ONO SOKKI

CL-5610/5610S

NON-CONTACT THICKNESS METER

INSTRUCTION MANUAL

ONO SOKKI CO., LTD.

Warranty

1. This product is covered by a warranty for a period of one year from the date of purchase.
2. This warranty covers free-of-charge repair for defects judged to be the responsibility of the manufacturer, i.e., defects occurred while the product is used under normal operating conditions according to descriptions in this manual and notices on the unit label.
3. For free-of-charge repair, contact either your sales representative or our sales office nearby.
4. The following failures will be handled on a fee basis even during the warranty period.
   (a) Failures occurring through misuse, mis-operation, or modification
   (b) Failures occurring through mishandling (dropping) or transportation
   (c) Failures occurring through natural calamities (fires, earthquakes, flooding, and lightening), environmental disruption, or abnormal voltage.

* For repairs after the warranty period expired, contact your sales representative or our sales office nearby.

■ Contents

For Your Safety

To ensure safe proper use of the CL-5610/5610S Non-Contact Thickness Meter, please be sure to confirm the warnings and precautions described in this manual and this chapter before use.

When operating the CL-5610/5610S Non-Contact Thickness Meter, please follow the directions described in this manual and this chapter.

Ono Sokki, Ltd. bears no responsibility for any warranty regarding damages, failures, or injury resulting from failure to follow instructions given in this manual and this chapter.

■ Safety Notices and Symbols

This manual explains possible danger or risk of the CL-5610/5610S Non-Contact Thickness Meter, possible danger or risk you may encounter if relevant direction is ignored, and measures for avoiding such danger or risk.

A warning label is stuck on or near portions of the CL-5610/5610S Non-Contact Thickness Meter with possible danger or risk.

In this manual two different terms WARNING and CAUTION are used depending on the degree of danger or risk possible.

⚠ **WARNING**	Indicates a risk of death or serious personal injury to the operator if the direction is ignored.
⚠ **CAUTION**	Indicates a risk of burn or other personal injury to the operator or a risk of material damage to the product if the direction is ignored.

Precautions and notices for danger are given by three different symbols: Attention, Prohibited, and Compulsory. Each symbol has the following meaning.

Symbol	Definition	Meaning	Example
	Attention	Indicates a risk of danger if the direction is ignored. The pictogram in the symbol specifically indicates the danger.	
	Prohibited	Indicates an action that is prohibited and should never be attempted. The pictogram in or near the symbol specifically indicates the prohibited action.	
	Compulsory	Indicates an action that is mandatory and must be performed to avoid risk. The pictogram in the symbol specifically indicates the compulsive action.	

■ Meaning of Symbols Used in This Document and WARNING Labels

● Attention

	Indicates a risk of electric shock.
	Indicates a risk of injury.
	Indicates a risk of smoking or igniting.
	Indicates a general precaution or warning.

● Prohibited

	Do not disassemble, repair, or modify this instrument. There is a risk of electric shock or fire.
	Do not use this instrument on locations subject to water or other liquid. Getting water may cause electric shock or igniting.
	Do not bring this instrument close to fire. There is a risk of igniting.
	Do not touch this instrument while your hands are wet. There is a risk of electric shock.
	Do not touch the specified portion. There is a risk of electric shock or burn or other injury.
	Indicates a general action that is prohibited.

● Compulsory

	Unplug the power cord from the outlet. There is a risk of fire or electric shock.
	Indicates a general action that must be performed by the operator following the direction.

To ensure safe and proper use of the CL-5610/5610S Non-Contact Thickness Meter, please be sure to understand warnings and precautions described in this document before use. Please use the CL-5610/5610S Non-Contact Thickness Meter safely and correctly.

■ Measurement

⚠CAUTION

	Use only the dedicated cable. • The sensor cable has a special structure and operates as a part of the VE sensor. Therefore, using other cables or modifying the dedicated cable may cause failure. Never use cables other than the dedicated cable. Never modify the dedicated cable.
	Use the sensor and converter in combination. • The converter has been adjusted in combination with the sensor. Therefore, using the converter together with other sensors may not satisfy the specified accuracy.
	Use the sensor and cable in combination. • The dedicated cable has been adjusted in combination with the sensor. Therefore, using the dedicated cable together with other sensors or cables may not satisfy the specified accuracy.
	Do not connect or disconnect input and output connectors during measurement. There is a risk of failure of external equipment.
	With the VE Series Capacitive Gap Detector, measurement is not possible unless correct type setting is made. • For detailed setup procedures, refer to "Setting Various Conditions" on page 59.
	Be careful of the voltage output from the connector for REMOTE. • The connector for REMOTE on the rear panel is provided with a +5V voltage output (G pin). Never short-circuit this pin. Short-circuiting it is very dangerous because there is a risk of fire, electric shock, or damage to the equipment.
	After turning the power ON, perform aging for about 30 minutes. • Since the VE sensor has a remarkably high sensitivity, perform aging for 30 minutes after turning the power ON and then start measurement.

■ General Precautions

⚠ WARNING

	Remove static electricity of the object under measurement using a destaticizing brush, destaticizing blower, etc. • The sensor and sensor amplifier are not provided with overvoltage protection function because of the detecting principle. Therefore, the sensor amplifier may be damaged if the object under measurement is charged.
	Operate the instrument on the specified voltage. • The standard operating voltage for this instrument is 100 to 240VAC ± 10%. Operating the instrument on voltages other than the specified one may cause damage to the instrument.
	Make sure that correct power voltage is connected before turning on the power. Supply the power to the instrument from a line separated from other power equipment.
	Only use fuses of the rating (current, voltage, and blowing characteristic) specified for the instrument. · Using fuses other than specified one may cause fire. Be sure to turn the power OFF and unplug the power cord for at least one minute before replacing fuses.
	Do not operate the instrument on locations where there is gas or steam. • Using the instrument where steam or combustible or explosive gas is present may result in an explosion.
	Do not use the instrument on locations at extremely high temperature. There is a risk of fire. • Using it at a temperature exceeding the operating temperature range (0 to 40 ℃) may cause fire.
	Do not block the heat radiation system. • There is a risk of fire if heat builds up inside the instrument. Place the instrument away from the wall on locations with the best ventilation possible. • Do not place the instrument sideways.
	Do not remove the casing or take apart the instrument. • Use of the instrument without its casing or while taken apart may result in damage to instrument or electric shock. When internal adjustment, inspection or repair is required, contact your dealer or Ono Sokki sales office nearby.
	Do not splash or spill water on the instrument because there is a risk of fire or electric shock due to short or increased heat. • If you get water inside the instrument, unplug the power cord immediately and call your dealer or Ono Sokki sales office nearby as soon as possible.
	Do not apply excessive shock or vibration to the instrument.
	Do not use the instrument near equipment generating strong noise (such as a large electromagnetic valve, a large motor, etc.) There is a risk of malfunction.
	Never perform electrostatic breakdown test to the sensor or sensor input section. • The sensor and sensor amplifier are not provided with overvoltage protection function because of the detecting principle.

■ ABOUT POWER CORD

⚠WARNING

	Only use the power cord or power plug supplied with the instrument or one specified by Ono Sokki. • Use the supplied AC power cord with 125VAC or less. • When operating the instrument on voltage exceeding 125VAC, be sure to use the specified power cord (with a withstand voltage of 250VAC or higher) that suits the operating voltage (prepared as an option).
	If you do not use the instrument for a prolonged period of time, be sure to unplug the power cord from the outlet. Failure to do so may cause degraded insulation resulting in electric shock or fire caused by a short circuit.

■ PRECAUTIONS ON ELECTRIC SHOCK

⚠WARNING

	Never cut the internal or external protective ground wire or disconnect the wire connected to the protective ground terminal of the instrument. • There is a risk of electric shock or damage to the instrument.
	Before connecting the instrument to the device under measurement or an external control circuit, make sure that protective grounding is securely made and that the power is OFF. • Connecting to external equipment without protective grounding or while the power is still ON may cause electric shock.
	Before touching parts of the instrument where voltage is output or circuits connected to parts where voltage is output, make sure that the power is OFF. • Touching such parts with the power turned ON may cause electric shock. Be sure to insulate the circuit so as to sufficiently withstand the output voltage.
	Be sure that the power meets specified voltage, power, and frequency requirements. • Using power not meeting the specified voltage, power, and frequency requirements may cause electric shock, fire, or damage to the instrument.
	If you hear thunder, do not touch any metal parts of the instrument or the plug. Using the instrument under such conditions may cause electric shock from conducted lightning. Do not use the instrument outdoors if you hear thunder.

■ IF A PROBLEM OCCURS

⚠WARNING

If any metal, water, or foreign object should fall inside, unplug the instrument immediately.

- Using the instrument after metal, water, or foreign object has fallen inside may cause fire or electric shock.
- Unplug the instrument immediately, then contact your dealer or Ono Sokki sales office nearby as soon as possible.

If you perceive smoke, noise, or abnormal odor coming from the instrument, unplug the instrument immediately. Using the instrument under such conditions may cause fire or electric shock.

- If you accidentally drop or damage it, unplug the instrument immediately and contact your dealer or Ono Sokki sales office nearby as soon as possible.

■ ABOUT INSTALLATION AND CONNECTIONS

⚠CAUTION

Do not install the instrument in unstable locations.

- If the instrument should fall, it may cause injury or damage to the instrument.

Do not place a large or heavy object on top of the instrument.

- If an object on top of the instrument should fall, it may cause injury or damage to the instrument.

Do not install the instrument in locations where there is oily smoke or steam or where there is high humidity or lots of dust.

- Electricity could conduct through the oil, water vapor, or dust resulting in fire or electric shock.

Do not install the instrument in locations subject to extremely high temperature or direct sunlight because there is a risk of fire.

When attaching the instrument to a panel rack, the weight of the CL-5610/5610S unit must be supported on the bottom face.

■ ABOUT POWER CORD

⚠ CAUTION

	Be sure to hold onto the plug when plugging in or unplugging the power cord. • Pulling on the cord may damage or break the cord possibly resulting in fire or electric shock.
	Do not plug in or unplug the power cord while your hands are wet. There is a risk of electric shock.
	Keep the power cord away from heaters or appliances which generate high temperature as the cord sheath may melt resulting in fire or electric shock.
	To prevent electric shock due to deteriorated insulation or fire due to leakage, if the instrument will not be in use for a prolonged period of time, unplug the power cord or turn OFF the breaker on the distribution panel.

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Chapter 1

Product Overview and Measurement Principle

1. Overview of CL-5610/5610S

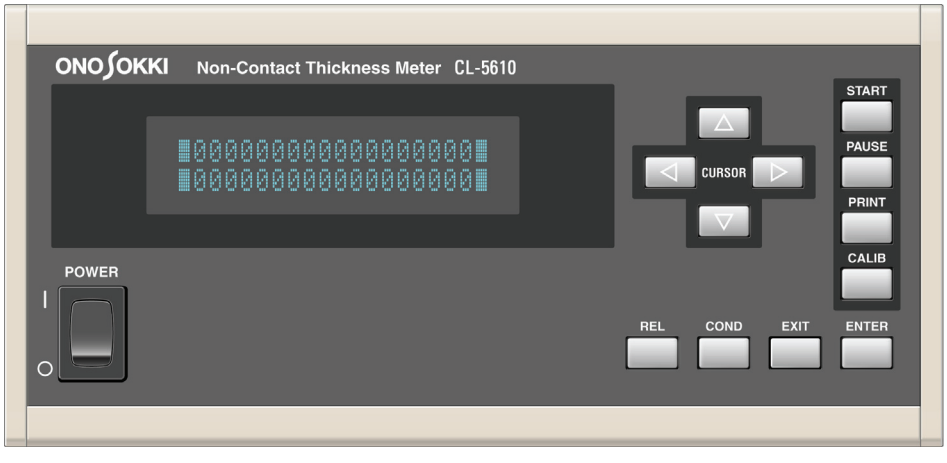
1.1 Overview

The CL-5610/5610S Non-Contact Thickness Meter is used to perform non-contact measurement of the thickness of the object under measurement in combination with the VE Series Capacitive Gap Detector having many field-proven records as a precision non-contact displacement sensor.

The CL-5610/5610S makes it possible to measure the thickness of semiconductors such as an aluminum disc conductor, a silicon wafer, etc. Further, when the CL-0300 Insulator Measurement Function option is installed, the CL-5610/5610S allows measurement of insulators such as a plastic film.

■ Features

- Performs non-contact measurement of the thickness of conductors, semiconductors, and insulators (option) with a single unit.
- Realizes legible display of measurement values and setup menus with the use of a fluorescence display tube.
- High precision, high stability, and high resolution based on a unique calculation method.
- Inline thickness measurement is possible.
- Can be used as a 2-channel displacement meter.



1.2 Objects under Measurement

Basically with the CL-5610/5610S Non-Contact Thickness Meter, measurement is possible as long as the material under measurement is a conductor. However, measurement may not be possible depending on the structure or the object under measurement and environmental conditions.

■ Measurable Objects

Basically, measurement is possible as long as the object under measurement is a conductor. A conductor refers to a material that conducts the electricity. Conductors are shown below.

Metal plate	Iron, aluminum, stainless steel, and other metals
Silicon wafer	Measurable like the metal plate.
Copper-foil substrate	Thickness of a double-sided copper-foil substrate before etching can be measured.
Paste form object	Past form object, such as a battery electrode plate before calcination
Carbon-group plate	Plate containing a lot of carbon-group materials, such as a gasket material, etc.

■ Objects Requiring Caution at Measurement

Alumite	• An aluminum plate with alumite processing has an insulated film on the surface, which may make measurement unstable.
Painted object	• If the insulator is painted, measurement values include an error.
Round object	• Since the VE sensor targets a flat surface as an object under measurement, a curved surface may cause an error.
Object with coarse surface	• If an object with coarse surface is measured, measurement values become thinner than those by a contact-type measuring instrument. • Measurement by the CL-5610/5610S Non-Contact Thickness Meter gives almost an average for surface irregularities. If the surface is very coarse, measurement may not be possible.
Porous object	• If the object under measurement is porous, measurement values become thinner depending on the opening ratio.
Inclined object	• An object under measurement inclined with respect to sensor may cause an error.
Vibrating object	• Although vertical movement within a gap between sensors has no effect, vibration accompanying inclination may cause an error.

■ Materials measurable by installing an option

Although insulators cannot be measured with the standard specifications, the following insulators (materials that do not conduct electricity) can be measured by installing the CL-0300 Insulator Measurement Function option.

1.3 Insulator Measurement with CL-0300

● **Measurable conditions**

Insulators satisfying the following conditions are measurable.

- Has a relative permitivity of 2 to 6 and is stable to temperature and humidity.
- Has a thickness of 1mm or less.
- Made of a single material.
- Causes little vibration and inclination produced during measurement.

● **Insulators requiring caution at measurement**

Insulator containing air bubbles	Since styrene foam etc. contains air, the apparent dielectric constant is small resulting in a large calculation error.
Insulator containing water	With a material containing moisture, such as paper, the dielectric constant changes depending on the moisture content resulting in a measurement error. Measurement is possible if the moisture content is constant.
Insulator with a large dielectric constant	If the dielectric constant of the object under measurement is large, the electric field emitted by the sensor in the sensor gap is disturbed resulting in an error. Since this effect increases as the object under measurement comes closer to the sensor, the error can be reduced by bringing the object under measurement as close to the reference floor as possible.If the dielectric constant is very large, firmly attach the object under measurement to the reference floor before measurement.
Thick insulator	When the object under measurement has a thickness which is at least a half of the sensor rating (rough standard), the electric field is disturbed like "Insulator with a large dielectric constant" resulting in an error.
Laminated material	With combined materials composed of multiple materials laminated having different relative permitivities, measurement is possible by setting the relative permitivity recognizing the laminated materials as one material. However, measurement becomes difficult if the thickness ratio of each material largely changes.
Compound material	With compound materials consisting of different types of materials, such as glass epoxy, asbestos, etc., the relative permitivity may change at some measuring points, which needs to be kept in mind at measurement.
Small/thin insulator	To obtain the original performance of the VE sensor, the size of the object under measurement needs to be equal to or larger than the outer diameter of the sensor. Otherwise, an error may occur.
Insulator with coarse surface	If an object with coarse surface is measured by the CL-5610/5610S Non-Contact Thickness Meter, measurement values become thinner than those by a contact-type measuring instrument. Measurement by the CL-5610/5610S Non-Contact Thickness Meter gives almost an average for surface irregularities. If the surface is very coarse, measurement values may disperse or measurement may not be possible.
Insulator subjected to surface treatment	If a material subjected to surface treatment, such as antistatic treatment, is measured, an error may occur or measurement may not be possible depending on situation.
Miscellaneous	An error may occur depending on environmental conditions, such as temperature, dust, mist, etc.

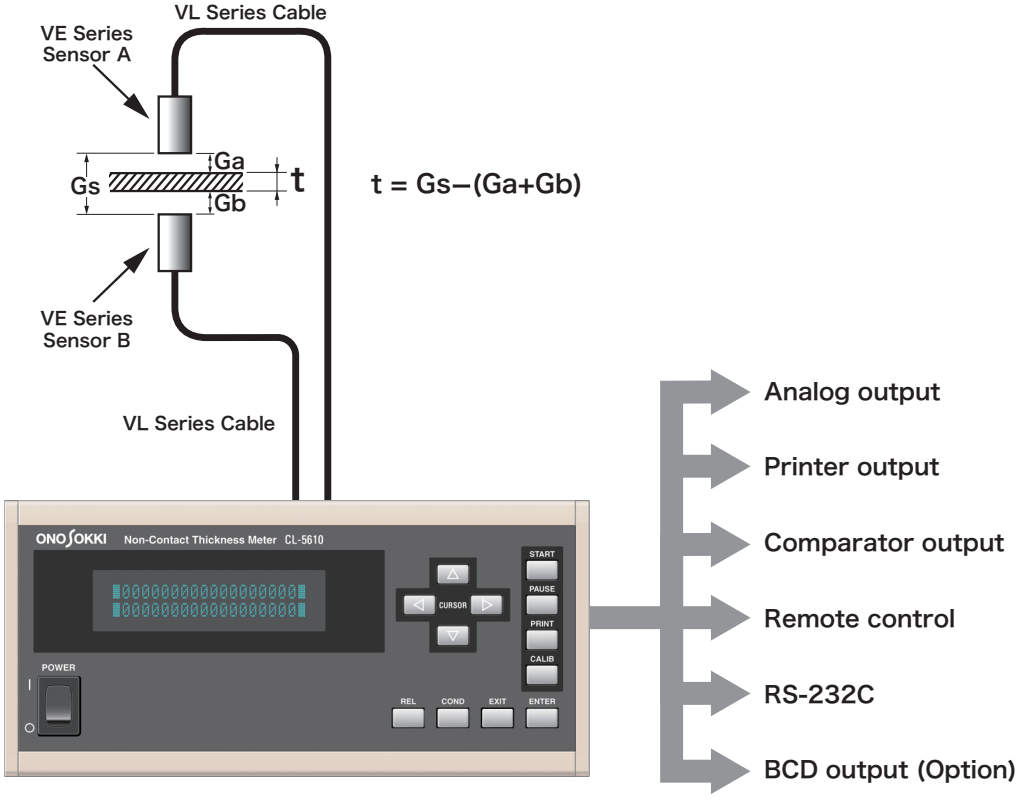
● **Insulators difficult to measure**

Insulator integrally formed with metal	Thickness of a film stuck on a metal plate or thickness of a painted film cannot be measured. However, if the metal surface can be considered as a reference floor, measurement may be possible.
Magnetic tape/floppy disk	With audio tapes and floppy disks to which magnetic substance is applied, the apparent relative permitivity is very large and stable measurement is difficult.
Tile	Ceramics with cover coating, such as decorated tiles, are difficult to measure because of uneven material.

