface of BCD Data Output

# MODEL 5811-03D,04D

**(for Model 3568)**

**I-01680**

**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 3568.

## ⚠ CAUTION

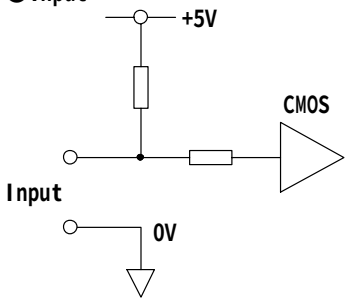
- **Switch OFF the power of the main unit and pull out the power cord plug.**
- **Do not short-circuit or apply voltage to output.**

## 1. Specifications of BCD data input & output

### 1.1 ●MODEL 5811-03D (3568-03)

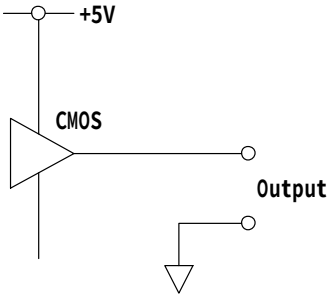
BCD data is output by TTL level.
Output system : Parallel BCD code, positive logic.
"L" level is output by logic "0", and "H" level by logic "1".

●Input




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

●Output

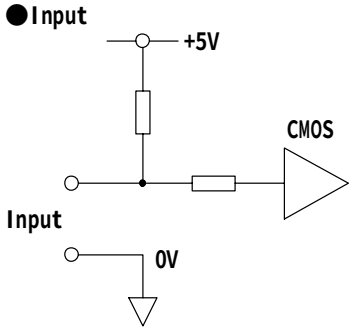



Output level : TTL level
Fo=2

### 1.2 ●MODEL 5811-04D (3568-04)

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

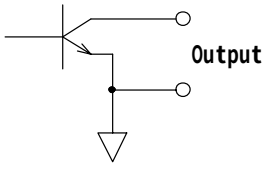
●Input




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

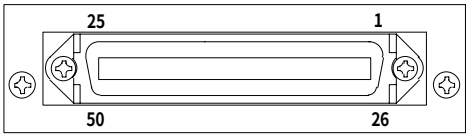
●Output

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 ($\times 10^0 \sim \times 10^4$)
Measured data is output with parallel BCD code.

**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.

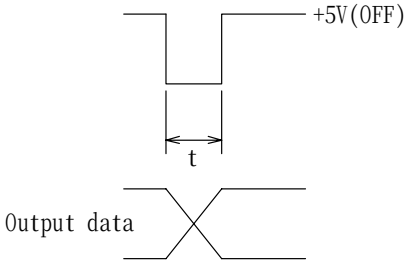
**Table of output code:**

| Display | Output | | | |
|---|---|---|---|---|
| | DP4 | DP3 | DP2 | DP1 |
| **3 5 0 . 0 0** | 1 | 1 | 0 | 1 |
| **3 5 . 0 0 0** | 1 | 0 | 1 | 1 |
| **3 . 5 0 0 0** | 0 | 1 | 1 | 1 |

**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 |
|---|---|
| SLOW, FAST | 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**

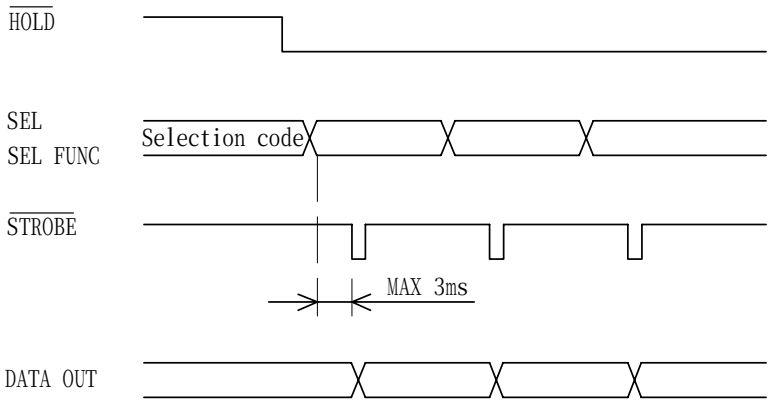
| Function \ Selection code | | 4 2 1 | 4 2 1 | 4 2 1 | 4 2 1 | 4 2 1 | 4 2 1 | 4 2 1 | 4 2 1 |
|---|---|---|---|---|---|---|---|---|---|
| | | L L L | L L H | L H L | L H H | H L L | H L H | H H L | H H H |
| At resistance measurement | | OHM | OHM | OHM | OHM | OHM | OHM | OHM | OHM |
| At temperature 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 |

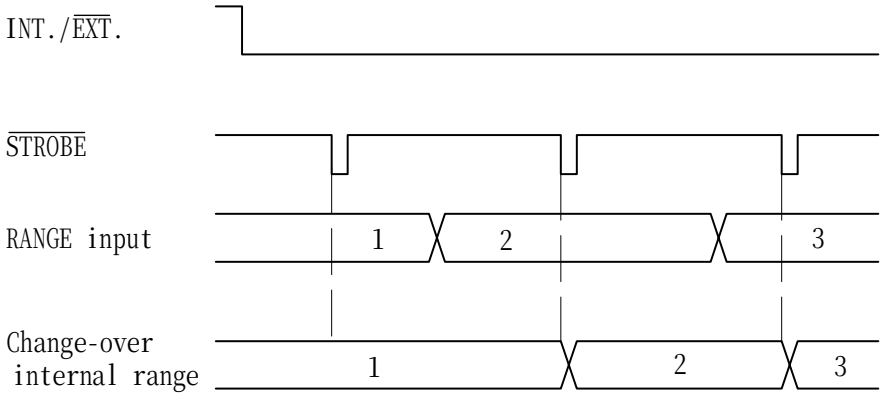
**Note**: Setting other than the above is ineffective.