2. CL-5610/5610S System Configuration

Memo

- **Peripheral devices to be connected depend on the object under measurement and your measurement purpose and application. A specific example of configuration is shown below. For detailed configuration according to your measurement application and purpose, contact your dealer or Ono Sokki sales office nearby.**



3. Measurement Principle

The following describes basic measurement principle and measurement principle for each of a conductor and an insulator.

3.1 Measurement Overview

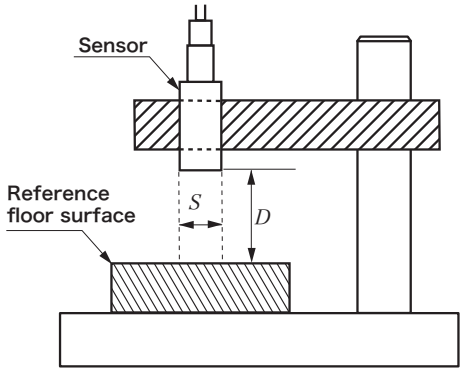
The VE Series Gap Detector is used to measure and display a gap (displacement) based on the capacitance between the sensor and the object under measurement.

The capacitance C is a function of the opposing area S and the gap D of the conductors.

When the opposing conductors (sensor and object under measurement) are flat plates arranged in parallel, the capacitance C can be represented by expression ① where ε represents the dielectric constant of air.

If the area S is fixed, the distance D is in inverse proportion to the capacitance C.

Therefore, common capacitive-type sensors need to be linearized. However, the CL-5610/5610S Non-Contact Thickness Meter directly obtains a voltage proportional to the gap D by means of an Ono Sokki original high-precision calculation circuit. To achieve higher precision, the CL-5610/5610S converts the voltage to digital form, and calculates and displays the thickness and displacement by means of a built-in microcomputer.



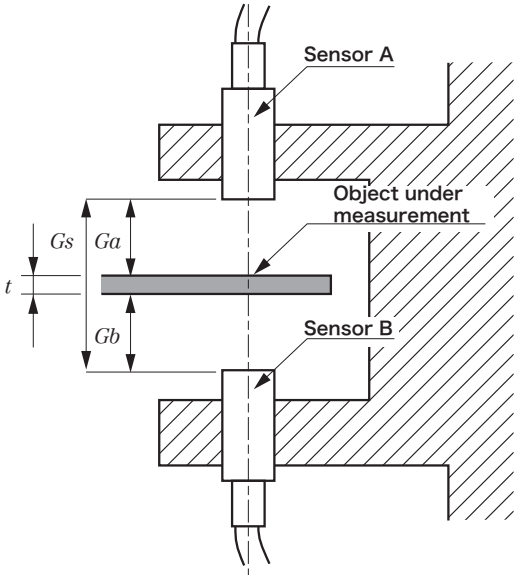
$$C = \varepsilon \frac{S}{D} \quad \text{- - - - - - - - - - - - ①}$$

ε = *Dielectric constant (air)*

3.2 Principle of Conductor Measurement

Two sensors are arranged in parallel with a gap (Gs) (calibrated in advance) formed between them and then the gap value is set in the counter.

An object under measurement is inserted between sensors A and B, and a gap value for each sensor (Ga/Gb) is measured. Then, the dimension (t) of the object under measurement can be measured by subtracting the gap value from the setting in the counter.

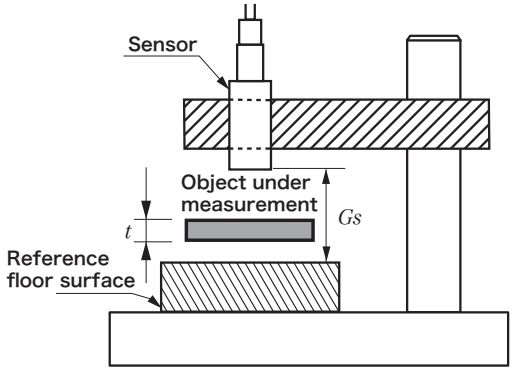


$t=Gs-(Ga+Gb)$ - - - - - - - - - - - ②

3.3 Principle of Insulator Measurement

When a sensor and a conductor are arranged in parallel with a certain gap (Gs) formed between them and then an object under measurement is inserted into the gap, the output voltage changes with changing thickness. Therefore, the thickness (t) of the object under measurement can be calculated from voltage variation and relative permitivity.

However, since the relative permitivity differs from material to material, the numeric value needs to be set in the counter.



4. Sensors

Select a VE sensor to be connected to the CL-5610/5610S Non-Contact Thickness Meter, which best suits your measurement application and purpose, with reference to the following specifications.

4.1 Applicable VE Sensors

VE sensors which can be connected to the CL-5610/5610S Non-Contact Thickness Meter are shown below.

Model Name	Measurable Range	Minimum Measurable Diameter	Cable Length	Temperature Coefficient	Operating Temperature Range
VE-5010	50 to 500	φ6	1.5m directly connected cable	k1=1.7 × 10-5 k2=3.4 × 10-5	0 to 80 ℃
VE-1020	100 to 1000	φ8			
VE-1520	150 to 1500	φ10	1.5m VL-1520/1521		
VE-3020	300 to 3000	φ20			
VE-8020	800 to 8000	φ40			
VE-2011	20 to 200	φ3			
VE-5011	50 to 500	φ6			
VE-1021	100 to 1000	φ8			
VE-3021	300 to 3000	φ20			
VE-8021	800 to 8000	φ40			

- **Measuring range**

  The measuring range represents the maximum gap from the VE sensor end face to the object under measurement.

- **Minimum measurable diameter**

  If the size of the object under measurement opposing to the VE sensor is less than the described size, the accuracy cannot be guaranteed.

- **Operating temperature range**

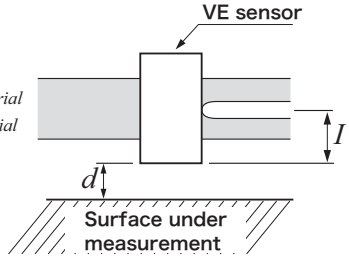
  The operating temperature range is a temperature range in which a VE sensor normally operates. It is not the temperature range in which the accuracy is guaranteed. To ensure the accuracy, use the VE sensor in a temperature range of 23 ± 2 ℃ .

- **Temperature coefficient**

  Temperature characteristics of the VE sensor are based on the following expression.

$$\Delta d \fallingdotseq (k1 \times I + k2 \times d) \times \Delta t$$

k1 : Linear expansion coefficient of sensor housing material
k2 : Area expansion coefficient of sensor electrode material
I : Distance between sensor surface and fixing point
Δt : Temperature change
d : Measurement gap
Δd : Change of converter outp



Memo

- **Even with a VE sensor of the same model name, there is a deviation of ± 0.5 to 1% (depending on model) in measurement values.**
- **At the time of shipment, the Non-Contact Thickness Meter (CL Series) has been subjected to matching adjustment with a VE sensor to be combined to achieve the specified accuracy.**
- **The Non-Contact Thickness Meter (CL Series) can be used in combination with up to six VE sensors for two channels. However, when multiple VE sensors are used with the same single channel, matching adjustment is performed in combination with any one VE sensor and therefore the specified accuracy may not be satisfied in combination with other VE sensors.**
- **If you request re-matching adjustment with VE sensors to be combined, contact Ono Sokki sales office nearby.**

4.2 Points for VE Sensor Selection

There are the following four points for VE sensor selection.

● Accuracy and resolution

The resolution is determined by the VE sensor to be used.

For example, using a VE sensor having a small measuring range provides a high resolution but a narrow measuring range.

● Allowable gap

If the object under measurement is vibrating, you need to take a measuring range that is wider than the vibration range of the object under measurement. Therefore, when selecting a VE sensor, select one having a measuring range that is wider than the vibration range of the object under measurement.

Special caution is required for an object under measurement that is moving while vibrating.

● Size of object under measurement

The VE sensor targets a surface not a point. Therefore, a flat surface larger than the minimum measurement diameter of the VE sensor is required.

● Can VE sensor be attached ?

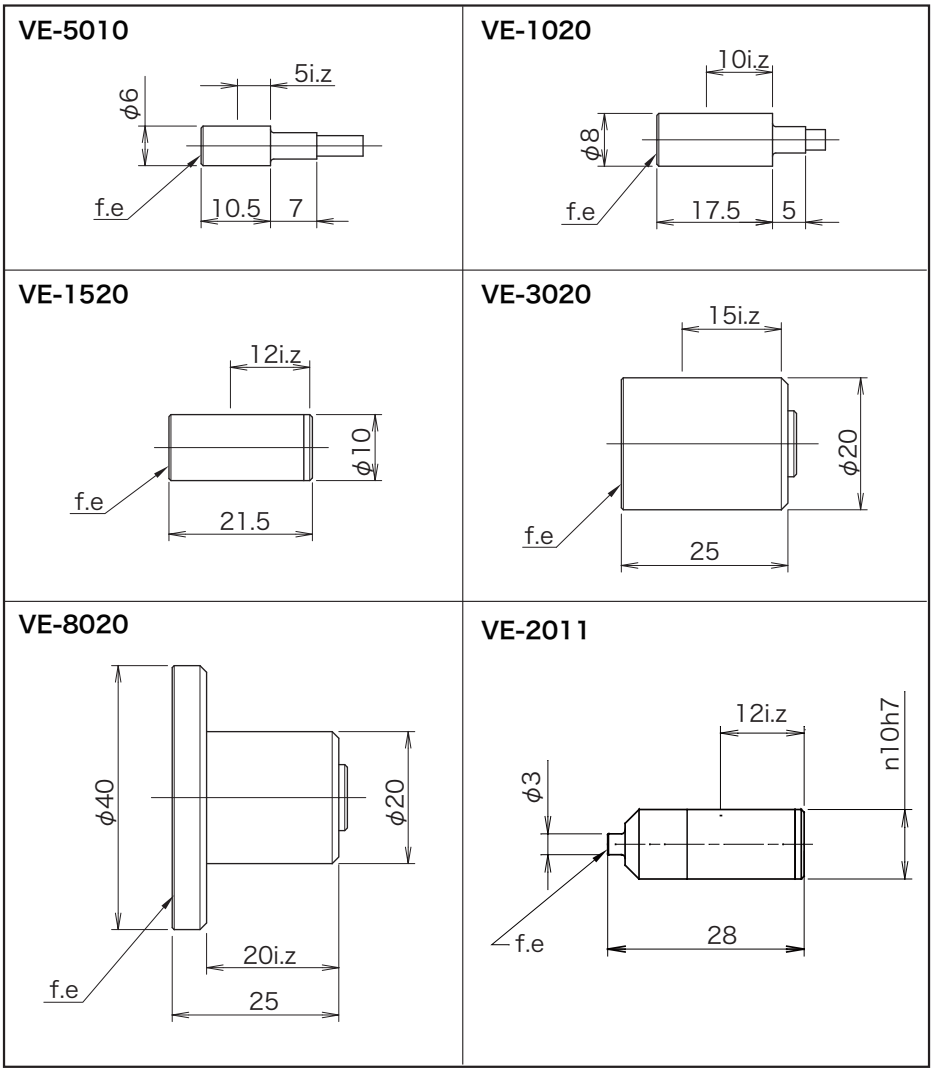
The VE sensor has comparatively large outside dimensions to ensure accuracy.

Therefore, consider whether it can be attached in advance.

In particular, take into consideration spaces for the cable connector and the cable. For details, refer to ″VE Series VE Sensor Outside Dimensions″ on page 24.

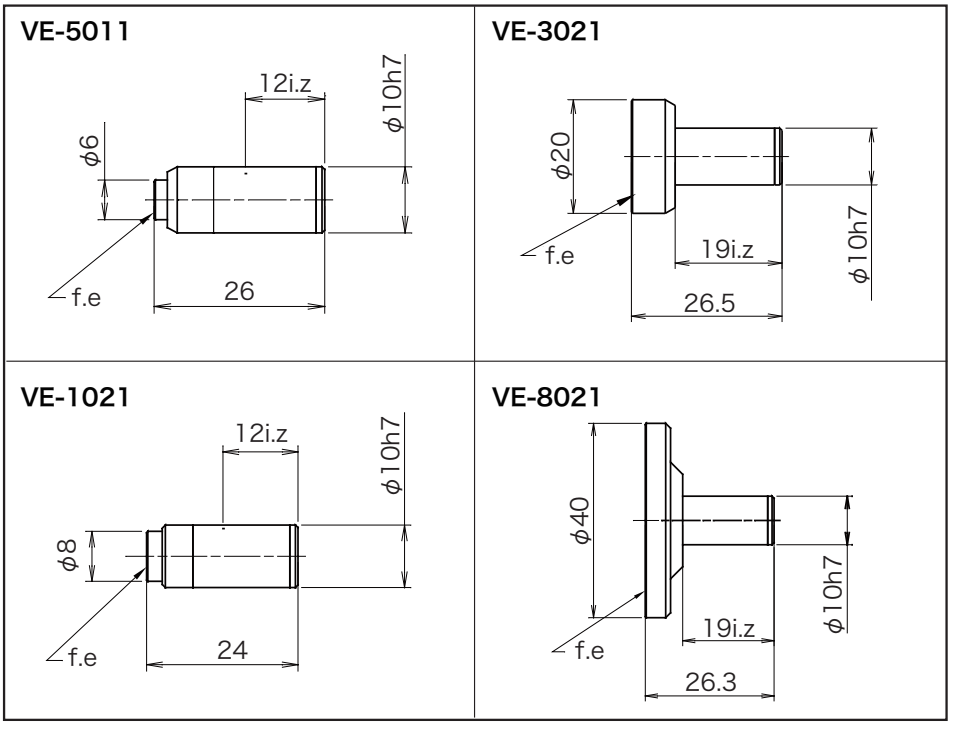
4.3 VE Series VE Sensor Outside Dimensions

- The electrode surface of the VE sensor must be maintained in parallel with the object under measurement and firmly fixed so that it may not be affected by vibration, etc.
- When fixing the VE sensor, be careful not to apply force to portions other than the insertion zone (refer to the Figure below). Other portions are structurally weak and therefore may be damaged by excessive force.
- The outer diameter of the insertion zone of the VE sensor is finished with a fit tolerance of h7. Therefore, it is appropriate to finish the hole diameter for the mount fitting of the VE sensor with a fit tolerance of G7. The minimum bending radius of the cable is R10.



f.e: An abbreviation of face end which indicates the sensor end face.

i.z: An abbreviation of insertion zone. When fixing a sensor, hold it within the range of the insertion zone.



f.e: An abbreviation of face end which indicates the sensor end face.

i.z: An abbreviation of insertion zone. When fixing a sensor, hold it within the range of the insertion zone.

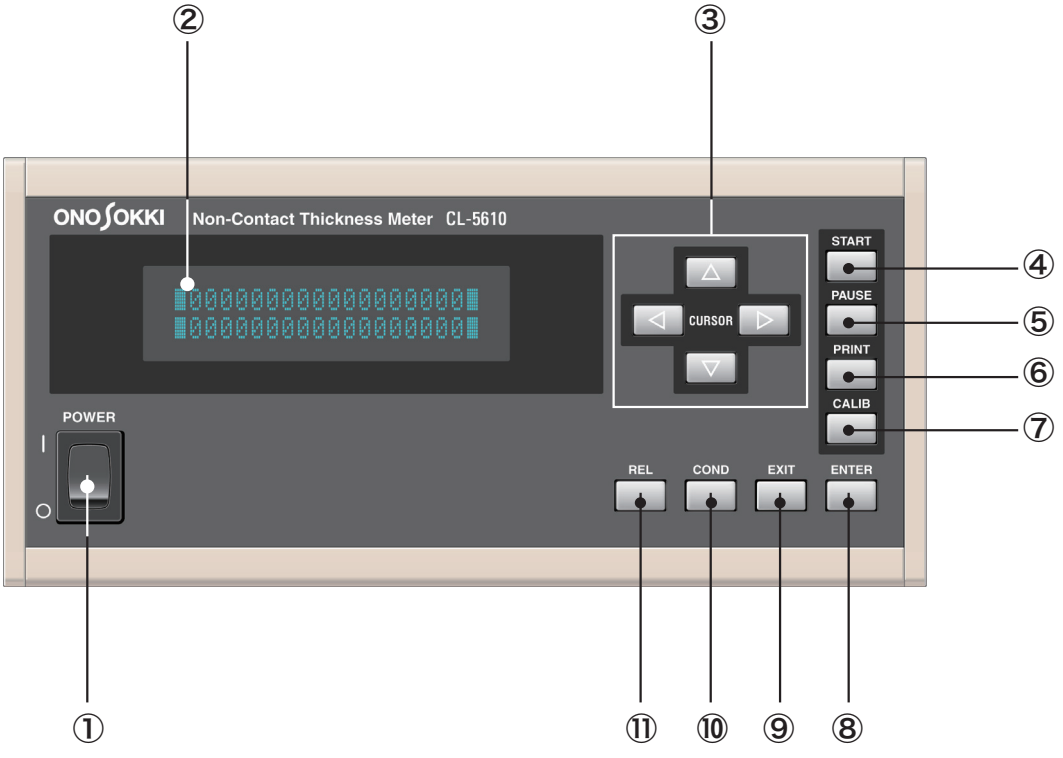
Chapter 2

Basics of CL-5610/5610S

1. Name and Function of Each Section

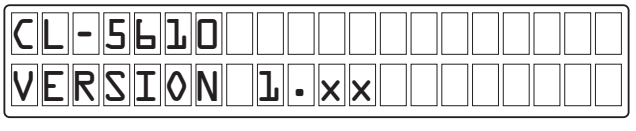
The following describes name and function of each section of the front and rear panels of the CL-5610/5610S Non-Contact Thickness Meter.

1.1 Name and Function of Each Section on Front Panel



① Power switch (POWER)

Turns the power ON or OFF.
When the power is turned ON, the software version information of the CL-5610/5610S Non-Contact Thickness Meter appears on the display.
If an option is added, the model name of the added option appears as follows:



② Display

Displays measurement results, and options and settings in the setup mode.