### 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.

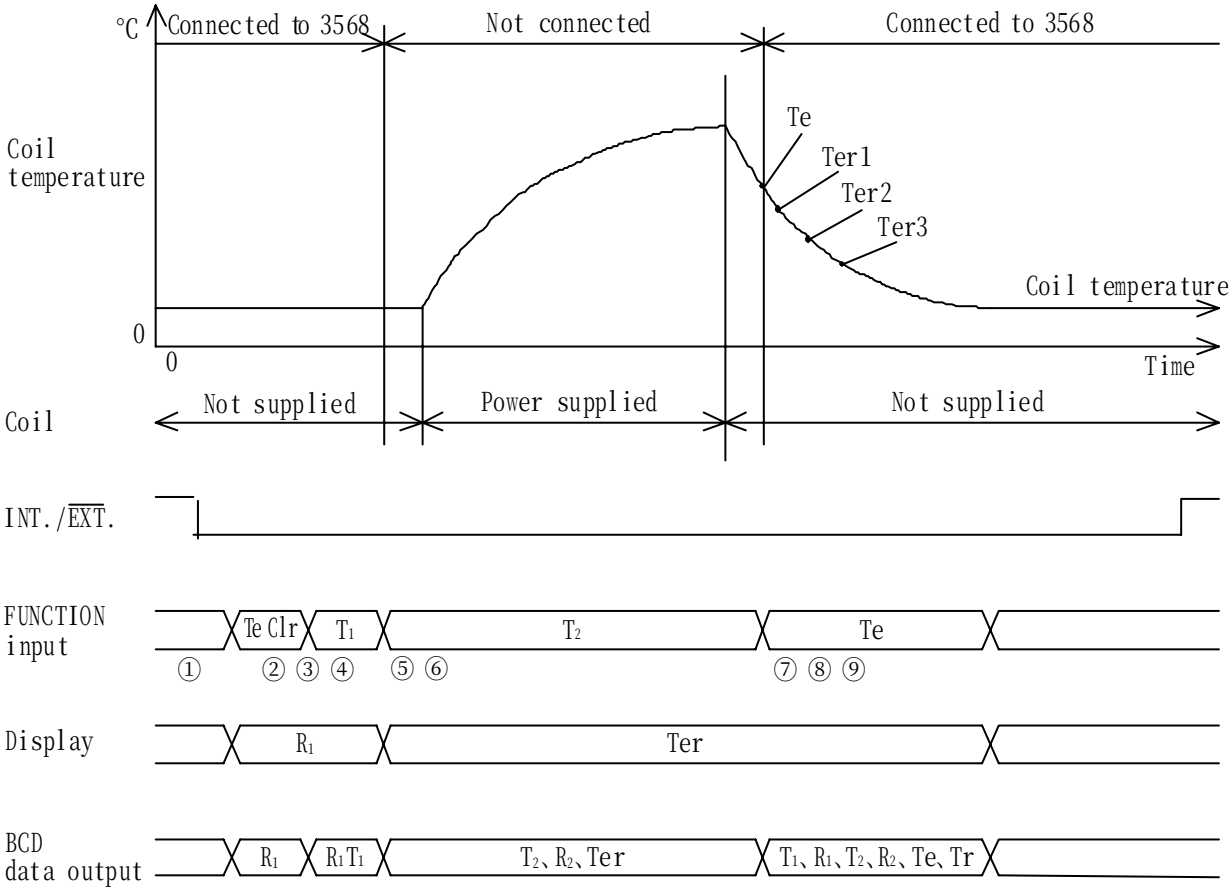
## 4.5 ●Temperature conversion

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.)
"T.E CLR" is displayed.
③ Connect a test sample to measuring input.
④ Input the $T_1$ code.
"T.E T1" is displayed.
⑤ Input the $T_2$ code.
$T_1$ and $R_1$ at input are memorized.
"T.E T2" is displayed.
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.
"T.E END" is displayed.
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.

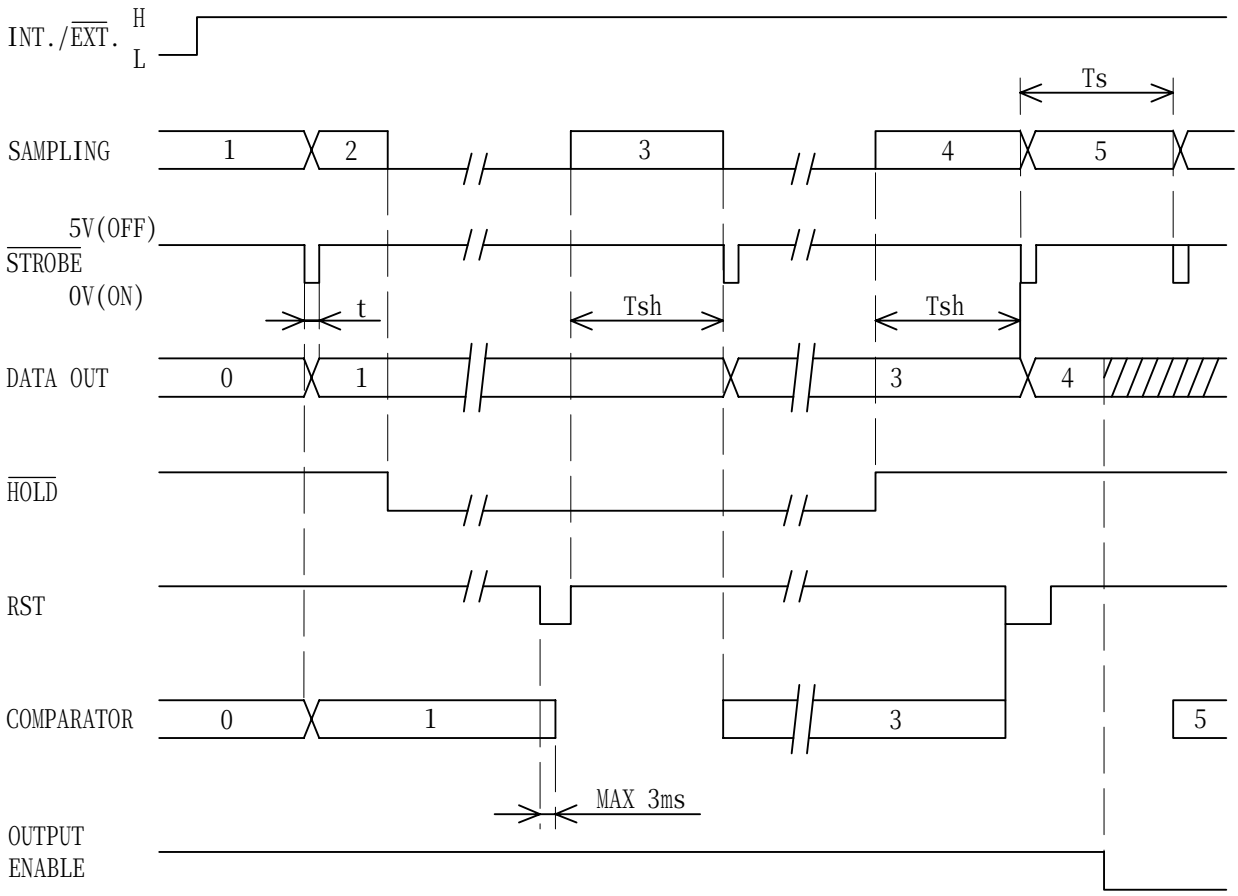
**Note 1**: Perform the measurement separately from the conductance test. If the test sample is in the condition being conducted, the measurement can not be made.
**Note 2**: Zero-adjustment function can not be used.

○ Performance



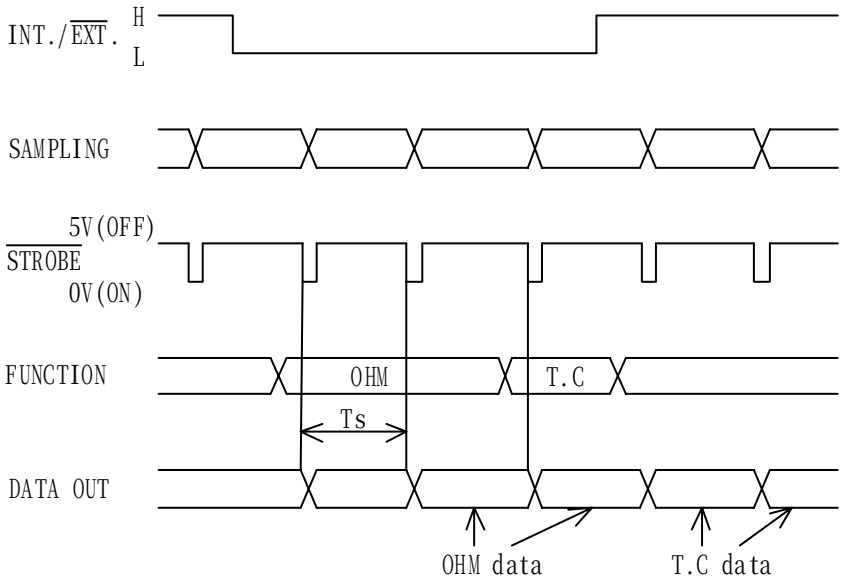
## 5. Timing chart

### 5.1 ●Data output




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

### 5.2 ●Timing chart for switching-over of function





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

Instruction Manual
Interface of RS-232C

# MODEL 5811-05A

**(for Model 3566)**

**I-01549**

**TSURUGA ELECTRIC CORPORATION**

# Contents

Page

# 1. Specifications

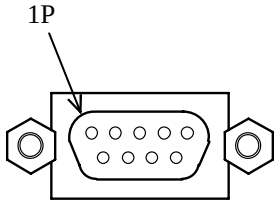
**Table 1.1**

| | |
|---|---|
| Transmission system | Start-stop synchronous duplex transmission |
| Transmission speed | 9600, 4800, 2400bps<br>(Set to 9600bps at delivery from factory) |
| Data bit length | 8 bit |
| Stop bit | 1 bit |
| Parity bit | Nil, even number, odd number<br>(Set to Nil at delivery from factory) |
| Delimiter | LF (0AH) |
| Xon/Xoff | Controllable (Xon at delivery from factory) |
| Connector | Sub-D 9 pin (male) |

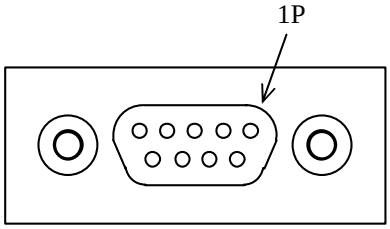
# 2. Connection

## 2.1 ●Connector and signal

Meter connector D-sub9pin




Attached connector: D-sub9pin plug type




XM2D-0901 (OMRON)

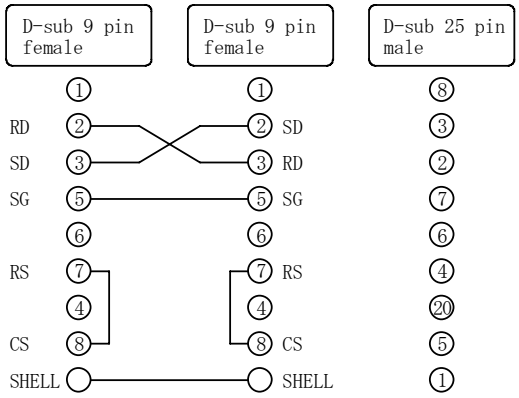
| Pin No. | Meter signal JIS (RS-232C) | Direction | Name |
|---|---|---|---|
| ① | | | Not in use |
| ② | RD (RXD) | Input | Receiving data |
| ③ | SD (TXD) | Output | Transmission data |
| ④ | | | Not in use |
| ⑤ | SG (GND) | | Ground for signal |
| ⑥ | | | Not in use |
| ⑦ | RS (RTS) | Output | Request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

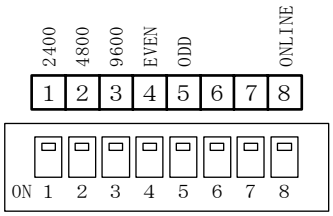
No hardware handshake




## 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.

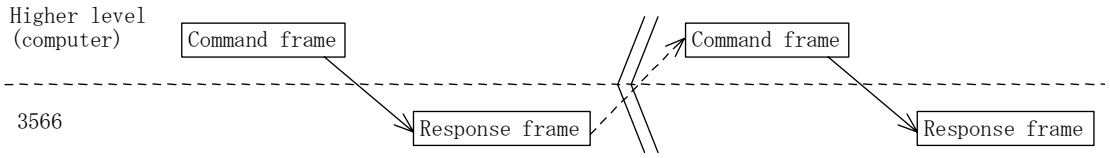
## 2.5 ●ONLINE switch

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,
Response: FUNCTION=OHM
In case of ineffective command: FUNCTION=MACHIGAI,
Response: Command Error

# 4. Explanation of command

## 4.1 ●Program data

JIS punctuation code is used for the command data.