③ Cursor keys(△◁▷▽)

These cursor keys are used to select a setup item and enter a numeric value in the setup mode.

[◁] [▷]	• Pressed to select an item. • Moves the digit when pressed during numerical setup.
[△] [▽]	• When the DUAL display type is selected, pressing the [△] key in the measurement and calculation mode displays the details on the display item of DISP1 in the bottom row. • - When the DUAL display type is selected, pressing the [▽] key in the measurement and calculation mode displays the details on the display item of DISP2 in the top row.

④ START Key

Pressing the [START] key activates the calculation mode.

The LED lights up in the calculation mode and blinks in the calculation suspend mode.

Pressing the [START] key again in the calculation mode terminates the calculation mode.

⑤ PAUSE Key

Pressing the [PAUSE] key in the calculation mode pauses the calculation mode.

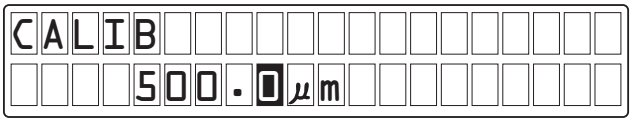
Pressing the [PAUSE] key again in the calculation mode restarts the calculation mode.

⑥ PRINT Key

Pressing the [PRINT] key prints out measurement data on a printer connected to the RS-232C connector.

⑦ CALIB Key

Pressing the [CALIB] key in the measurement mode selects the calibration mode for setting a reference thickness.



⑧ ENTER Key

Applies various setups and input values.

If a warning or error occurs, pressing the [ENTER] key displays details of the warning or error.

⑨ EXIT Key

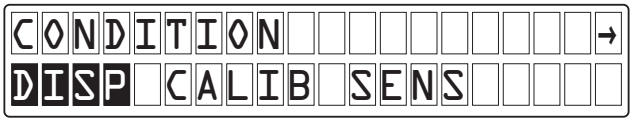
Cancels various setups and input values.

Pressing this key in the setup mode returns the previous setup mode.

⑩ COND key: Function key

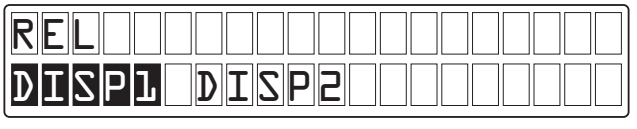
Pressing the [COND] key in the measurement mode selects the setup mode for setting display and measurement conditions, etc.

Pressing the [COND] key again in the setup mode for setting display and measurement conditions, etc. returns to the measurement mode.



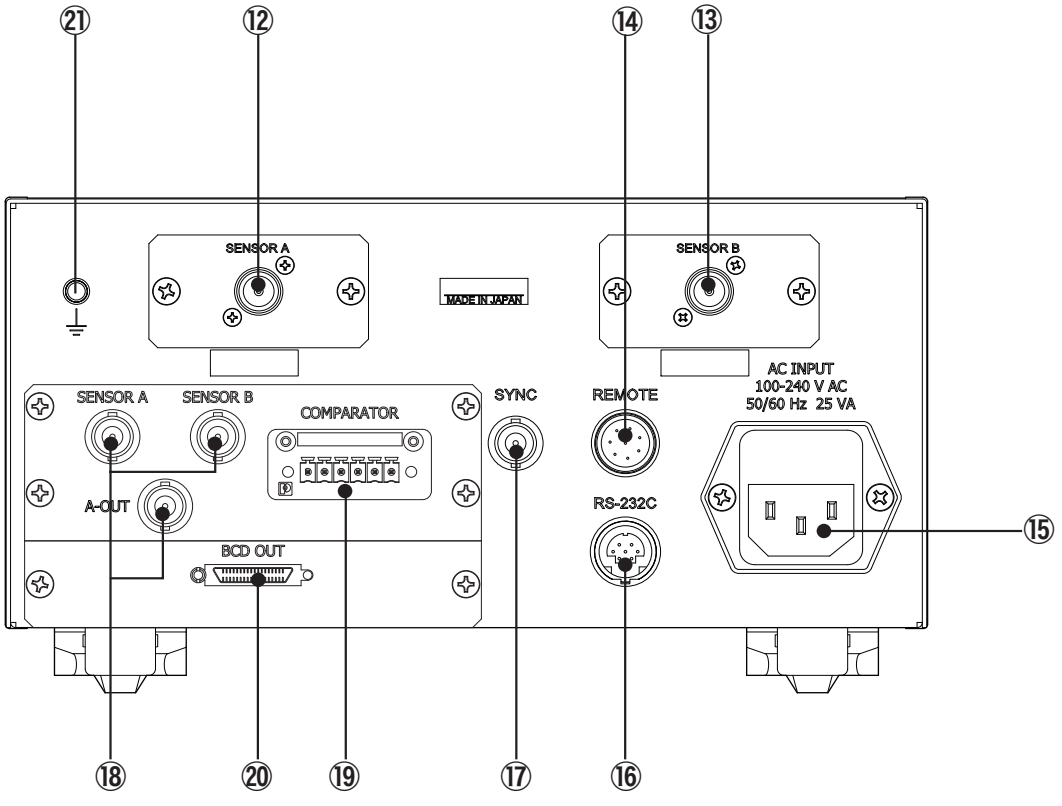
⑪ REL key: Function key

Pressing the [REL] key selects the measurement reference value setup mode in which a deviation is used at the time of calculation.



1.2 Name and Function of Each Section on Rear Panel (CL-5610)

The CL-5610 with the option installed thereon is shown below. The same option can be installed on the CL-5610S.



⑫ SENSOR A

Connect an optional VE sensor to this terminal.

Refer to "Sensors" on page 22.

⑬ SENSOR B

Connect an optional VE sensor to this terminal.

Refer to "Sensors" on page 22.

⑭ REMOTE

Used for remote operation contact input from external.

Applicable connector: R03-PB8M (Tajimi Electronics)

⑮ AC inlet

Inputs the 100 to 240 VAC power. Also functions as a fuse.

CAUTION !

- **Make sure to use the power cable and plug that are specified or supplied with the product.**
- **When using the product at over 125 VAC, be sure to use the specified power cable provided as an optional item. (For the details, contact the nearest Ono Sokki sales office or the distributor where you purchased the product.)**

⑯ RS-232C

Used for RS-232C communication. Allows condition setup and data collection from a personal computer via RS-232C communication.

When a printer is connected to the RS-232C connector, pressing the [PRINT] key prints out measurement data.

Applicable connector: HR212-10P8PSAT3042 (Hirose Electric)

⑰ SYNC

Used to measure the same single test piece using multiple CL-5610/5610S units. Applicable connector: C02 type (BNC)

⑱ ANALOG OUT

The ANALOG OUT terminal is an option.

When an option is installed, this terminal outputs an analog voltage of A-OUT or Sensor A or B. Applicable connector: C02 type (BNC)

⑲ COMPRATOR

The COMPRATOR terminal is an optional terminal used to output a result of comparison in contact output form (Photo-Mos output).

⑳ BCD OUT

The BCD OUT terminal is an optional terminal used to output any measurement value in the BCD format.

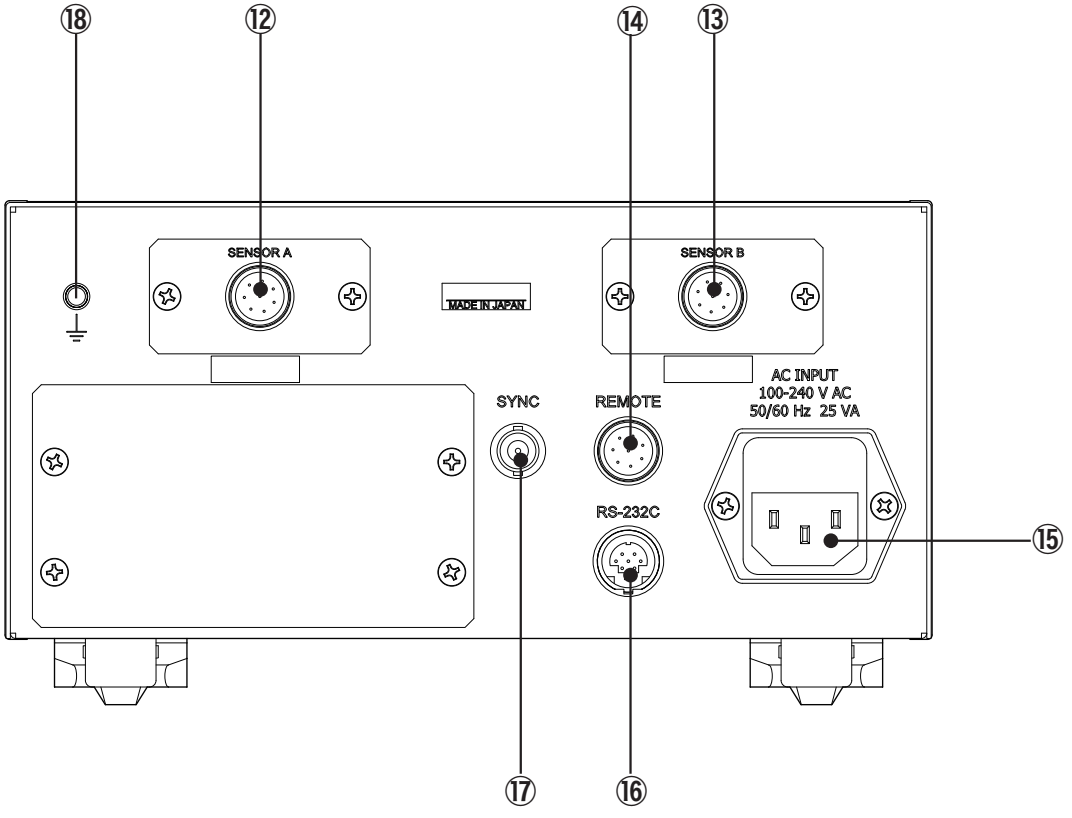
The applicable connector is HDRA-E36MA (HONDA TSUSHIN KOGYO).

㉑ Ground terminal

Used to set the object under measurement to the same electrical potential as the CL-5610/5610S.

1.3 Name and Function of Each Section on Rear Panel (CL-5610S)

The CL-5610S without the option is shown below. The same option can be installed on the CL-5610.



⑫ SENSOR A

Used to connect the CL-0420 conversion unit.

⑬ SENSOR B

Used to connect the CL-0420 conversion unit.

⑭ REMOTE

Used for remote operation contact input from external.

Applicable connector: R03-PB8M (Tajimi Electronics)

⑮ AC inlet

Inputs the 100 to 240 VAC power. Also functions as a fuse.

CAUTION !

- **Make sure to use the power cable and plug that are specified or supplied with the product.**
- **When using the product at over 125 VAC, be sure to use the specified power cable provided as an optional item. (For the details, contact the nearest Ono Sokki sales office or the distributor where you purchased the product.)**

⑯ RS-232C

Used for RS-232C communication.

Used for RS-232C communication. Allows condition setup and data collection from a personal computer via RS-232C communication.

When a printer is connected to the RS-232C connector, pressing the [PRINT] key prints out measurement data.

Applicable connector: HR212-10P8PSAT3042 (Hirose Electric)

⑰ SYNC

Used to measure the same single test piece using multiple CL-5610/5610S units.

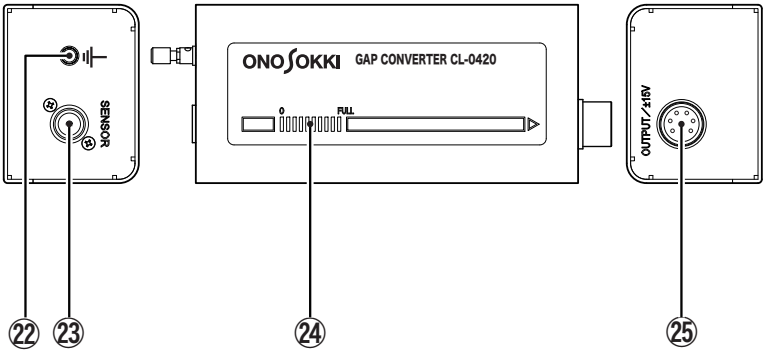
Applicable connector: C02 type (BNC)

⑱ Ground terminal

Used to set the object under measurement to the same electrical potential as the CL-5610/5610S.

1.4 Name and Function of Each Section of CL-0420

The CL-0420 is a gap converter amplifier dedicated for the CL-5610S.



㉒ Ground terminal

Used to set the object under measurement to the same electrical potential as the CL-0420.

For example, if the external case of the VE sensor and the surface under measurement cannot be set to the same electrical potential, connect the ground terminal and the object under measurement with a copper wire, etc. to set them to the same electrical potential.

CAUTION !

*** A potential difference or resistance between the converter and the object under measurement may cause an error or noise.**

㉓ VE sensor connection terminal (SENSOR)

Used to connect the optional VE sensor.

When using a directly connected cable of the VE sensor:
Connect a cable to the SENSOR connector on the CL-0420 rear panel.
This connector allows one-touch operation. To connect a cable, push it until it clicks into place.
To disconnect a cable, hold the connector and then pull it out. Do not hold the cable when pulling out.

When using a VE sensor cable (VL-1520):
First, connect either end of the cable to the SENSOR connector on the CL-0420 rear panel.
Then, connect the other end of the cable to the connector of the VE sensor.
This connector allows one-touch operation. To connect a cable, push it until it clicks into place.
To disconnect a cable, hold the connector and then pull it out. Do not hold the cable when pulling out.

㉔ LED meter

Monitors measurement values.

When the LED lights up in proportion to the gap and then a measurement value agrees with the rated measurement gap of the VE sensor, the LED on the FULL side lights up.

㉕ Signal output/power supply terminal (OUTPUT/ ± 15V)

Connect this terminal with the CL-5610/5610S.

Used for DC power (± 15V) supply and signal output. Outputs a voltage proportional to the gap.

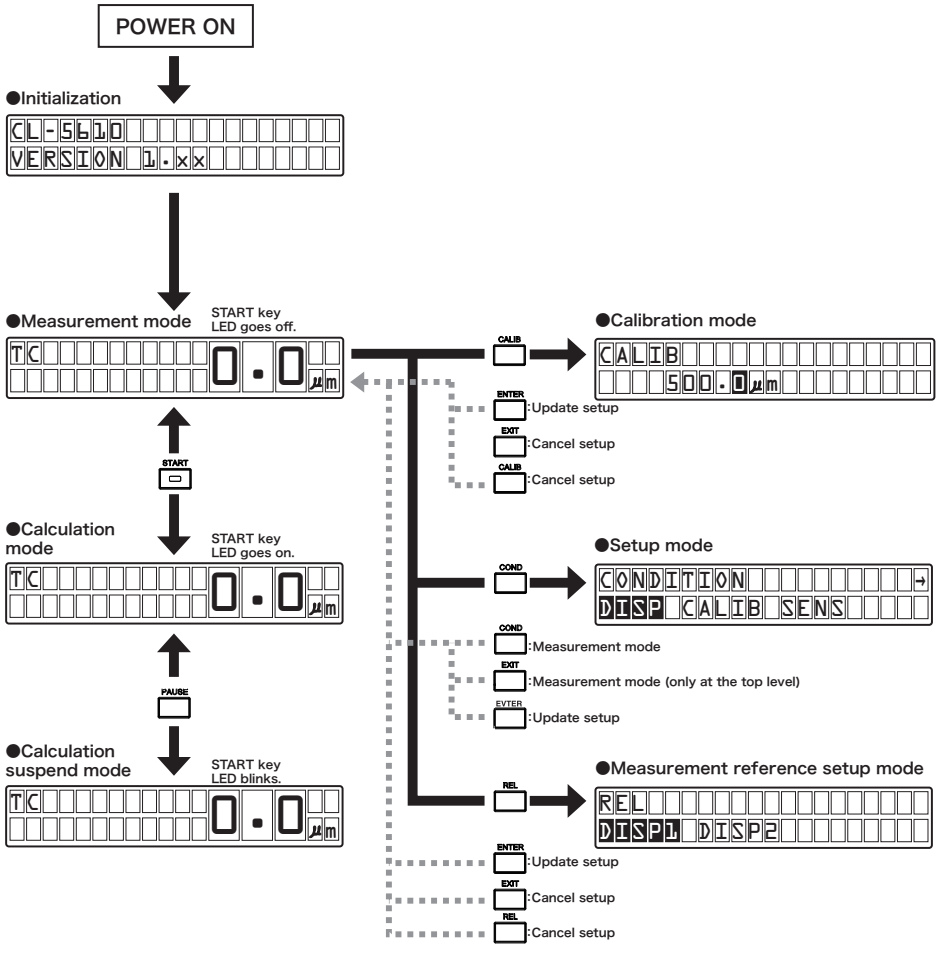
Connect an indicator, recorder, or peripheral device that suits the operating conditions.

2. Overview and Operations of Command Keys and Function Keys

The CL-5610/5610S is provided with two different types of keys: command keys ([START], [PAUSE], and [PRINT]) and function keys ([CALIB], [REL], and [COND]).

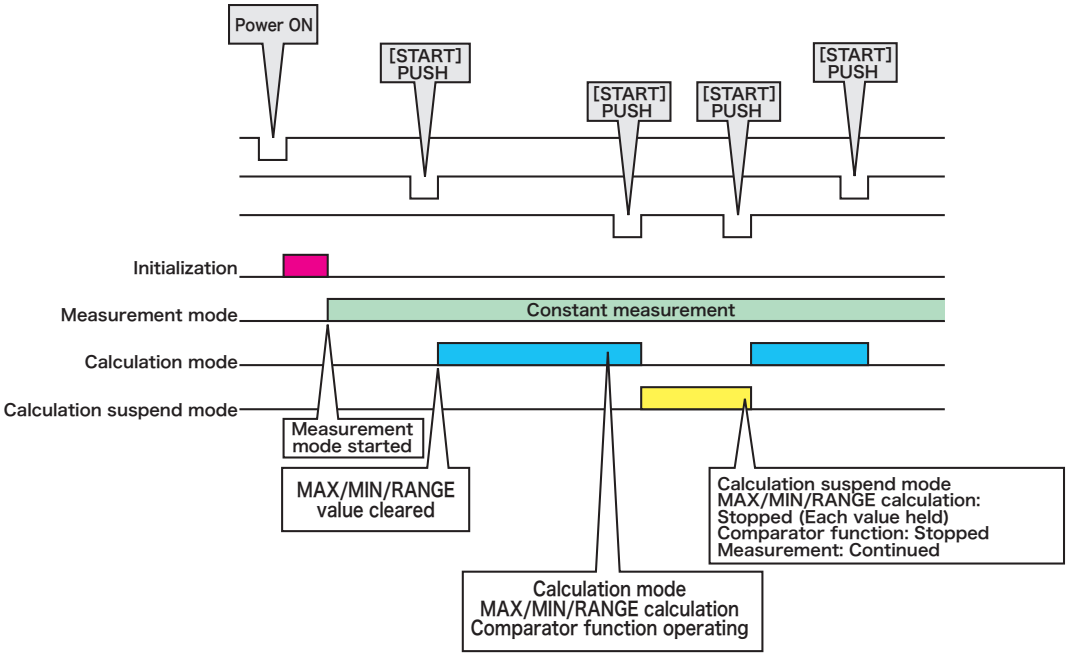
2.1 Keys and Modes

The following shows a state transition diagram of keys.