Example:

RANGE=30mOHM [CR][LF]

Command Delimiter

1. Command Command to control the 3566.
2. Delimiter Code (delimiter) to inform the 3566 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 command data

### 4.2.1 ONLINE= (setting of online)

Function — The settings and to do or not to the control through RS-232C is set.

Structure — ONLINE=[ON/OFF]

[ON/OFF] : The setting and control through RS-232C is possible with "ON".
The setting and control through RS-232C is not possible with "OFF".

**Note**: The setting is not possible when the ONLINE is made by the dip switch on the rear.

### 4.2.2 ONLINE? (read-out of online)

Function — The settings of online is read out.

Structure — ONLINE?

Transmission

ONLINE?

Response

ONLINE OFF

### 4.2.3 BUZZ= (setting of buzzer)

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

Structure — BUZZ= OFF/GO/HI/LO/HILO/PASS/FAIL/GOOD/NG , Data

BUZZ= : Buzzer setting command

OFF/GO/HI/LO/HILO/PASS/FAIL/GOOD/NG :

"OFF" designates the buzzer OFF.
"GO" designates the buzzer at GO.
"HI" designates the buzzer at HI.
"LO" designates the buzzer at LO.
"HILO" designates the buzzer at HI or LO.
"PASS" designates the PASS buzzer.
"FAIL" designates the FAIL buzzer.
"GOOD" designates the buzzer at GO and PASS buzzer.
"NG" designates the buzzer at HI, LO or FAIL buzzer.

**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=GO,03
```

### 4.2.4 BUZZ? (read-out of buzzer data)

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

Structure — BUZZ?

Transmission

```
BUZZ?
```

Response

```
BUZZ=GO,03
     ① ②
```

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

### 4.2.5 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

### 4.2.6 MODE? (read-out of mode)

Function — Read out the memory mode, manual mode.

Structure — MODE?

Transmission

MODE?

Response

MODE=MANUAL
①

① Mode setting data (data length = 6).

### 4.2.7 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

**Note**: If it is not in the memory mode, "Not Control" is returned.

### 4.2.8 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?

Response

MEM=01, OHM_ _ _ _ _, OHM _ _ _ _ _ _ _ _, 300mOHM, RH35.000_OHM, RL100.00_OHM
① ② ③ ④ ⑤ ⑥
, 5V_, VH+5.0000V, VL-2.0000V
⑦ ⑧ ⑨

① Shows the memory number (data length = 2).
② Shows the display mode (data length = 8).
③ Shows the resistance measurement function (data length = 10).
④ Shows the resistance measurement range (data length = 7).
⑤ Shows the HI data of resistance comparator (data length = 12).
⑥ Shows the LO data of resistance comparator (data length = 12).
⑦ Shows the voltage measurement range (data length = 3).
When the resistance range is set to AUTO, the voltage measurement also works in the auto-range.
The set value is output as response data.
⑧ Shows the HI data of voltage comparator. (data length = 10).
⑨ Shows the LO data of voltage comparator. (data length = 10).

### 4.2.9 MEM= (setting of memory data)

Function

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

Structure

MEM= No. , VIEW , FUNC , RANGE , RH HI SET ,
RL LO SET , VOLT , VH HI SET , VL LO SET

MEM= : Data setting command of the memory.
No. : Designate the memory number "01" ~ "30".
VIEW : Display mode "OHM", "VOLT", "OHM-VOLT".
FUNC : Function table "OHM", "OHM-RATIO".
RANGE : Designates either one of the resistance range "30mOHM", "300mOHM", 3OHM", "30OHM", "300OHM", "3kOHM".
RH HI SET : High limit value data of the resistance comparator. (Adjustable range of numeral: 0~35000)
RL LO SET : Low limit value data of the resistance comparator. (Adjustable range of numeral: 0~35000)
VOLT : Voltage range "5V", "50V".
VH HI SET : High limit value data of the voltage comparator. (Adjustable range of numeral: ±50000)
VL LO SET : Low limit value data of the voltage comparator. (Adjustable range of numeral: ±50000)

**Note-1**: RH HI SET and RL 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**: VH HI SET and VL LO SET are to be set adding the unit and decimal point.
Example of setting: 45.000V

Transmission

MEM=01,OHM,OHM,300mOHM,RH35.0000HM,RL100.000HM,5V,VH5.0000V,VL2.0000V

MEM=01,OHM,OHM-RATIO,30OHM,RH15.0000HM,RL100.0%,5V,VH5.0000V,VL2.0000V

**Note**: If it is not in the memory mode, "Not Control" is returned.

### 4.2.10 COMPR=, COMPV= (setting of comparator)

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

Structure

COMPR=RH[ HI SET ],RL[ LO SET ] — For resistance comparator
COMPR=VH[ HI SET ],VL[ LO SET ] — For voltage comparator

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, 5.0000V

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

Transmission

Set the HI SET of resistance comparator to 2.0000kΩ and the LO SET to 1.5000kΩ.
COMPR=RH2.0000kOHM, RL1.5000kOHM
Set the HI SET of voltage comparator to 15.000V and the LO SET to 2.000V.
COMPV=VH+15.000V, VL-02.000V

**Note**: The setting is not possible in the memory mode.
The setting of the resistance comparator is not possible when the measuring function is RATIO (ratio display).

### 4.2.11 COMPR?, COMPV? (read-out of comparator data)

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

Structure

COMPR? — Read-out of the resistance comparator
COMPV? — Read-out of the voltage comparator

Transmission

COMPR?

Response

COMPR=RH3.0000kOHM, RL1.0000kOHM
① ② ③

① Shows the data output of resistance comparator.
② Shows the HI data of the comparator (data length = 12).
③ Shows the LO data of the comparator (data length = 12).

**Note**: The read-out is not possible when the resistance measurement function is RATIO (ratio display).

Transmission

COMPV?

Response

COMPV=VH+5.0000V, VL-1.0000V
① ② ③

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

### 4.2.12 DATA? (read-out of measurement data)

Function　Read out the measurement data.

Structure　DATA?

DATA? : Measurement data output command

Transmission

DATA?

Response

1. Resistance measurement

OHM=+199.99kOHM,R-JUDGE=HI LO,VOLT=+0.1234V,V-JUDGE=FAIL
①　②　③　④

① Resistance measurement data (data length = 11)
② Resistance judgement output (data length = 13)
③ Voltage measurement data (data length = 13)
④ Voltage judgement output (data length = 12)

2. Ratio measurement

RATIO=+0123.4%,Rs=1.0000_OHM,Rx=+1.2345_OHM,R-JUDGE=GO,
①　②　③　④
VOLT=+0.1234V,V-JUDGE=FAIL
⑤　⑥

① Shows the ratio data (data length = 7)
② Shows the resistance measurement data (data length = 13)
③ Shows the ratio standard resistance value (data length = 14)
④ Shows the resistance judgement output (data length = 13)
⑤ Shows the voltage measurement data (data length = 13)
⑥ Shows the voltage judgement output (data length = 12)

**Note**: R-JUDGE output

| | |
|---|---|
| At GO | : R-JUDGE=GO |
| At HI | : R-JUDGE=HI |
| At LO | : R-JUDGE=LO |
| At HI LO | : R-JUDGE=HI LO |
| At No judgement output | : R-JUDGE=NULL |
| At CC error | : R-JUDGE=CC |

(CC error means the SOURCE open.)
(At the CC error, the CC error is output regardless of the judgement result.)

V-JUDGE output

| | |
|---|---|
| At good voltage judgement | : V-JUDGE=PASS |
| At faulty voltage judgement | : V-JUDGE=FAIL |
| At No judgement output | : V-JUDGE=NULL |

### 4.2.13 FUNCTION= (measuring function)

Function — Designate the measuring function.

Structure — FUNCTION=[Function code]

FUNCTION= : Function setting command

[Function] : "OHM" Resistance measurement,
"OHM-RATIO" Ratio display.

Transmission

Set the measuring function to the resistance measurement.