2.2 Command Keys and Mode Transition Timing

The following shows a mode transition timing chart related to command keys.



Mode	Description
Measurement mode	After turning ON the power and then completing initialization, the measurement mode is entered. • Updates measurement data for each sampling.
Calibration mode	A gap between sensors is calibrated using a reference piece of object under measurement. • In thickness measurement, setup of a gap between sensors is required.
Setup mode	Various conditions of display, measurement conditions, and sensor conditions are set.
Calculation mode	Enables the MAX/MIN/RANGE/comparator function.
Calculation suspend mode	Suspends the calculation mode. • When the calculation mode is suspended, the value before suspension is retained.
Measurement reference setup mode	Data to be used as a reference for calculation of deviation is set.

2.3 Setting Various Conditions

In any mode activated by a key, you can select items and change numeric values using the cursor keys (△ ◁ ▷ ▽).

Changed items and numeric values can be applied with the [ENTER] key or canceled with the [EXIT] key.

The following explains basic condition setup procedures exemplifying thickness setup for a reference piece (conductor) of object under measurement to be used during calibration in conductor measurement.

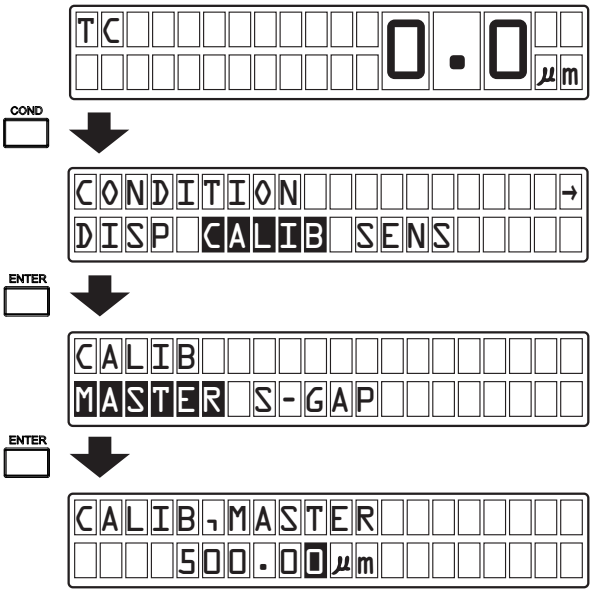
1. Display the calibration reference piece thickness setup screen.

First, press the [COND] key (function key) to select the setup mode.

Then, press the [◁] and [▷] cursor keys to select item [CALIB] (highlighted), and then press the [ENTER] key to select the calibration screen.

Subsequently, in the calibration screen, press the [◁] and [▷] cursor keys to select item [MASTER] (highlighted), and then press the [ENTER] key to select the numeric value setup screen for reference piece of object under measurement.

If a wrong screen is selected, press the [EXIT] key to return to the previous screen.

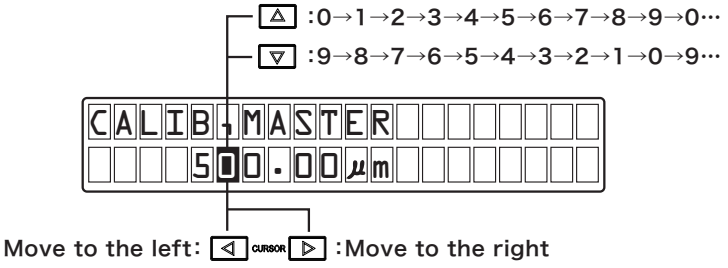


2. Set the thickness (500.00 μm) of the reference piece of object under measurement.

Press the [◁] and [▷] cursor keys to select a target digit (highlighted).
When you press the [◁] cursor key, the selection cursor moves to the left.
When you press the [▷] cursor key, it moves to the right.

When you press the [▷] cursor key with the selection cursor positioned at the right end, the selection cursor moves to the left end of the numeric display that has changed to [000500.00].
Press the [△] and [▽] cursor keys to change the numeric value.

When you press the [△] cursor key, the numeric value changes as 0->1->2->3->4->5->6->7->8->9->0. When you press the [▽] cursor key, the numeric value changes as 9->8->7->6->5->4->3->2->1->0->9.



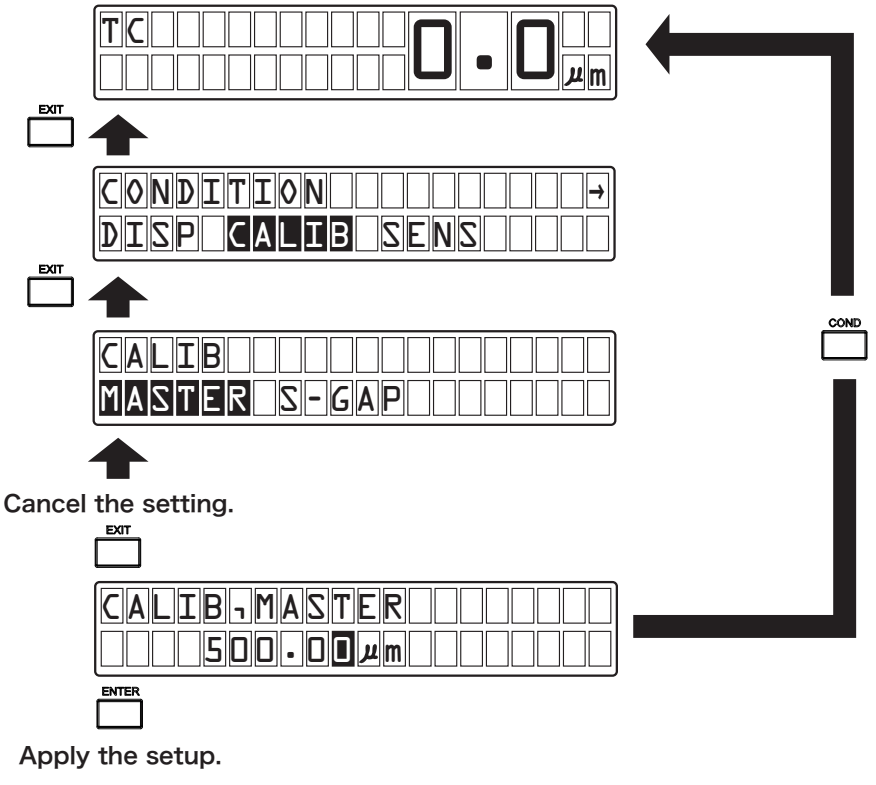
3. **Apply the changed setup.**

Upon completion of setup, press the [ENTER] key to apply the specified numeric value.

Then, press the [COND] key to return to the normal measurement mode.

If you press the [COND] key without pressing the [ENTER] key, the set numeric value is canceled and then the normal measurement mode resumes.

If you press the [EXIT] key without pressing the [ENTER] key, the set numeric value is canceled and then the previous screen resumes.



3. Measurement Procedures

The following describes basic measurement procedures by the CL-5610/5610S Non-Contact Thickness Meter.

3.1 Basic Measurement Procedures

Basic measurement procedures by the CL-5610/5610S Non-Contact Thickness Meter are shown below.

Step 1 Installing the VE sensor

Install the VE sensor with correct procedures and methods.

Refer to: 3.2, "Installing a VE Sensor"

Step 2 Preparing the CL-5610.

Connect the VE sensor and other necessary peripheral devices to the CL-5610 and turn the power ON.

Refer to: 3.3, "Setting Up the CL-5610/5610S"

Step 3 Set various conditions (parameters).

Set display and measurement conditions, VE sensor type, and other conditions.

Refer to: 3.4, "Setting Various Conditions (Parameters)"

Step 4 Perform calibration (for thickness measurement).

Perform calibration for thickness measurement.

Refer to: 3.5, "Calibration Procedures for Thickness Measurement"

Step 5 Perform measurement.

Measurement types include "Thickness measurement", "Gap measurement", nd "Deviation from the reference value."

Refer to: 3.6, "Performing Measurement"

3.2 Installing the VE Sensor

The following explains procedures for installing the VE sensor.

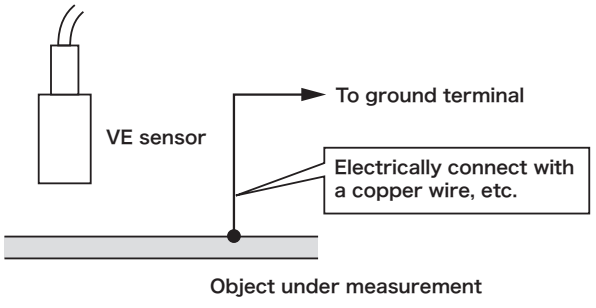
For details on VE sensors, refer to "Sensors" on page 22.

3.2.1 Handling the VE Sensor

When the VE sensor is attached or used, observe the following points:

Observe the following precautions before attaching the VE sensor.

- Since the VE sensor handles a minute capacity, the electrode surface has precisely been polished. Be careful not to damage the electrode surface.
- An oil film or dust adhering to the VE sensor may cause an error. Always keep the electrode surface clean.
- Glass is used as the insulating material in the VE sensor. Therefore, applying excessive force or shock to the VE sensor may cause damage to it.
- Make arrangements so that the outer case of the VE sensor is set to the same electrical potential as the surface under measurement.
  If the same potential cannot be maintained, a measurement error may occur. If necessary, connect the VE sensor case or ground terminal and the object under measurement with a copper wire or the like, as shown below.



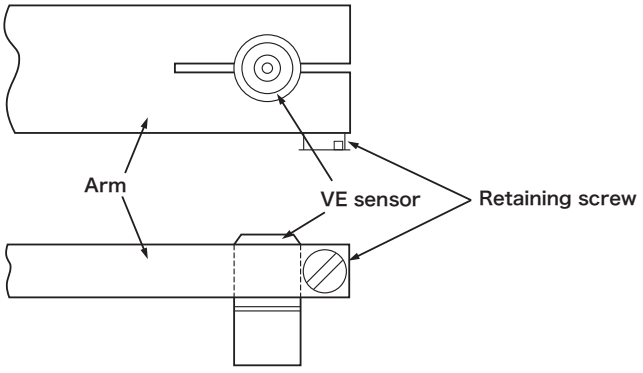
There are the following two different exemplary methods for fixing the VE sensor. Select either fixing method that best suits your measurement purpose and application.

■ Fixing to a grip arm

Maintaining the electrode surface of the VE sensor in parallel with the object under measurement, firmly fix the VE sensor so that it may not be affected by vibration, etc. Therefore, Ono Sokki recommends the use of a grip arm for fixing the VE sensor.

When using the grip arm, a crack is made at the end of the arm, and the VE sensor is inserted into it and fastened with a screw, as shown below.

This method is ideal because the height of VE sensor can be easily adjusted and there is little influence on the VE sensor itself.



■ Fixing the VE sensor semipermanently

When fixing the VE sensor semiparmanently, Ono Sokki recommends the use of the SCE300 type clamp element from SANKI Co., Ltd.

For details on the SCE300 type clamp element, contact SANKI Co., Ltd. (8-122, Kiba-cho, Minato-ku, Nagoya City, Japan).

CAUTION !

- **Ono Sokki does not recommend the use of a set-screw because fastening it too much may cause damage to the VE sensor and deformation, making it difficult to remove.**
  Further, the deformation of the VE sensor caused by a set-screw may cause failure or malfunction.

3.2.2 Installing the VE sensor in Conductor Measurement

The following explains procedures for installing the VE sensor at the time of conductor measurement.

■ Installing a VE sensor in conductor measurement

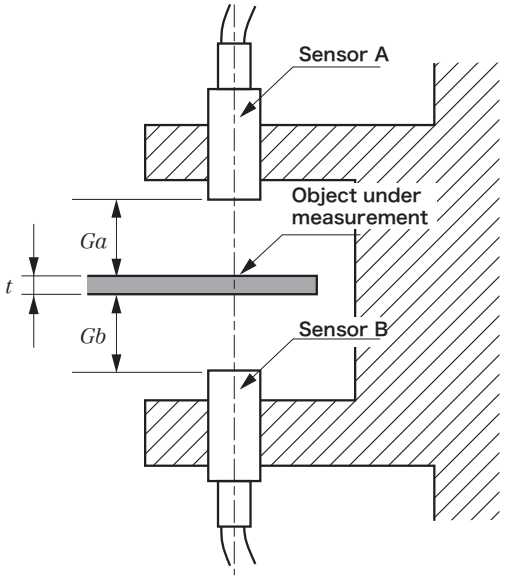
At the time of conductor measurement, install a VE sensor as shown below.

For details on the measurement principle, refer to "Principle of Conductor Measurement" on page 20.

● Notes on installing the VE sensor in conductor measurement

Before installing the VE sensor at the time of conductor measurement, confirm the following notes:

- Attach the VE sensor so that it becomes in parallel with the object under measurement.
- Attach Sensors A and B so that they oppose each other.
- Align the centerlines of Sensors A and B.
- Select an arm having a sufficient rigidity, to which a sensor is to be attached.
- Install a sensor attachment section made of metal so that the object under measurement and the sensor attachment section (sensor case) is set to the same electrical potential.
- Fix the gap between sensors under measurement so that the distance therebetween (Ga/Gb in the figure) does not exceed the measuring range of the sensor regardless of the position of the object under measurement within the gap.
- Hold the object under measurement so that the surface under measurement becomes perpendicular to the centerline of the sensor. The inclination of the object under measurement may cause an error.
- Position the object under measurement approximately at the center of the gap between the two sensors (Ga ≒ Gb).



■ Confirming the installation position of each sensor in conductor measurement

To confirm the installation position of each sensor, it is necessary to check the gap value of each sensor after operating the CL-5610/5610S Non-Contact Thickness Meter.

First, perform the procedures described in "Setting Up the CL-5610/5610S" on page 46 and "Setting Various Conditions (Parameters)" on page 47.

Then, put an object under measurement which is the thinnest.

Finally, fine-adjust the installation position of each sensor so that its gap value is within the measuring range.

If the position of the object under measurement fluctuates, check the position also within the fluctuation range.

3.2.3 Installing a VE sensor in Insulator Measurement.

The following explains procedures for installing a VE sensor at the time of insulator measurement.

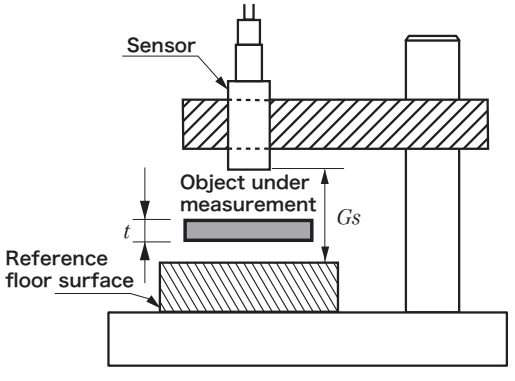
■ Installing a VE sensor in insulator measurement

At the time of insulator measurement, install a VE sensor as shown below.

For details on the measurement principle, refer to "Principle of Insulator Measurement" on page 21.

● Notes on installing a VE sensor in insulator measurement

- Attach the VE sensor so that it faces the metal reference floor.
- Select an arm having a sufficient rigidity, to which the sensor is to be attached.
- The sensor attachment section (sensor case) must be made of metal. Install the sensor attachment section so that the reference floor and sensor attachment section are set to the same electrical potential.
- Attach the sensor so that the gap between the sensor end face and the reference surface (Ga: when Sensor A is used) is within the rated range of the sensor.
- The thickness of the object under measurement, t, must be thinner than Ga. Ono Sokki recommends that t is smaller than 1/3 Ga.
- Attach the sensor so that the sensor end face is in parallel with the reference floor surface. Inclined reference surface may cause an error.



■ Checking the sensor installation position in insulator measurement

To confirm the installation position of each sensor, it is necessary to check the gap value of each sensor after operating the CL-5610/5610S Non-Contact Thickness Meter.

First, perform the procedures described in "Setting Up the CL-5610/5610S" on page 46 and "Setting Various Conditions (Parameters)" on page 47.

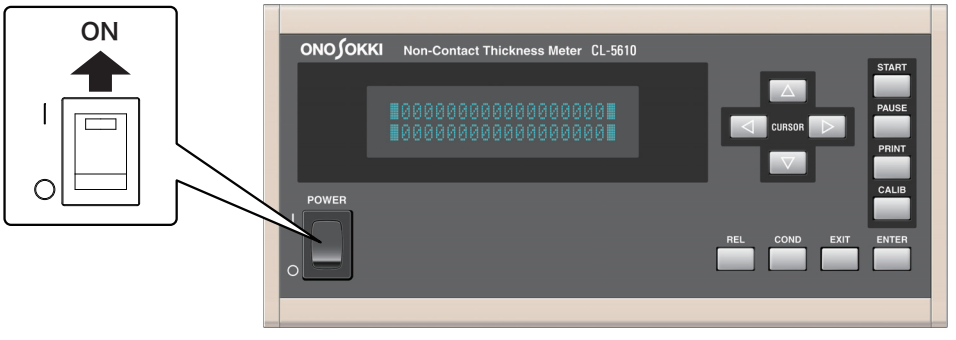
Then, display the gap value of the sensor and fine-adjust the sensor installation position so that the gap between the reference floor and the sensor is within the measuring range.

3.3 Setting Up the CL-5610/5610S

First, connect the VE sensor and other necessary peripheral devices to the CL-5610/5610S Non-Contact Thickness Meter.

Refer to "Sensors" on page 22. Refer to "CL-5610/5610S System Configuration" on page 18.

Then, turn ON the power switch (POWER) of the CL-5610/5610S Non-Contact Thickness Meter.



3.4 Setting Various Conditions (Parameters)

Set display and measurement conditions, VE sensor type, and other conditions.

For detailed setup of various conditions,refer to "Setting Various Conditions" on page 59.

3.4.1 Selecting a Sensor

First, press the [COND] key to select the setup mode.

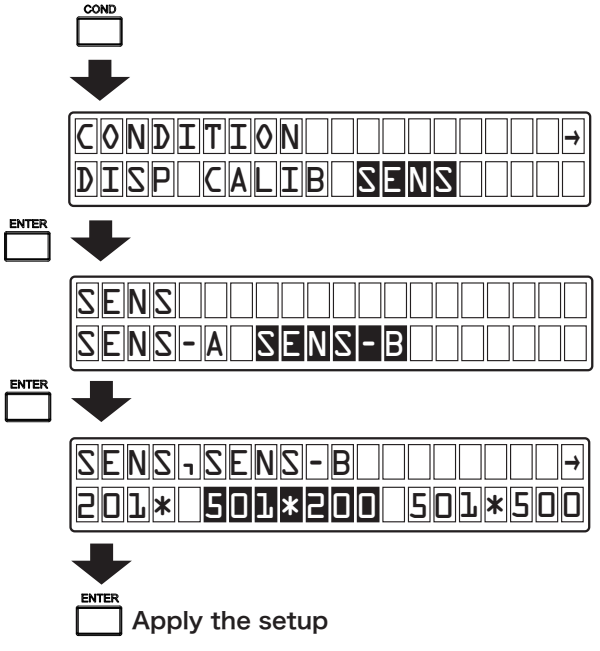
Then, select [SENS-A] or [SENS-B] as the sensor channel to be selected. In the following example, [SENSB] is selected.

To set conditions of the sensor connected to the SENSOR-A terminal on the rear panel of the CL-5610/5610S Non-Contact Thickness Meter, select [SENS-A] and then press the [ENTER] key.

Pre-corrected sensors are registered to corrective sensors [E1] to [E6]. Here, select a corrective sensor having the same model name and serial number as the sensor connected.

CAUTION !

*** Corrective sensors cannot be used commonly for [SENS-A] and [SENS-B].**
For example, the correction value of the sensor connected to the SENSOR-A terminal and calibrated cannot be used for the SENSOR-B terminal. Therefore, even if you select [SENSB], the list is not displayed.



3.4.2 Setting Up the Display

With the CL-5610/5610S Non-Contact Thickness Meter, you can select the SINGLE (1-line) or DUAL (2-line) display type as well as display items according to your application and purpose (refer to "Display Conditions Setup: DISP" on page 73).

■ Selecting the display type

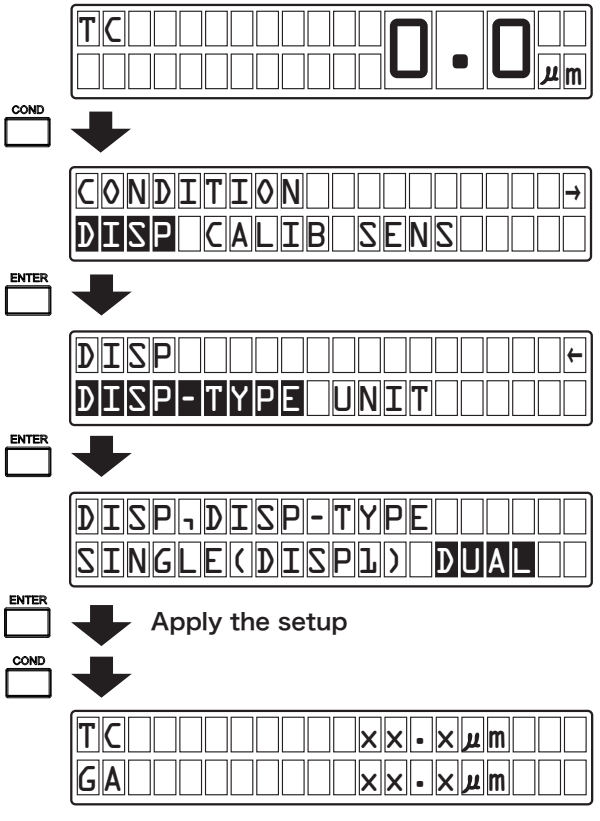
The following example shows procedures for selecting the DUAL display type.

First, press the [COND] key to select the setup mode.

Then, select items [DISP] and [DISP-TYPE] in this order to change the screen.

Finally, select [DUAL] and then press the [ENTER] key to select the DUAL display type.

Then, press the [COND] key to return to the measurement mode.



■ Selecting a display item

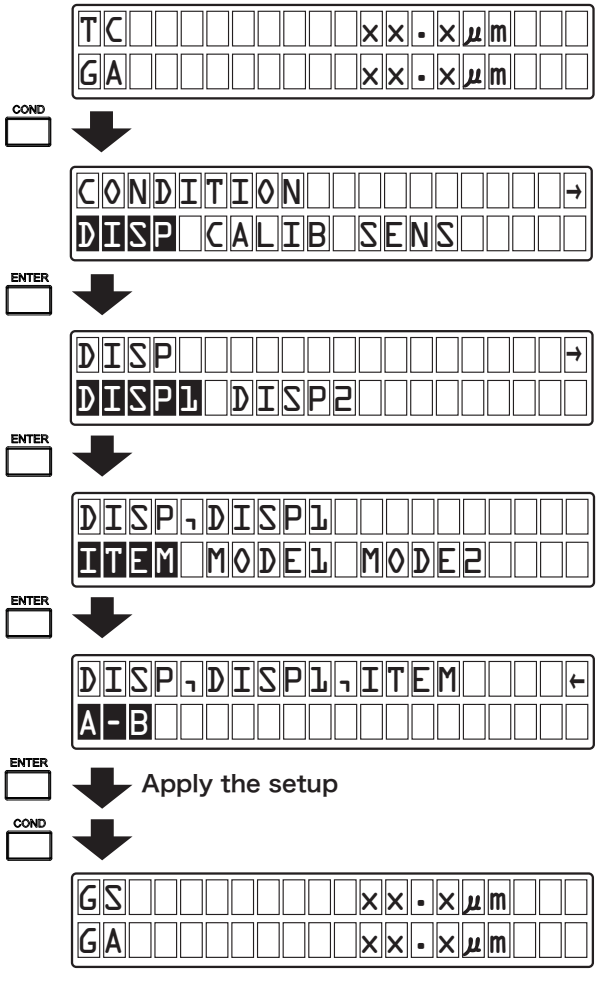
The following example shows procedures for selecting A–B for displaying the difference between Sensor A and Sensor B.

First, press the [COND] key to select the setup mode.

Then, select items [DISP], [DISP1], and [ITEM] in this order to change the screen.

Finally, select [A–B] and then press the [ENTER] key to select display item A–B.

Then, press the [COND] key to return to the measurement mode.



3.5 Calibration Procedures for Thickness Measurement

The following describes calibration procedures in each of conductor measurement and insulator measurement.

■ Calibration procedures in conductor measurement (when using a reference piece of object under measurement)

With the CL-5610/5610S Non-Contact Thickness Meter, you need to set a gap between sensors (Gs) before performing conductor thickness measurement. There are the following two different setup procedures:

- When the gap between sensors (Gs) is known:
  Directly set the gap between sensors (Gs). For setup procedures and detailed conditions, refer to "Setting Various Conditions" on page 59.
- Using a reference piece of object under measurement:
  Set the gap between sensors (Gs) through calculation using a reference piece of object under measurement as a reference thickness.

● Setup for using the reference piece of object under measurement

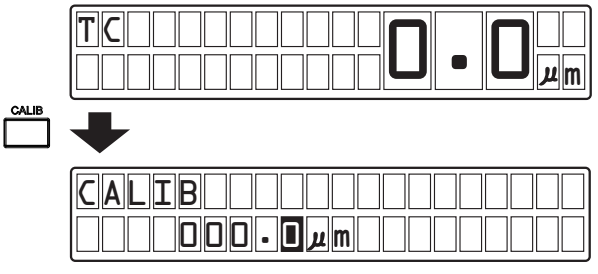
The following explains procedures for specifying the use of the reference piece of object under measurement.

Before performing calibration, prepare a reference piece of object under measurement having a known thickness (preferably, a thickness as close to that of the object under measurement as possible).

1. Select the calibration mode.

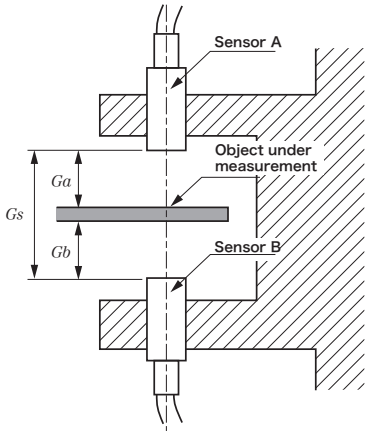
After making sure that the CL-5610/5610S is in the measurement mode, press the [CALIB] key (function key) to select the calibration mode.

In this case, the thickness of the reference piece of the object under measurement used in the last calibration and then registered is displayed.



2. Insert the reference piece of object under measurement between Sensors A and B.

When inserting the reference piece, be careful that the gap between the sensor and the reference piece of object under measurement (Ga/Gb) does not exceed the measuring range of the sensors.

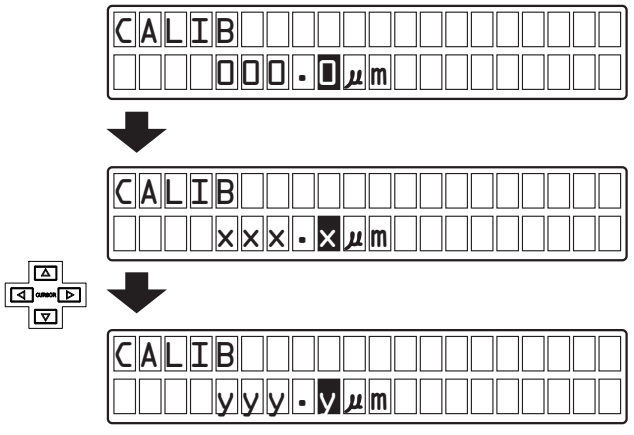


3. **Change the thickness of the reference piece of object under measurement.**

When changing the registered thickness of the reference piece of object under measurement currently displayed, use the cursor keys.

Press the [◁] and [▷] cursor keys to select the target digit of the numeric value (highlighted).
Press the [△] and [▽] cursor keys to change the numeric value.

Since the unit (μm) and decimal point (.) cannot be changed, the selection cursor cannot be moved thereto.



To leave the setting unchanged, proceed with the next step (Step 4).

4. **Apply the thickness of the reference piece of object under measurement.**

Press the [ENTER] key to apply the current measurement value of the reference piece of object under measurement as the thickness of the reference piece of object under measurement currently displayed.

To cancel the setup, press the [EXIT] key.

■ Calibration procedures in insulator measurement (when using a reference piece of object under measurement)

With the CL-5610/5610S Non-Contact Thickness Meter, in order to measure the thickness of an insulator, you need to first set gap Ga (or Gb) between the VE sensor and the reference floor and then the relative permitivity εA (or εB) of the object under measurement.

● Setting the gap between the VE sensor and the reference floor

Set Ga (or Gb) with either of the following two setup procedures:

- Setting gap Ga (or Gb) through measurement:
  Measure and set the distance between the sensor and the reference floor without inserting the object under measurement.
- When Ga (or Gb) is known:
  Set a value directly in the setup mode. For setup procedures and detailed conditions, refer to "Setting Various Conditions" on page 59.

● Measuring and setting Ga (or Gb)

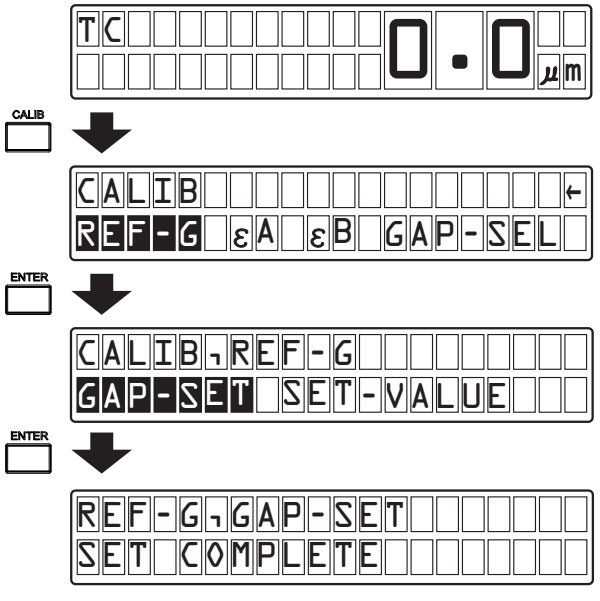
The following explains procedures for measuring and setting Ga (or Gb).

1. **Select the calibration setup screen.**

Make sure that the current mode is the insulator measurement mode with reference to refer to "Setting Conductor and Insulator Conditions" on page 98, and then press the [CALIB] key to select the calibration setup screen.

2. **Display the gap Ga (or Gb) between the VE sensor and the reference floor.**

Here, do not put anything between the sensor and the reference floor.
First, select [REF-G] in the calibration setup screen and then press the [ENTER] key.
When the screen changes, select [GAP-SET] and then press the [ENTER] key. "SET COMPLETE" is displayed for about one second and then the current Ga (or Gb) is applied.



● **Setting the relative permitivity ε A (or ε B)**

Set the relative permitivity ε A (or ε B) with either of the following two different setup procedures:

- Using a reference piece of object under measurement:
  Using the reference piece of object under measurement for reference thickness, calculate relative permitivity ε A (or ε B)
- When relative permitivity ε A (or ε B) is known:
  Set the relative permitivity value directly in the setup mode. For setup procedures and detailed conditions, refer to "Setting Various Conditions" on page 59.

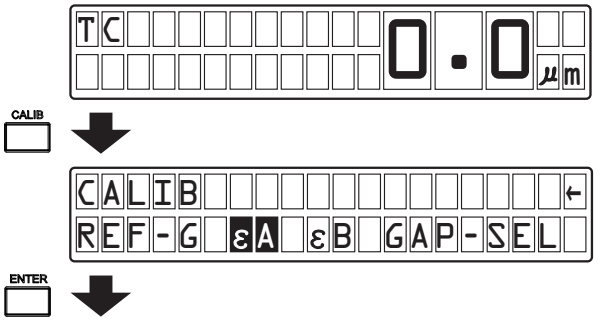
● **Setup for using the reference piece of object under measurement**

The following explains procedures for specifying the use of the reference piece of object under measurement.

Before performing calibration, prepare a reference piece of object under measurement having a known thickness (preferably, a thickness as close to that of the object under measurement as possible).

1. Select the calibration setup screen.

Make sure that the current mode is the insulator measurement mode and then press the [CALIB] key to select the calibration setup screen.



2. Insert the reference piece of object under measurement between Sensor A or B and the reference floor surface.

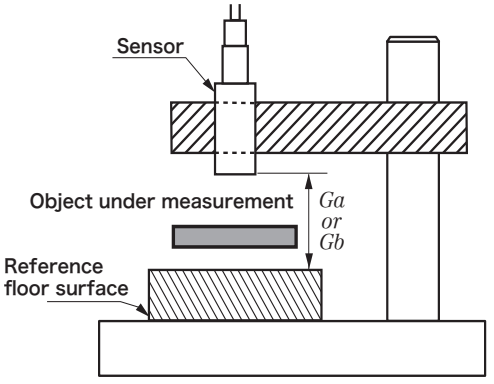
When inserting the reference piece, be careful that the gap between the sensor and the reference piece of object under measurement (Ga/Gb) does not exceed the measuring range of the sensors.

3. Display the reference piece of object under measurement in the calibration mode.

First, select [ε A] (or [ε B]) in the calibration setup screen and then press the [ENTER] key.

Then, when the screen changes, select [MASTER] and then press the [ENTER] key.

Here, the thickness of the current reference piece of object under measurement appears.



4. Apply the thickness of the reference piece of object under measurement.

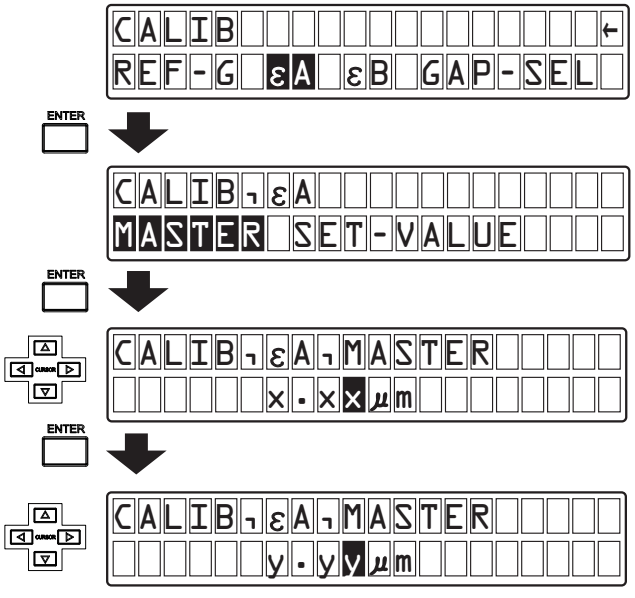
If the currently displayed thickness of the reference piece of object under measurement is left unchanged, press the [ENTER] key to apply the currently displayed thickness of the reference piece of object under measurement.

When changing the currently displayed thickness of the reference piece of object under measurement, use the cursor keys.

Press the [◁] and [▷] cursor keys to select the target digit of the numeric value (highlighted).
Press the [△] and [▽] cursor keys to change the numeric value.

Press the [ENTER] key to apply the currently displayed thickness of the reference piece of object under measurement. To cancel the setting, press the [EXIT] key.

To change the unit (μm or mm), make setting as a separate display condition (refer to "Display Conditions Setup: DISP" on page 73).



3.6 Performing Measurement

The CL-5610/5610S Non-Contact Thickness Meter allows measurement of thickness, gap, and deviation from the reference value.

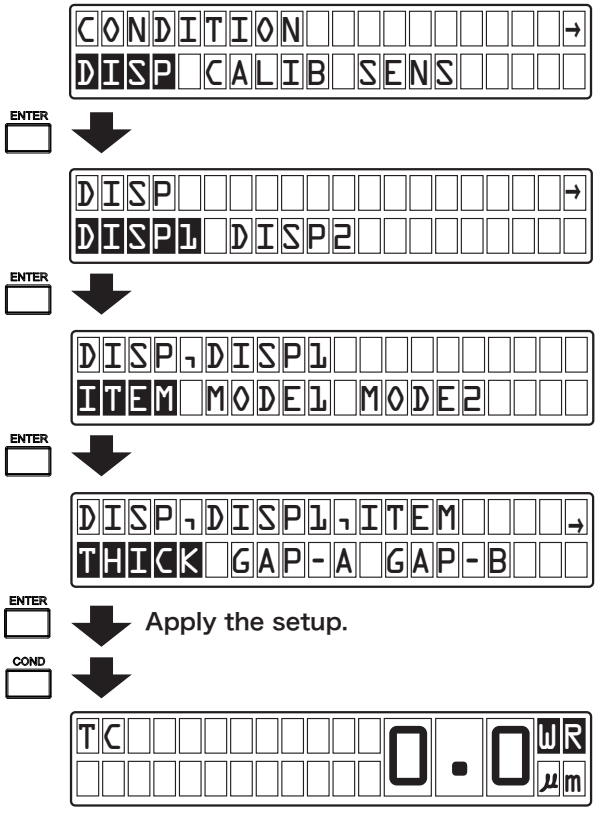
The following explanation is made on the premise that setup for measurement is completed. For details on setup for measurement, refer to "Basic Measurement Procedures" on page 41.