```
FUNCTION=OHM
FUNCTION=OHM-RATIO
```

### 4.2.14 FUNC? (read-out of function data)

Function — Read out the type of measuring function.

Structure — FUNC?

FUNC? : Measuring function output command

Transmission

```
FUNC?
```

Response

```
FUNCTION=OHM
    ①     ②
```

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

### 4.2.15 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
```

### 4.2.16 HOLD? (read-out of hold status)

Function — Read out the status of hold.

Structure — HOLD?

Transmission

```
HOLD?
```

Response

```
HOLD=ON_
  ①  ②
```

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

### 4.2.17 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 30mΩ ~ 3kΩ.

To make the auto-range, set AUTO.

**Table 4.1**

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

Transmission

Set the resistance measurement range to 30Ω.

```
RANGE=30OHM
```

### 4.2.18 RANGE? (read-out of measuring range)

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

Structure — RANGE?

Transmission

```
RANGE?
```

Response

```
RANGE=3__kOHM
  ①     ②
```

① Shows the range data output.
② Shows the data of setting condition of the range. (data length = 7)

### 4.2.19 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 (00.0~199.9%)

Transmission

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

```
RATIOSTD=10.0000HM,20.0%
```

### 4.2.20 RATIOSTD? (read-out of standard ratio value)

Function — Read the data of ratio standard value.

Structure — RATIOSTD?

Transmission

```
RATIOSTD?
```

Response

```
RATIOSTD=10.000kOHM,020.0%
    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)

### 4.2.21 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

Rest the comparator judgement output.

RST=ON

- One sampling hold
  While the 3566 is in hold status, and when the reset is made ON and afterward turned OFF, one sampling hold can be done.

### 4.2.22 RST? (read-out of judgement reset status)

Function — Read out the status of comparator judgement reset.

Structure — RST?

Transmission

RST?

Response

RST=OFF
① ②

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

### 4.2.23 SAMPLING= (setting of sampling rate)

Function — Set the sampling rate.

Structure — SAMPLING= SLOW/MEDIUM/FAST

SAMPLING= : Setting command of the sampling rate.

SLOW/MEDIUM/FAST :

| | | 50Hz | 60Hz |
|---|---|---|---|
| SLOW | : | 1.56 times/sec. | 1.88 times/sec. |
| MEDIUM | : | 6.25 times/sec. | 7.52 times/sec. |
| FAST | : | 50 times/sec. | 60 times/sec. |

Transmission

Set the measuring sampling rate to low speed.

```
SAMPLING=SLOW
```

### 4.2.24 SAMPLING? (read-out of sampling rate)

Function — Read out the status of sampling rate.

Structure — SAMPLING?

Transmission

```
SAMPLING?
```

Response

```
SAMPLING=SLOW
    ①      ②
```

① Shows the sampling data output.
② Shows the status. (data length = 6)

### 4.2.25 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

### 4.2.26 ZEROADJ? (read-out of zero adjustment)

Function — Read out the status of zero adjustment.

Structure — ZEROADJ?

Transmission

ZEROADJ?

Response

ZEROADJ=OFF
① ②

① Shows the status of zero adjustment output.
② Shows the status of zero adjustment. (data length = 3)

### 4.2.27 VIEW= (setting of display mode)

Function — Make the setting of display mode.

Structure — VIEW=[Display mode]

Display mode= : Display mode setting command.

[Display mode] : "OHM" Rr mode
"VOLT" Vv mode
"OHM-VOLT" RV mode

Transmission

Set the display mode to Rr.