3.6.1 Thickness Measurement Procedures

Thickness measurement can be performed by selecting display item [THICK] in the display setup screen.

■ Setting thickness measurement data display conditions

First, press the [COND] key to select the setup mode.
Then, select items [DISP], [DISP1], and [ITEM] in this order to change the screen.
Finally, select [THICK] and then press the [ENTER] key to select display item THICK (thickness measurement).
Upon completion of setup, when you press the [COND] key to return to the measurement mode and perform measurement, the numeric value of the thickness appears.



3.6.2 Gap Measurement Procedures

Gap measurement can be performed by selecting display item [GAP-A] or [GAP-B] in the display setup screen.

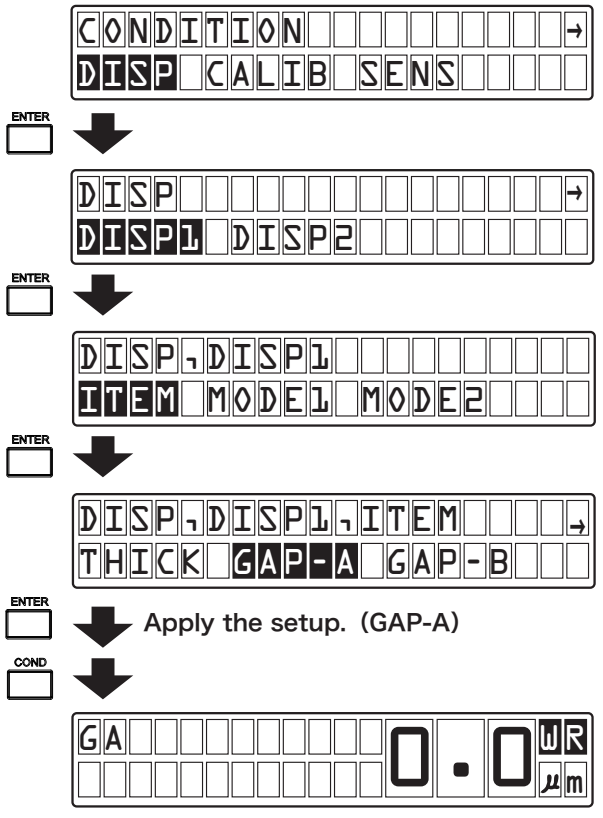
■ Setting gap measurement data display conditions

First, press the [COND] key to select the setup mode.

Then, select items [DISP], [DISP1], and [ITEM] in this order to change the screen.

Finally, select [GAP-A] or [GAP-B] and then press the [ENTER] key to select display item GA or GB (gap measurement).

Upon completion of setup, when you press the [COND] key to return to the measurement mode and perform measurement, the numeric value of the gap appears.



3.6.3 Measuring a Deviation from Reference Value

The CL-5610/5610S Non-Contact Thickness Meter can display the deviation value (difference between a certain reference value and a measurement value).

Deviation value = Measurement value - Measurement reference value

The measurement reference value can be set with either of the following two different setup procedures:

- Set a measurement value or a reference value directly from the [REL] function key.
- Set a value in the setup mode.
  For setup procedures and detailed conditions, refer to "Setting Various Conditions" on page 59.

The following explains procedures for setting the measurement value or reference value directly from the [REL] command key.

■ Setting a measurement reference value

1. **Select the measurement reference value setup screen.**

After making sure that the CL-5610/5610S is in the measurement mode, press the [REL] key to select the measurement reference value setup mode.

Then, select DISP1 (top display value for dual-screen display setup) or DISP2 (bottom display value for dual-screen setup).

In the following example, DISP1 is selected.

When the display item of DISP2 is set to [COMP], DISP2 cannot be selected.

2. **Select reference value setup to a measurement value or direct input.**

To set the current measurement value as a reference value, select [ABS] and then press the [ENTER] key.

To directly enter a reference value, select [SET-VALUE] and then press the [ENTER] key.

3. **Apply the reference value.**

When [ABS] is selected, make sure the current display value and then press the [ENTER] key to apply the reference value.

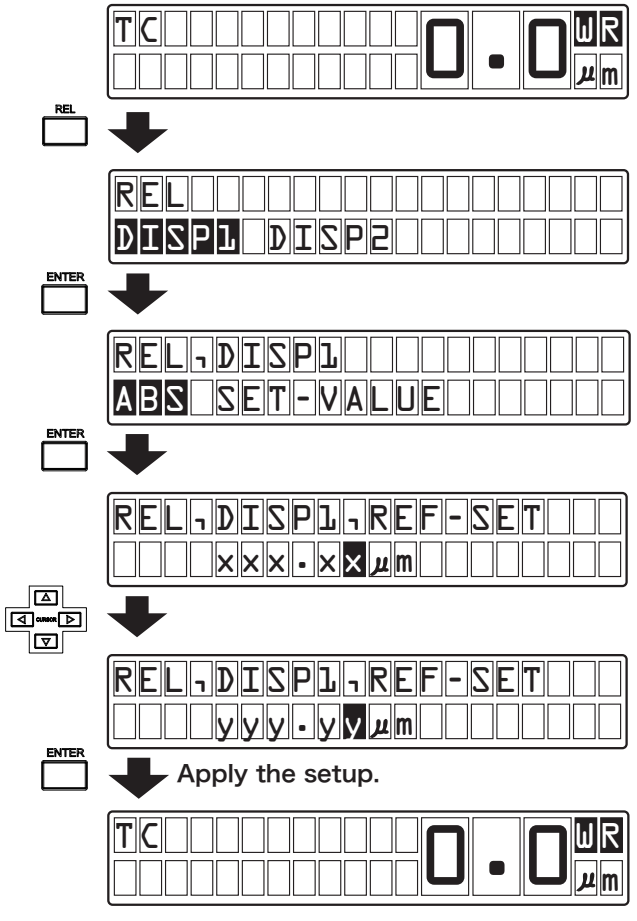
When [SET-VALUE] is selected, set the reference value to any desired numerical value.

To change the currently displayed reference value, use the cursor keys.

Press the [◁] and [▷] cursor keys to select the target digit of the numeric value (highlighted).
Press the [△] and [▽] cursor keys to change the numeric value.
Press the [ENTER] key to apply the currently displayed reference value.

To cancel the setup, press the [EXIT] key.

In the following example, [ABS] is selected.


TC
0.0
WR
μm
REL
REL
DISP1 DISP2
ENTER
REL┐DISP1
ABS SET-VALUE
ENTER
REL┐DISP1┐REF-SET
xxx.xxμm
CURSOR
REL┐DISP1┐REF-SET
yyy.yyμm
ENTER
Apply the setup.
TC
0.0
WR
μm

Chapter 3

Setting Various Conditions

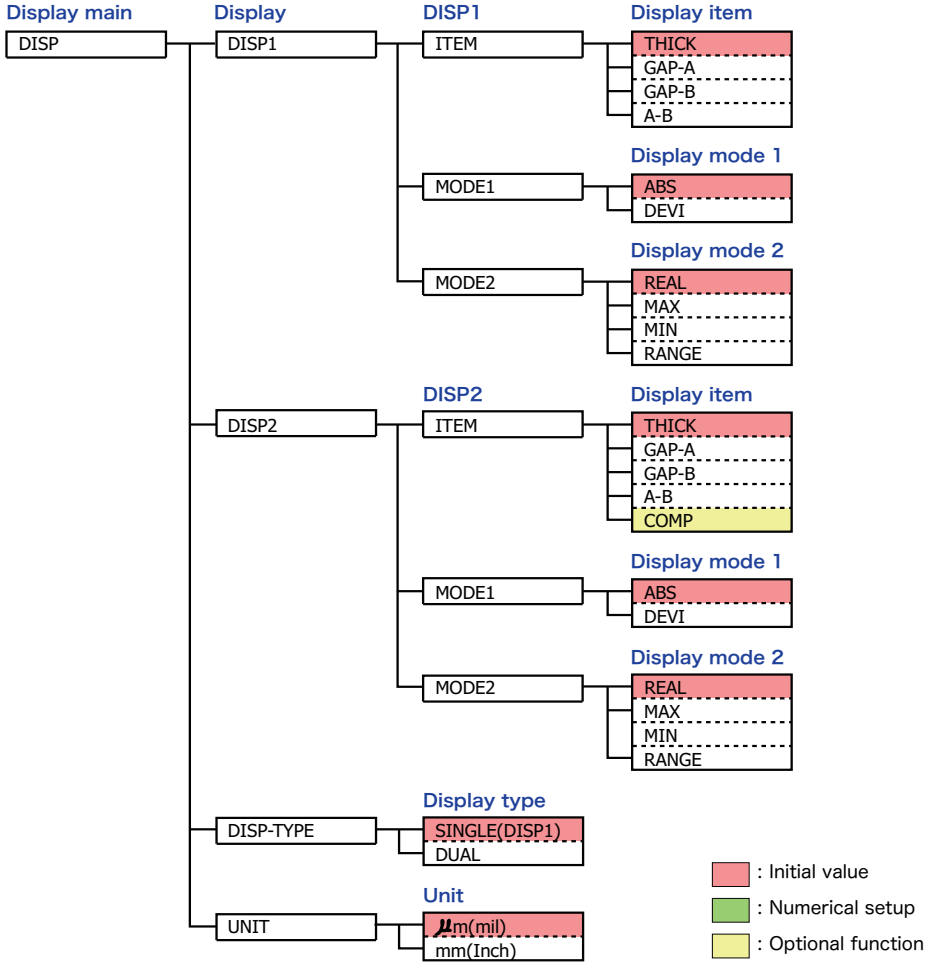
1. Configuration of Conditions Setup Screen

When you press the [COND] key, one of the following five different setup modes is entered: DISP (display conditions setup screen), CALIB (calibration conditions setup screen), SENS (sensor conditions setup screen), and OTHER (other conditions setup screen).

The following describes a configuration of each setup screen and details of setup items.

1.1 DISP: Display Conditions Setup Screen

■ Configuration of display conditions setup screen



■ Display condition settings

● DISP

DISP1	Displays the top setup screen in the measurement mode.
DISP2	Displays the bottom setup screen in the measurement mode (enabled only in the DUAL-screen display type).
DISP-TYPE	Displays the SINGLE (1-line)/DUAL (2-line) display type setup screen.
UNIT	Displays the display unit setup screen.

● DISP>DISP1/2

ITEM	Displays the THICK/CAP-A/CAP-B/A-B setup screen.
MODE1	Displays the ABS/DEVI setup screen.
MODE2	Displays the REAL/MAX/MIN/RANCE setup screen.

● DISP1/2>ITEM

THICK	Selects the thickness (DISP1 initial value).
GAP-A	Selects the distance between SENSOR A and the object under measurement (DISP2 initial value).
GAP-B	Selects the distance between SENSOR B and the object under measurement.
A-B	Selects the difference between SENSOR A and SENSOR B.
COMP	Selects the comparator status (only DISP2 is enabled). • COMP is enabled only when an option is installed.

● DISP1/2>MODE1

ABS	Selects a measurement value (initial value).
DEVI	Selects the difference between a measurement value and a measured reference value.

● DISP1/2>MODE2

REAL	Selects a measurement value without calculation (initial value).
MAX	Selects the maximum value from the calculation start time.
MIN	Selects the minimum value from the calculation start time.
RANGE	Selects MAX-MIN from the calculation start time.

• A time point at which the [START] key is pressed is the calculation start time.

● DISP-TYPE

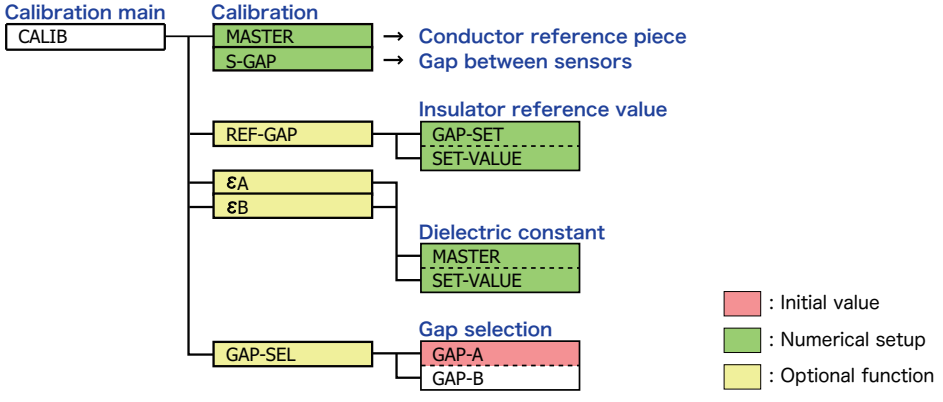
SINGLE(DISP1)	Selects display of only DISP1 (1-line display) (initial value).
DUAL	Select DISP1 display at the top and DISP2 display at the bottom.

● UNIT

μm(mil)	Sets the display unit to μm (initial value).
mm(Inch)	Sets the display unit to mm.

1.2 CALIB: Calibration Conditions Setup Screen

■ Configuration of calibration conditions setup screen



■ Calibration condition settings

● CALIB

MASTER	Displays the conductor reference piece thickness setup screen.
S-GAP	Displays the sensor gap value setup screen.
REF-GAP	Displays the insulator reference gap value setup screen. • REF-GAP is enabled only when an option is installed.
ε A	Display the A relative permitivity setup screen. • ε A is enabled only when an option is installed.
ε B	Display the B relative permitivity setup screen. • ε B is enabled only when an option is installed.
GAP-SEL	Displays the insulator measurement gap setup screen. • GAP-SEL is enabled only when an option is installed.

● CALIB>REF-GAP (CL-0300)

GAP-SET	Set a numeric value from the current measurement value.
SET-VALUE	Set any desired numerical value.

● CALIB> ε A/B (CL-0300)

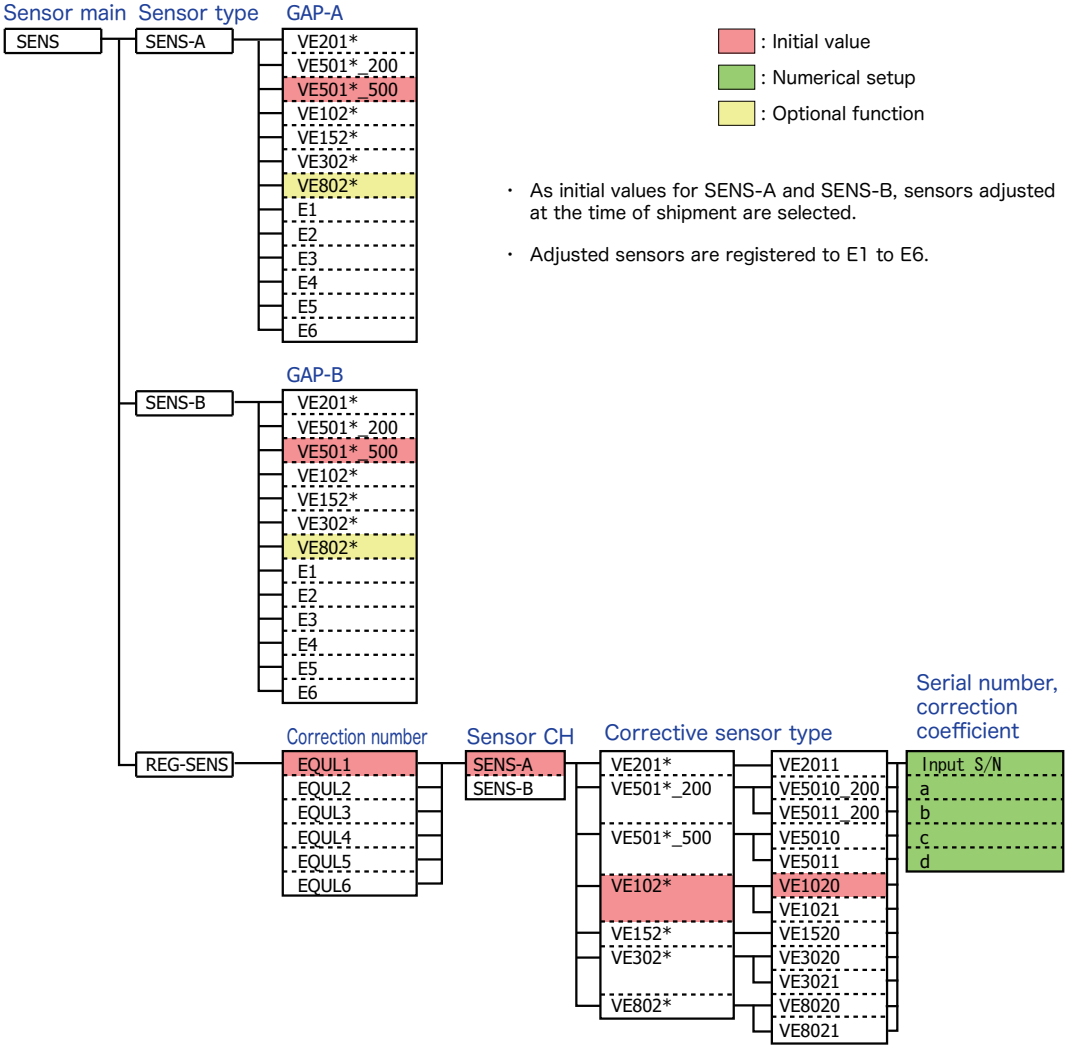
MASTER	Calculates and sets a relative permitivity from the insulator reference piece.
SET-VALUE	Sets a relative permitivity directly with a numeric value.

● CALIB>GAP-SEL (CL-0300)

GAP-A	Selects GAP-A as a sensor used for insulator measurement.
GAP-B	Selects GAP-B as a sensor used for insulator measurement.

1.3 SENS: Sensor Conditions Setup Screen

■ Configuration of sensor conditions setup screen



■ Sensor condition settings

● SENS

GAP-A	Displays the sensor setup screen for sensor used for Gap A.
GAP-B	Displays the sensor setup screen for sensor used for Gap B.
REG-SENS	Displays the model name/serial number/correction value setup screen for corrective sensor.

● SENS>GAP-A/GAP-B

VE201*	VE201 * (20 to 200μm)
VE501*200	VE501 * 200 (50 to 500μm)
VE501*500	VE501 * 500 (50 to 500μm)
VE102*	VE102 * (100 to 1000.0μm) (Initial value)
VE152*	VE152 * (150 to 1500.0μm)
VE302*	VE302 * (300 to 3000.0μm)
VE802*	VE802 * (800 to 8000.0μm)
E1 ～ 6	EQUL1-6 (corrective sensor)

● SENS>REG-SENS (correction number)

EQUL1 ～ EQUL6	Selects the corrective sensor number from EQUL1 to EQLU6. • Enabled only when a corrective sensor is registered.

● SENS>REG-SENS>EQUL1-EQLU6 (sensor channel)

SENS-A/SENS-B	Selects sensor channel A or B. • Enabled only when a corrective sensor is registered.

● SENS>REG-SENS>EQUL1 - EQLU6>SENS-A/SENS-B (corrective sensor type)

VE201*	VE201 * (20 to 200μm)
VE501*200	VE501 * 200 (50 to 500μm)
VE501*500	VE501 * 500 (50 to 500μm)
VE102*	VE102 * (100 to 1000.0μm) (Initial value)
VE152*	VE152 * (150 to 1500.0μm)
VE302*	VE302 * (300 to 3000.0μm)
VE802*	VE802 * (800 ～ 8000.0μm)

● SENS>REG-SENS>EQUL1 - EQLU6>SENS-A/SENS-B (corrective sensor type)

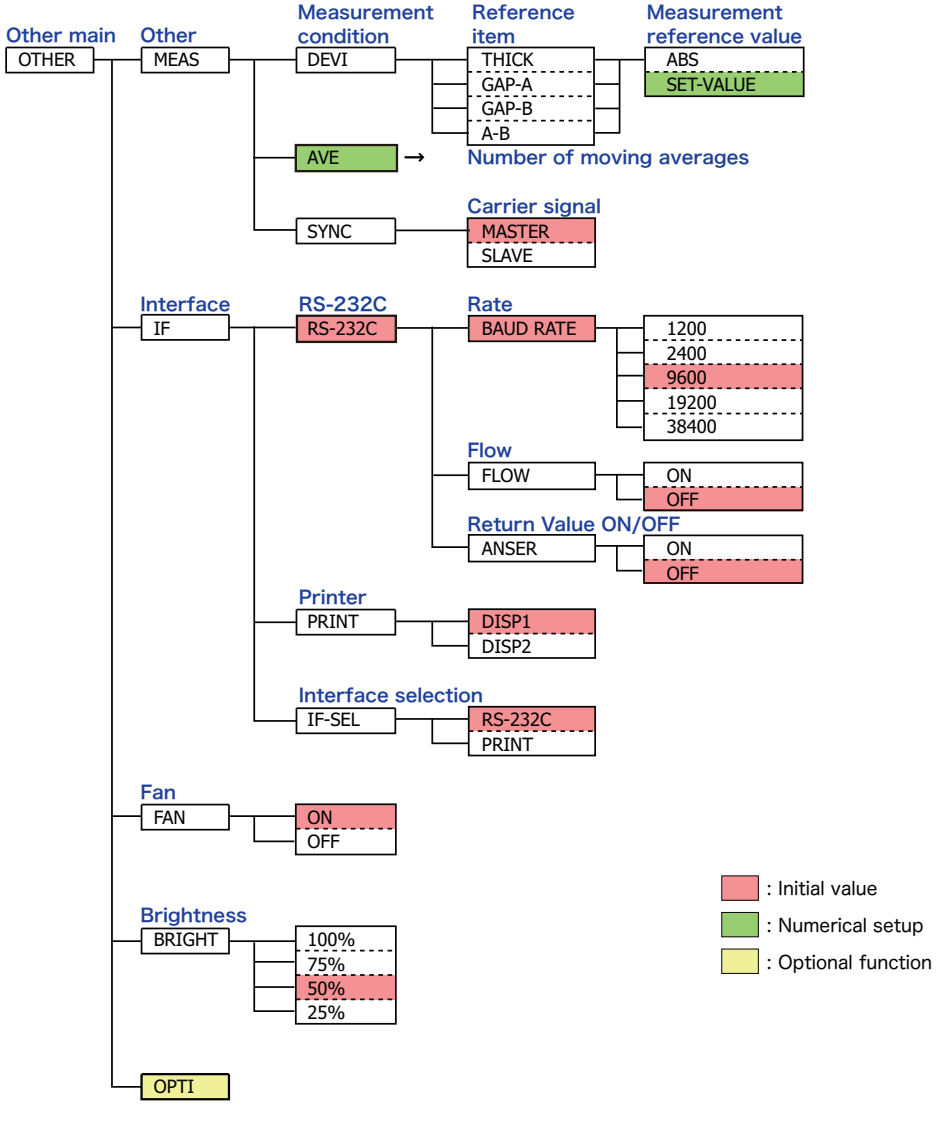
VE2011	VE2011 (20 to 200μm)
VE5010_200	VE5010 * 200 (20 to 200μm)
VE5010	VE5010 * 500 (50 to 500μm)
VE5011_200	VE5011 * 200 (20 to 200μm)
VE5011	VE5011 * 500 (50 to 500μm)
VE1020	VE1020 (100 to 1000μm)
VE1021	VE1021 (100 to 1000μm)
VE1520	VE1520 (150 to 1500μm)
VE3020	VE3020 (300 to 3000μm)
VE3021	VE3021 (300 to 3000μm)
VE8020	VE8020 (800 to 8000μm)
VE8021	VE8021 (800 to 8000μm)

● SENS>REG-SENS>EQUL1-EQLU6>SENS-A/SENS-B/VE501-VE802 (serial number/correction coefficient)

S/N	Input the serial number.
a ～ d	Selects the correction coefficient from a to d.

1.4 OTHER: Other Measurement Conditions Setup Screen (Standard Function)

■ Configuration of other measurement conditions setup screen (standard function)



■ Other measurement condition settings (standard function)

● OTHER

MEAS	Displays the measurement conditions setup screen.
IF	Displays the interface (RS-232C/printer) conditions setup screen.
FAN	Displays the fan setup screen.
BRIGHT	Displays the display brightness setup screen.
OPTI	Displays the option conditions setup screen. • Enabled only when an option is installed.

● OTHER>MEAS

DEVI	Displays the measurement reference value setup screen.
AVE	Displays the moving average setup screen. · Enter a moving average as a numeric value in the moving average setup screen. (Initial value: 1)
SYNC	Displays the carrier signal setup screen.

● OTHER>MEAS>DEVI

THICK	Selects the thickness (DISP1 initial value).
GAP-A	Selects the distance between SENSOR A and the object under measurement (DISP2 initial value).
GAP-B	Selects the distance between SENSOR B and the object under measurement.
A-B	Selects the difference between SENSOR A and SENSOR B.

● OTHER>MEAS>DEVI>THICK/GAP-A/GAP-B/A-B

ABS	Set a numeric value from the current measurement value.
SET-VALUE	Set a numeric value from the current setting.

● OTHER>MEAS>SYNC

MASTER	Sets the carrier signal as master. · The present CL-5610/5610S is set as master. (Initial value)
SLAVE	Sets the carrier signal as slave. • The present CL-5610/5610S is set as slave.

• Condition setup used when measuring the same single test piece using multiple CL-5610/5610S units.

● OTHER>IF

RS-232C	Displays the RS-232C conditions setup screen.
PRINT	Displays the printer conditions setup screen.
IF-SEL	Displays the interface (RS-232C/printer) setup screen.

● OTHER>IF>RS-232C

BAUD RATE	Displays the baud rate setup screen.
FLOW	Displays the flow control ON/OFF setup screen.
ANSER	Displays the RS-232C command transmission return value ON/OFF setup screen.

● OTHER>IF>RS-232C>BAUD RATE

1200	Sets the baud rate to 1200 bps.
2400	Sets the baud rate to 2400 bps.
9600	Sets the baud rate to 9600 bps (initial value).
19200	Sets the baud rate to 19200 bps.
38400	Sets the baud rate to 38400 bps.

● OTHER>IF>RS-232C>FLOW

ON	Set flow control to ON.
OFF	Set flow control to OFF (initial value).

● OTHER>IF>RS-232C>ANSER

ON	Sets the return value for RS-232C command transmission to ON.
OFF	Sets the return value for RS-232C command transmission to OFF (initial value).

● OTHER>IF>PRINT

DISP1	Set the printer output display to DISP1 (initial value).
DISP2	Set the printer output display to DISP2.

● OTHER>IF>IF-SEL

RS-232C	Selects the use of RS-232C (initial value).
PRINT	Selects the use of the printer.

● OTHER>FAN

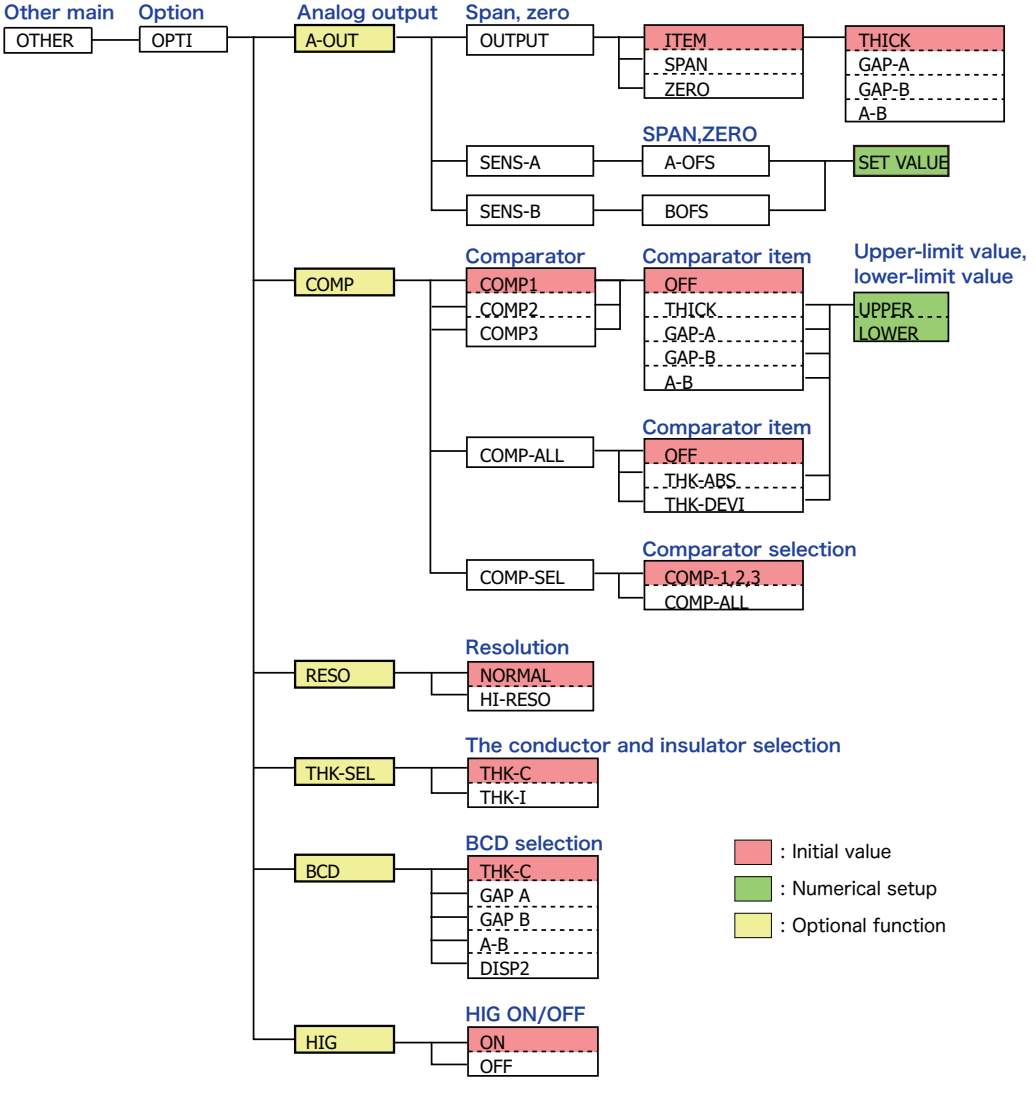
ON	Constantly operates the FAN (initial value).
OFF	Does not operate the FAN.

● OTHER>BRIGHT

100%	Sets the brightness of the display to 100% (brightest).
75%	Sets the brightness of the display to 75%.
50%	Sets the brightness of the display to 50% (initial value).
25%	Sets the brightness of the display to 25% (darkest).

1.5 OTHER: Option Conditions Setup Screen

■ Configuration of option conditions setup screen



■ Option condition settings

● OTHER>OPTI

A-OUT	Displays the CL-0100 option conditions setup screen.
COMP	
RESO	Displays the CL-0200 option conditions setup screen.
THK-SEL	Displays the CL-0300 option conditions setup screen.
BCD	Displays the CL-0120 option conditions setup screen.
HIG	Displays the CL-0120 option conditions setup screen.

● OTHER>OPTI>A-OUT

OUTPUT	Displays the ITEM, SPAN, and ZERO condition setup screen.
SENS-A	Displays the SEAS-A offset condition setup screen.
SENS-B	Displays the SEAS-B offset condition setup screen.

● OTHER>OPTI>A-OUTI>OUTPUT

ITEM	Set an item of the analog voltage output from A-OUT on the rear panel.
SPAN	Set a span of the analog voltage output from A-OUT on the rear panel.
ZERO	Set the thickness when a 0V analog voltage is output from A-OUT on the rear panel.

● OTHER>OPTI>A-OUT>OUTPUT>ITEM

THICK	Set an analog voltage output from A-OUT on the rear panel as THICK.
GAP-A	Set an analog voltage output from A-OUT on the rear panel as GAP-A.
GAP-B	Set an analog voltage output from A-OUT on the rear panel as GAP-B.
A-B	Set an analog voltage output from A-OUT on the rear panel as A-B.

● OTHER>OPTI>A-OUT>SENS-A

A-OFS	Set an amount of offset applied to the analog voltage output from SESOR A on the rear panel.

● OTHER>OPTI>A-OUT>SENS-B

B-OFS	Set an amount of offset applied to the analog voltage output from SESOR B on the rear panel.

● OTHER>OPTI>COMP

COMP1	Displays the comparator 1 (CMP1) output conditions setup screen.
COMP2	Displays the comparator 2 (CMP2) output conditions setup screen.
COMP3	Displays the comparator 3 (CMP3) output conditions setup screen.
COMP-ALL	Displays the comparator ALL (CMP1-3) output conditions setup screen.

COMP-SEL	Displays the comparator 1.2.3/ALL setup screen.

● OTHER>OPTI>COMP>COMP1/2/3

OFF	Sets the comparator to OFF (initial value).
THICK	Sets the comparator to thickness.
GAP-A	Sets the comparator to Gap A.
GAP-B	Sets the comparator to Gap B.
A-B	Set A-B as an item subjected to BCD output.
DISP2	Set DISP2 as an item subjected to BCD output.

● OTHER>OPTI>COMP>COMP1/2/3>THICK/GAP-A/GAP-B/A-B

UPPER	Set the comparator upper-limit value (initial value: 999999.99 μm) with a numeric value.
LOWER	Set the comparator lower-limit value (initial value: 0.00 μm) with a numeric value.

● OTHER>OPTI>COMP>COMP-ALL

OFF	Sets the comparator to OFF.
THK-ABS	Sets the comparator with a measurement value.
THK-DEVI	Sets the comparator with a difference between a measurement value and a set reference value.

● OTHER>OPTI>COMP>COMP-ALL>OFF/THICK-ABS/THK-DEV

UPPER	Set the comparator upper-limit value (initial value: 999999.99 μm) with a numeric value.
LOWER	Set the comparator lower-limit value (initial value: 0.00 μm) with a numeric value.

● OTHER>OPTI>COMP>COMP-SEL

COMP-1,2,3	Set the independent use of comparator 1.2.3 (initial value).
COMP-ALL	Uses comparator 1.2.3 to UPPER/LOWER judgment.

● OTHER>OPTI>RESO

NORMAL	Selects the normal resolution (initial value).
HI-RESO	Selects the high resolution.

● OTHER>OPTI>THK-SEL

THK-C	Selects conductor as an object under thickness measurement (initial value).
THK-I	Selects insulator as an object under thickness measurement.

● OTHER>OPTI>BCD

THICK	Set THICK as an item subjected to BCD output.
GAP A	Set GAP A as an item subjected to BCD output.
GAP B	Set GAP B as an item subjected to BCD output.
A-B	Set A-B as an item subjected to BCD output.
DISP2	Set DISP2 as an item subjected to BCD output.

● OTHER>OPTI>HIG

ON	Set the high-impedance ground mode to ON.
OFF	Set the high-impedance ground mode to OFF (initial value).

2. Display Conditions Setup: DISP

The following describes procedures for setting conditions for each specific purpose in the display conditions setup screen.

2.1 Setting Display Items

Display items to be displayed in the display can be selected from THICK/GAP-A/GAP-B/A-B/COMP.

■ Changing display items

In the following example, display item is changed from [THICK] to [GAP-A].

The following describes procedures for setting [DISP1] because of the SINGLE-screen display type. In the DUAL-screen display type, set the top display item with [DISP1] and the bottom display item with DISP2 with the same operations.

1. **Change the mode.**

Press the [COND] key to select the setup mode.。

2. **Select the display item setup screen.**

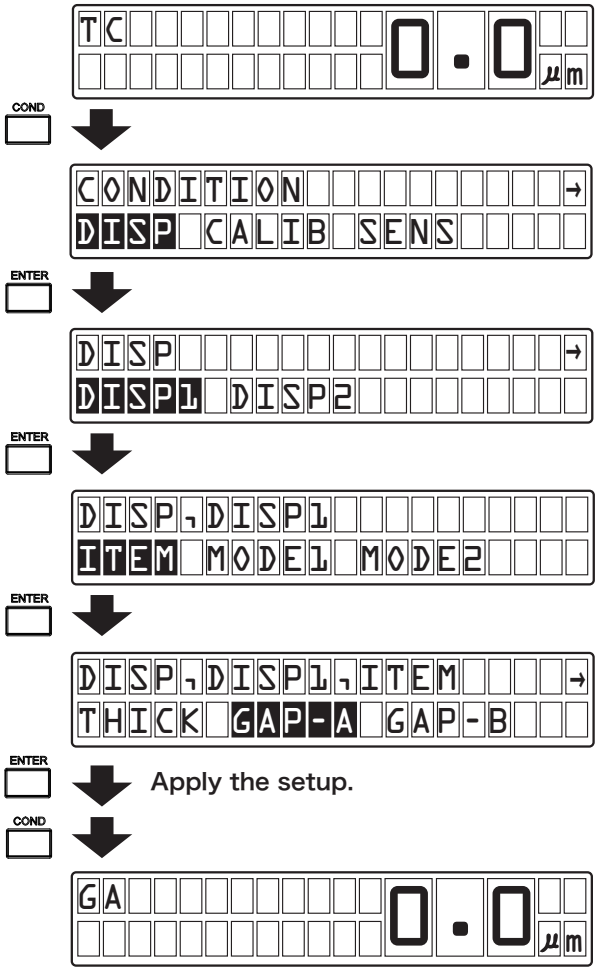
First, select [DISP], [DISP1], and [ITEM] in this order to display the display item setup screen.