```
VIEW="OHM"
```

### 4.2.28 VIEW? (read-out of display mode)

Function — Read out the display mode.

Structure — VIEW?

Transmission

```
VIEW?
```

Response

```
VIEW=OHM-VOLT
      ①
```

① Shows the display mode. (data length = 8)

Instruction Manual
Interface of RS-485

# MODEL 5811-06A

**(for Model 3566)**

**I-01550**

**TSURUGA ELECTRIC CORPORATION**

# Contents

# 1. Specifications

**Table 1.1 Specifications**

| | |
|---|---|
| Synchronization system | Start-stop synchronous system |
| Communication system | 2 wire half duplex system |
| Transmission speed | 9600bps |
| Data bit length | 7 bit |
| Stop bit | 1 bit |
| Error detection | Vertical parity: Even number parity |
| | BCC |
| Data | Compatible with JIS 8 unit code |
| Control character | STX (02H) start of text |
| | ETX (03H) end of text |
| Transmission procedure | No procedure |
| Numbers of connectable devices | Max. 32 devices including the higher level computer |
| Line length | Max. 500m |
| Device numbering | 00~99, set for each device (not to duplicate)<br>Set with the rear panel switch. |
| Terminator | Terminates with 200Ω<br>ON/OFF changeover with the rear panel switch. |

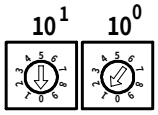
# 2. Connection

## 2.1 ●Connection terminals

| **Terminal number** | 1 | 2 |
|---|---|---|
| Signal name | + (A) | − (B) |

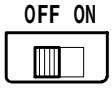
## 2.2 ●Switch for device numbering

Make a setting with the rotary switch on the rear panel.



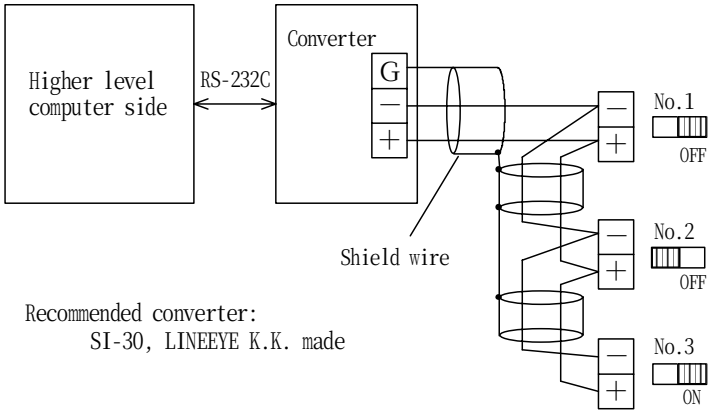

## 2.3 ●Terminator

When the switch on the rear panel is switched ON, the terminator resistor 200Ω is connected in parallel.



### 2.4 ●Connection

RS-485 allows a connection of up to 32 units including the higher level computer.
For the device at both end of transmission channel, it is necessary to make a designation as end station. To designate the end station, set the terminator switch to ON side.



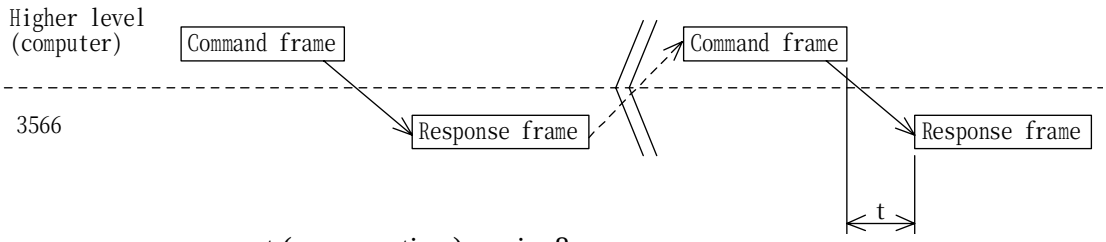

## 3. Communication

### 3.1 ●Remote control

When the tester is in ONLINE status by the key operation on the front panel, remote control and read out of the data by means of RS-485 are enabled.
Control functions in ONLINE are as follows.

- Setting and read out of each setting parameter are possible.
- Read-out of the working status and measurement data is possible.

### 3.2 ●Explanation of communication




t (response time) = min. 8ms

Response frame:
When the effective setting command is received, the content of receipt is returned.
When the effective output command is received, the designated data is output.
When the ineffective command is received, “Command Error” is returned.
Example: In case of effective command: FUNCTION=OHM,
Response: FUNCTION=OHM
In case of ineffective command: FUNCTION=MACHIGAI,
Response: Command Error

# 4. Data format

- Command frame

Device No.

| STX | 1 | 0 | R | A | N | G | E | ? | ETX | BCC |
|---|---|---|---|---|---|---|---|---|---|---|
| 02H | 31H | 30H | 52H | 41H | 4EH | 47H | 45H | 3DH | 03H | 60H |
| | $\times 10^1$ | $\times 10^0$ | | | | | | | | |

- Response frame

Device No.

| STX | 1 | 0 | R | A | N | G | E | = | 3 | 0 | H | M | ETX | BCC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 02H | 31H | 30H | 52H | 41H | 4EH | 47H | 45H | 3DH | 33H | 4FH | 48H | 4DH | 03H | 19H |
| | $\times 10^1$ | $\times 10^0$ | | | | | | | | | | | | |

BCC: BCC is defined as the calculated result of the exclusive logical addition from immediately after STX to ETX (including ETX).

# 5. Explanation of command

## 5.1 ●Command data

JIS punctuation code is used for the command data.

Example:


1. STX Start code
2. Device No.
3. Command Command to control 3566
4. ETX Finish code
5. BCC Error detection code

## 5.2 ●Detail of command data

### 5.2.1 ONLINE= (setting of online)

Function — The settings and to do or not to the control through RS-485 is set.

Structure — ONLINE=[ON/OFF]

[ON/OFF] : The setting and control through RS-485 is possible with "ON".
The setting and control through RS-485 is not possible with "OFF".

**Note**: The setting is not possible when the ONLINE is made by the dip switch on the rear.

### 5.2.2 ONLINE? (read-out of online)

Function — The setting of online is read out.

Structure — ONLINE?

Transmission

ONLINE?

Response

ONLINE OFF

### 5.2.3 BUZZ= (setting of buzzer)

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

Structure — BUZZ=[OFF/GO/HI/LO/HILO/PASS/FAIL/GOOD/NG],[Data]

BUZZ= : Buzzer setting command

[OFF/GO/HI/LO/HILO/PASS/FAIL/GOOD/NG] :

"OFF" designates the buzzer OFF.
"GO" designates the buzzer at GO.
"HI" designates the buzzer at HI.
"LO" designates the buzzer at LO.
"HILO" designates the buzzer at HI or LO.
"PASS" designates the PASS buzzer.
"FAIL" designates the FAIL buzzer.
"GOOD" designates the buzzer at GO and PASS buzzer.
"NG" designates the buzzer at HI, LO or FAIL buzzer.

**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 GO buzzer sound level to 3.

```
BUZZ=GO,03
BUZZ=OFF
```
(When the setting is OFF, the sound level setting is disregarded.)

### 5.2.4 BUZZ? (read-out of buzzer data)

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

Structure — BUZZ?

Transmission

BUZZ?

Response

```
BUZZ=PASS,03
     ①  ②
```

① The buzzer working mode.
② The buzzer sound volume. (data length = 2)

### 5.2.5 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

### 5.2.6 MODE? (read-out of mode)

Function — Read out the memory mode, manual mode.

Structure — MODE?

Transmission

MODE?

Response

MODE=MANUAL

### 5.2.7 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

**Note**: If it is not in the memory mode, "Not Control" is returned.

### 5.2.8 MEM No. ? (read-out of memory setting data)

Function — Read out the memory data designated by the No.

Structure — MEM No. ?

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

Transmission

MEM01?

Response

MEM=01,OHM_____,OHM _______,300mOHM,RH35.000_OHM,RL100.00_OHM
① ② ③ ④ ⑤ ⑥
,5V_,VH+5.0000V,VL-2.0000V
⑦ ⑧ ⑨

① Shows the memory number (data length = 2).
② Shows the display mode (data length = 8).
OHM_____ : Rr mode
VOLT____ : Vv mode
OHM_VOLT : RV mode
③ Shows the resistance measurement function (data length = 10).
OHM_______ : Resistance measurement
OHM-RATIO_ : Ratio display
④ Shows the resistance measurement range (data length = 7).
⑤ Shows the HI data of resistance comparator (data length = 12).
⑥ Shows the LO data of resistance comparator (data length = 12).
⑦ Shows the voltage measurement range (data length = 3).
When the resistance range is set to AUTO, the voltage measurement also works in the auto-range.
The set value is output as response data.
⑧ Shows the HI data of voltage comparator. (data length = 10).
⑨ Shows the LO data of voltage comparator. (data length = 10).

### 5.2.9 MEM= (setting of memory data)

Function

Set the memory data.
**Note**: Make the setting after changing to the memory mode.

Structure

MEM=[No.],[VIEW],[FUNC],[RANGE],RH[HI SET],
RL[LO SET],[VOLT],VH[HI SET],VL[LO SET]

MEM= : Data setting command of the memory.
[No.] : Designate the memory number "01" ~ "30".
[VIEW] : Display mode "OHM", "VOLT", "OHM-VOLT".
[FUNC] : Function table "OHM", "OHM-RATIO".
[RANGE] : Designates either one of the resistance range "30mOHM", "300mOHM", 3OHM", "30OHM", "300OHM", "3kOHM".
RH[HI SET] : High limit value data of the resistance comparator. (Adjustable range of numeral: 0~35000)
RL[LO SET] : Low limit value data of the resistance comparator. (Adjustable range of numeral: 0~35000)
[VOLT] : Voltage range "5V", "50V".
VH[HI SET] : High limit value data of the voltage comparator. (Adjustable range of numeral: ±50000)
VL[LO SET] : Low limit value data of the voltage comparator. (Adjustable range of numeral: ±50000)

**Note-1**: RH[HI SET] and RL[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: RH100.000HM,RL10.0%
**Note-3**: VH[HI SET] and VL[LO SET] are to be set adding the unit and decimal point.
Example of setting: 45.000V
**Note-4**: Make the setting of memory in the memory mode. (MODE=MEMORY)

Transmission

MEM=01,OHM,OHM,300mOHM,RH35.000OHM,RL100.000HM,5V,VH5.0000V,VL2.0000V

MEM=01,OHM,OHM-RATIO,30OHM,RH15.000OHM,RL100.0%,5V,VH5.0000V,VL2.0000V

**Note**: If it is not in the memory mode, "Not Control" is returned.

### 5.2.10 COMPR=, COMPV= (setting of comparator)

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

Structure

```
COMPR=RH[ HI SET ],RL[ LO SET ]    For resistance comparator
COMPR=VH[ HI SET ],VL[ LO SET ]    For voltage comparator
```

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,5.0000V

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

Transmission

Set the HI SET of resistance comparator to 2.0000kΩ and the LO SET to 1.5000kΩ.
COMPR=RH2.000kOHM,RL1.5000kOHM

Set the HI SET of voltage comparator to 15.000V and the LO SET to 2.000V.
COMPV=VH+15.000V,VL-02.000V

**Note**: In the memory mode, no setting is possible in the manual mode and the measuring function is RATIO (ratio display).

### 5.2.11 COMPR?, COMPV? (read-out of comparator data)

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

Structure

```
COMPR?    Read-out of the resistance comparator
COMPV?    Read-out of the voltage comparator
```

Transmission

```
COMPR?
```

Response

```
COMPR=RH3.0000kOHM,RL1.0000kOHM
  ①          ②            ③
```

① Shows the data output of resistance comparator.
② Shows the HI data of the comparator (data length = 12).
③ Shows the LO data of the comparator (data length = 12).

**Note**: The read-out is not possible when the resistance measurement function is RATIO (ratio display).

Transmission

```
COMPV?
```

Response

```
COMPV=VH+5.0000V,VL-1.0000V
  ①          ②           ③
```

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

### 5.2.12 DATA? (read-out of measurement data)

Function　Read out the measurement data.

Structure　DATA?

DATA? : Measurement data output command

Transmission

DATA?

Response

1. Resistance measurement

OHM=+199.99kOHM,R-JUDGE=HI LO,VOLT=+0.1234V,V-JUDGE=FAIL
①　②　③　④

① Resistance measurement data (data length = 11)
② Resistance judgement output (data length = 13)
③ Voltage measurement data (data length = 13)
④ Voltage judgement output (data length = 12)

2. Ratio measurement

RATIO=+123.4%,Rs=1.0000_OHM,Rx=+1.2345_OHM,R-JUDGE=GO_____,
①　②　③　④
VOLT=+0.1234V,V-JUDGE=FAIL
⑤　⑥

① Shows the ratio data (data length = 7)
② Shows the resistance measurement data (data length = 13)
③ Shows the ratio standard resistance value (data length = 14)
④ Shows the resistance judgement output (data length = 13)
⑤ Shows the voltage measurement data (data length = 13)
⑥ Shows the voltage judgement output (data length = 12)

**Note**: R-JUDGE output

| | |
|---|---|
| At GO | : R-JUDGE=GO |
| At HI | : R-JUDGE=HI |
| At LO | : R-JUDGE=LO |
| At HI LO | : R-JUDGE=HI LO |
| At No judgement output | : R-JUDGE=NULL |
| At CC error | : R-JUDGE=CC |

(CC error means the SOURCE open.)
(At the CC error, the CC error is output regardless of the judgement result.)

V-JUDGE output

| | |
|---|---|
| At good voltage judgement | : V-JUDGE=PASS |
| At faulty voltage judgement | : V-JUDGE=FAIL |
| At No judgement output | : V-JUDGE=NULL |

### 5.2.13 FUNCTION= (measuring function)

Function — Designate the measuring function.

Structure — FUNCTION=[Function code]

FUNCTION= : Function setting command

[Function] : "OHM" Resistance measurement,
"OHM-RATIO" Ratio display.

Transmission

Set the measuring function to the resistance measurement.

```
FUNCTION=OHM
FUNCTION=OHM-RATIO
```

### 5.2.14 FUNC? (read-out of function data)

Function — Read out the measuring function.

Structure — FUNC?

FUNC? : Measuring function output command

Transmission

```
FUNC?
```

Response

```
FUNCTION=OHM_____
FUNCTION=OHM-RATIO
   ①        ②
```

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

### 5.2.15 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
```

### 5.2.16 HOLD? (read-out of hold status)

Function — Read out the status of hold.

Structure — HOLD?

Transmission

```
HOLD?
```

Response

```
HOLD=ON_
HOLD=OFF
 ①   ②
```

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

### 5.2.17 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 30mΩ ~ 3kΩ.

To make the auto-range, set AUTO.

**Table 5.1**

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

Transmission

Set the resistance measurement range to 30Ω.

```
RANGE=30OHM
```

### 5.2.18 RANGE? (read-out of measuring range)

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

Structure — RANGE?

Transmission

```
RANGE?
```

Response

```
RANGE=3__kOHM
  ①    ②
```

① Shows the range data output.
② Shows the data of setting condition of the range. (data length = 7)

### 5.2.19 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 (00.0~199.9%)

Transmission

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

RATIOSTD=10.0000HM,20.0%

**Note**: When the FUNCTION is not RATIO, "Not Control" is returned.

### 5.2.20 RATIOSTD? (read-out of standard ratio value)

Function — Read the data of ratio standard value.

Structure — RATIOSTD?

Transmission

RATIOSTD?

Response

RATIOSTD=10.000kOHM,020.0%
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)

### 5.2.21 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

Rest the comparator judgement output.

RST=ON

- One sampling hold
  While the 3566 is in hold status, and when the reset is made ON and afterward turned OFF, one sampling hold can be done.

### 5.2.22 RST? (read-out of judgement reset status)

Function — Read out the status of comparator judgement reset.

Structure — RST?

Transmission

RST?

Response

RST=OFF
① ②

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

### 5.2.23 SAMPLING= (setting of sampling rate)

Function — Set the sampling rate.
The sampling rate for the temperature measurement is fixed at 4 times/sec. and no changeover is possible.

Structure — SAMPLING= SLOW/MEDIUM/FAST

SAMPLING= : Setting command of the sampling rate.

SLOW/MEDIUM/FAST :

| | | 50Hz | 60Hz |
|---|---|---|---|
| SLOW | : | 1.56 times/sec. | 1.88 times/sec. |
| MEDIUM | : | 6.25 times/sec. | 7.52 times/sec. |
| FAST | : | 50 times/sec. | 60 times/sec. |

Transmission

Set the measuring sampling rate to low speed (SLOW).

```
SAMPLING=SLOW
```

### 5.2.24 SAMPLING? (read-out of sampling rate)

Function — Read out the status of sampling rate.

Structure — SAMPLING?

Transmission

```
SAMPLING?
```

Response

```
SAMPLING=SLOW__
    ①      ②
```

① Shows the sampling data output.
② Shows the status. (data length = 6)

### 5.2.25 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

### 5.2.26 ZEROADJ? (read-out of zero adjustment)

Function — Read out the status of zero adjustment.

Structure — ZEROADJ?

Transmission

ZEROADJ?

Response

ZEROADJ=OFF
① ②

① Shows the status of zero adjustment output.
② Shows the status of zero adjustment. (data length = 3)

### 5.2.27 VIEW= (setting of display mode)

Function — Make the setting of display mode.

Structure — VIEW= Display mode

Display mode=: Display mode setting command.

| Display mode | | |
|---|---|---|
| : | "OHM" | Rr mode |
| | "VOLT" | Vv mode |
| | "OHM-VOLT" | RV mode |

Transmission

Set the display mode to Rr.

```
VIEW="OHM"
```

### 5.2.28 VIEW? (read-out of display mode)

Function — Read out the display mode.

Structure

```
VIEW?
```

Transmission

```
VIEW?
```

Response

```
VIEW=OHM-VOLT
     ①
```

① Shows the display mode. (data length = 8)