Then, select a target display item in the display item setup screen, and then press the [ENTER] key to display the selected display item.

3. **Complete the setup.**

Upon completion of setup, press the [COND] key to return to the measurement mode.

If you press the [EXIT] key, the current setting is canceled and then the previous screen resumes.


TC
0.0
μm
COND
CONDITION
DISP CALIB SENS
ENTER
DISP
DISP1 DISP2
ENTER
DISP,DISP1
ITEM MODE1 MODE2
ENTER
DISP,DISP1,ITEM
THICK GAP-A GAP-B
ENTER
Apply the setup.
COND
GA
0.0
μm

2.2 Setting Display Mode 1/2

The following describes procedures for selecting a measurement value or deviation for display mode 1 and a calculation value for display mode 2.

■ Selecting a measurement value (ABS) and deviation (DEVI): Display mode 1

Deviation (DEVI) refers to a difference between a measurement value and a set measurement reference value.

The reference value is a value set in the measurement reference setup mode or measurement reference value setup (initial value: 0.00 μm).

The following describes procedures for setting [DISP1] because of the SINGLE-screen display type. In the DUAL-screen display type, set the top display item with [DISP1] and the bottom display item with DISP2 with the same operations.

In the following example, the setting of display mode 1 is changed to deviation (DEVI).

1. **Change the mode.**

Press the [COND] key to select the setup mode.

2. **Select the display mode setup screen.**

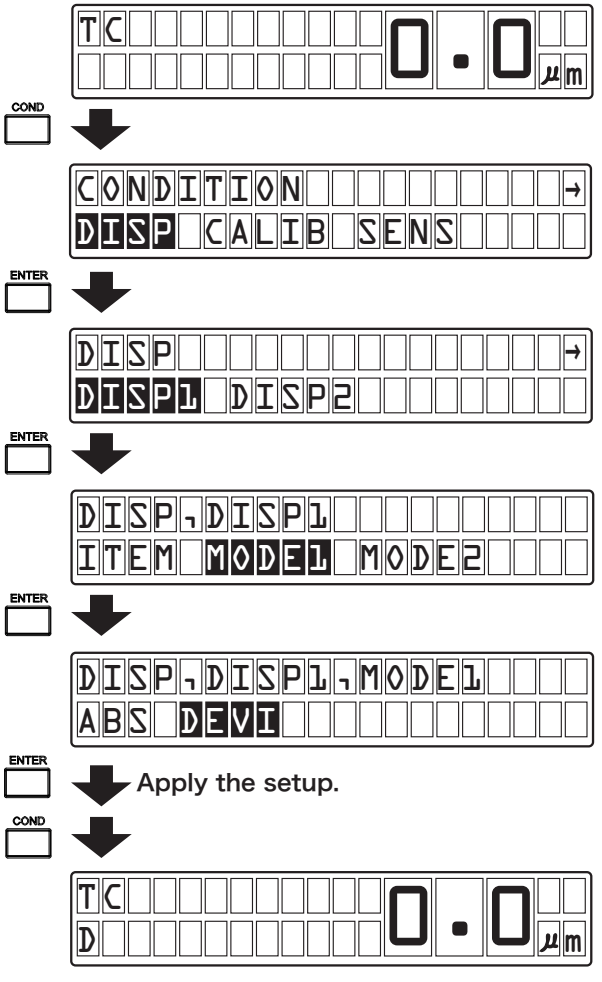
First, select items [DISP], [DISP1], and [MODE1] in this order to select the display mode 1 setup screen.

Then, select [ABS] (measurement value) or [DEVI] (DEVI) in the display mode 1 setup screen, and then press the [ENTER] key to apply the selected display mode.

3. **Complete the setup.**

Upon completion of setup, press the [COND] key to return to the measurement mode.

If you press the [EXIT] key, the current setting is canceled and then the previous screen resumes.


TC
0.0
µm
COND
CONDITION
DISP CALIB SENS
ENTER
DISP
DISP1 DISP2
ENTER
DISP,DISP1
ITEM MODEL MODE2
ENTER
DISP,DISP1,MODEL
ABS DEVI
ENTER
Apply the setup.
COND
TC
D
0.0
µm

■ Selecting a calculation value: Display mode 2

REAL (no calculation) or MAX (maximum value from calculation start time)/MIN (minimum value from calculation start time)/RANGE (MAX-MIN from calculation start time) can be selected as calculation value.
The following describes procedures for setting [DISP1] because of the SINGLE-screen display type. In the DUAL-screen display type, set the top display item with [DISP1] and the bottom display item with DISP2 with the same operations.
In the following example, the setting of display mode 2 is changed to MAX (maximum value from calculation start time).

1. **Change the mode.**

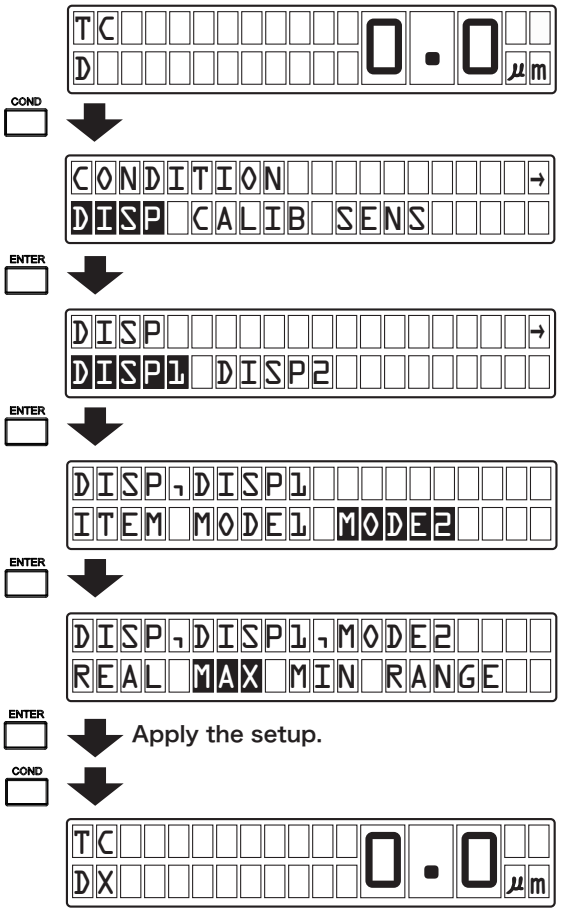
Press the [COND] key to select the setup mode.

2. **Select the display mode setup screen.**

First, select items [DISP], [DISP1], and [MODE2] in this order to select the display mode 2 setup screen.
Then, select [MAX] in the display mode 2 setup screen, and then press the [ENTER] key to apply the selected display mode.

3. **Complete the setup.**

Upon completion of setup, press the [COND] key to return to the measurement mode.
If you press the [EXIT] key, the current setting is canceled and then the previous screen resumes.



2.3 Setting Display Type Conditions

Display type setup is a setup for selecting the SINGLE display type (displays only DISP1) or the DUAL display type (displays DISP1 at the top and DISP2 at the bottom).

In the following example, the display type is changed from SINGLE (displays only DISP1) to DUAL (displays DISP1 at the top and DISP2 at the bottom).

1. **Change the mode.**

Press the [COND] key to select the setup mode.

2. **Select the display type setup screen.**

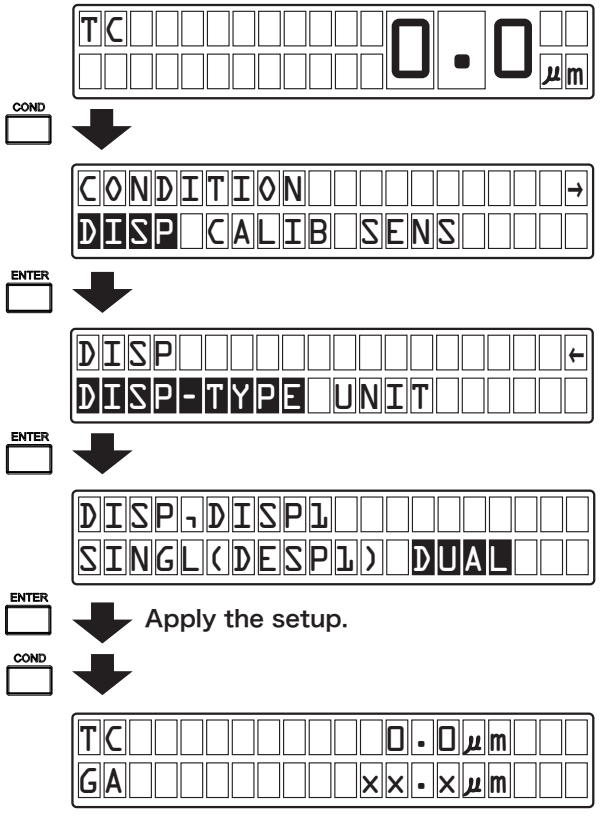
First, select items [DISP], [DISP1], and [DISP-TYPE] in this order to select the display type setup screen.

Then, select [SINGLE (DISP1)] or [DUAL] in the display type setup screen, and then press the [ENTER] key to apply the selected display type.

3. **Complete the setup.**

Upon completion of setup, press the [COND] key to return to the measurement mode.

If you press the [EXIT] key, the current setting is canceled and then the previous screen resumes.。



2.4 Setting Unit Conditions

Unit setup is a setup for selecting the unit in the display and the unit at the time of printing to μm (initial value) or mm.

In the following example, the unit is changed from μm (initial value) to mm.

1. Change the mode.

Press the [COND] key to select the setup mode.

2. Select the unit setup screen.

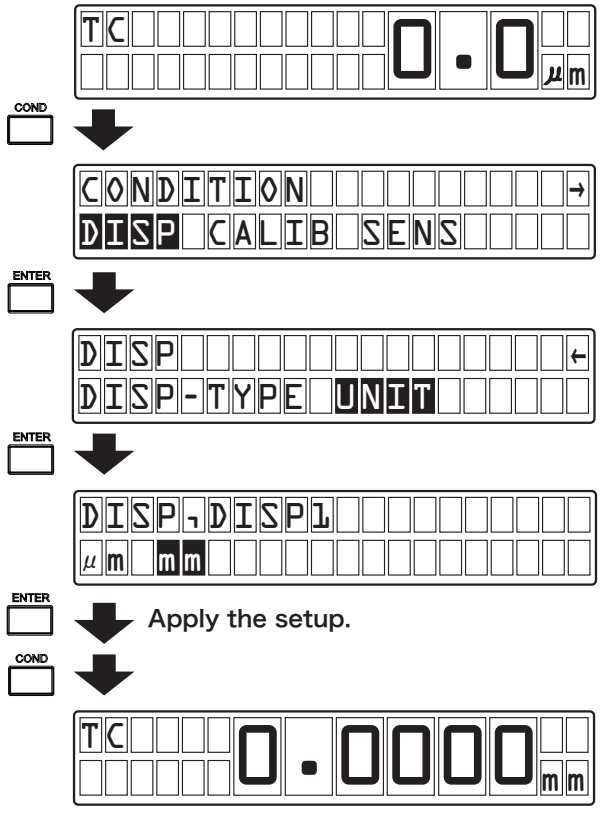
First, select items [DISP], [DISP1], and [UNIT] in this order to select the unit setup screen.

Then, select [mum] or [mm] on the unit setup screen, and then press the [ENTER] key to apply the selected unit.

3. Complete the setup.

Upon completion of setup, press the [COND] key to return to the measurement mode.

If you press the [EXIT] key, the current setting is canceled and then the previous screen resumes.



3. Calibration Conditions Setup: CALIB

The following describes procedures for setting conditions for each specific purpose in the calibration conditions setup screen.

CAUTION !

- **The CALIB screen is used to set various conditions for thickness calibration. Thickness calibration cannot be performed with this screen.**
  To start thickness calibration, press the [CALIB] switch. For details, refer to "Calibration Procedures for Thickness Measurement" on page 50.
- **When the gap between the sensor and the reference floor is changed, measurement values are affected.**

3.1 Setting the Thickness of Conductor Reference Piece

The thickness value of the conductor reference piece to be used for calibration in conductor measurement can be set.

The thickness of the conductor reference piece is set to 0.00 μm as initial value. It can be set to any numerical value.

The settable range is shown below.

Model Name	Standard Display Resolution	High Display Resolution
VE2011	0 to 99999.9 μm	0 to 9999.99 μm
VE5010		
VE5011		
VE1020		0 to 99999.9 μm
VE1021		
VE1520		
VE3020	0 to 999999 μm	
VE3021		
VE8020		0 to 999999 μm
VE8021		

1. Change the mode.

Press the [COND] key to select the setup mode.

2. Select the thickness value setup screen for conductor reference piece.

First, select items [CALIB] and [MASTER] in this order to select the thickness value setup screen for conductor reference piece to be used during calibration in conductor measurement.

Then, change the setting in the thickness value setup screen for conductor reference piece using the cursor keys.

Press the [◁] and [▷] cursor keys to select the target digit (highlighted).

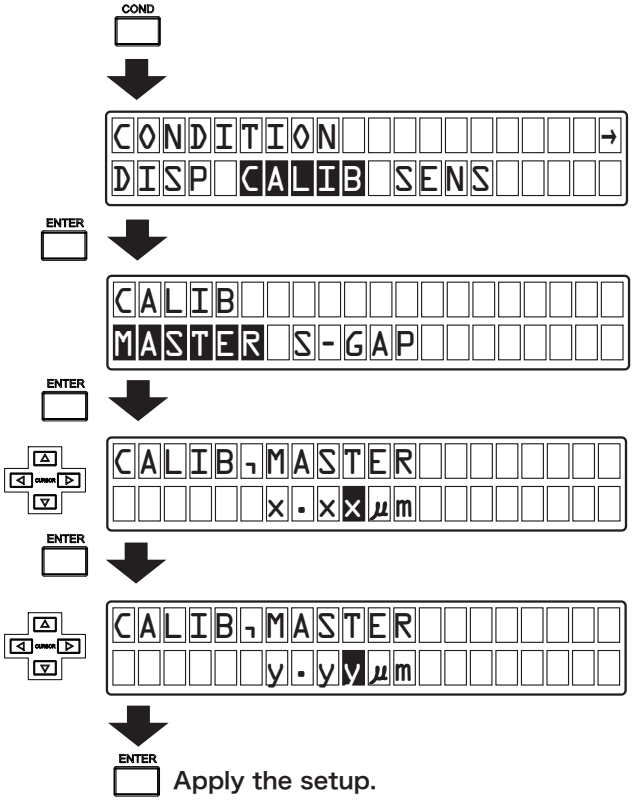
Press the [△] and [▽] cursor keys to change (increment or decrement) the numeric value.

Finally, when you change the value and then press the [ENTER] key, the thickness of the conductor reference piece is set. (The gap between the sensor and the reference floor is not set.)

3. Complete the setup.

Upon completion of setup, press the [COND] key to return to the measurement mode.

If you press the [EXIT] key, the current setting is canceled and then the previous screen resumes.



3.2 Setting the Gap between Sensors

The gap between sensors (distance between Sensors A and B) can be set.

The gap between the sensor and the reference floor is set to 0.00 μm as initial value. It can be set to any numerical value.

The settable range is shown below.

Model Name	Standard Display Resolution	High Display Resolution
VE2011	0 to 99999.9 μm	0 to 9999.99 μm
VE5010		
VE5011		
VE1020		0 to 99999.9 μm
VE1021		
VE1520		
VE3020	0 to 999999 μm	
VE3021		
VE8020		0 to 999999 μm
VE8021		

1. Change the mode.

Press the [COND] key to select the setup mode.

2. Select the setup screen for gap between sensors.

First, select items [CALIB] and [S-GAP] in this order to select the setup screen for gap between sensors.

Then, change the setting in the setup screen for gap between sensors using the cursor keys.

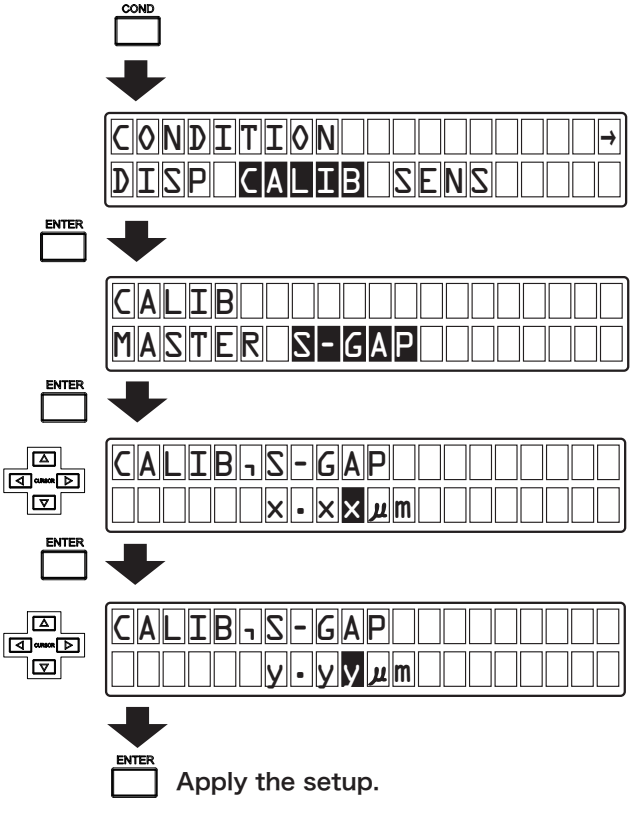
Press the [◁] and [▷] cursor keys to select a target digit (highlighted).
Press the [△] and [▽] cursor keys to change (increment or decrement) the numeric value.

After changing the setting, press the [ENTER] key to apply the specified gap between sensors.

3. Complete the setup.

Upon completion of setup, press the [COND] key to return to the measurement mode.

If you press the [EXIT] key, the current setting is canceled and then the previous screen resumes.


COND
CONDITION
DISP CALIB SENS
ENTER
CALIB
MASTER S-GAP
ENTER
CALIB S-GAP
x.xx µm
ENTER
CALIB S-GAP
y.yy µm
ENTER
Apply the setup.

4. Sensor Conditions Setup: SENS

The following describes procedures for setting conditions for each specific purpose in the sensor conditions setup screen.

CAUTION !

- **The CL-5610/5610S Non-Contact Thickness Meter is shipped after sensor correction values have been registered. Therefore, be sure to select a sensor before use.**
- **If the sensor to be used does not coincide with any corrective sensor registered in the CL-5610/5610S Non-Contact Thickness Meter, the accuracy cannot be guaranteed**

4.1 Setting Sensor Conditions

The sensor type can be set to SENS-A or SENS-B.

Procedures for setting the sensor type are shown below.

1. Change the mode.

Press the [COND] key to select the setup mode.

2. Select the sensor conditions setup screen.

First, select [SENS] and then press the [ENTER] key to select the sensor conditions setup screen.

Then, select [SENS-A] or [SENS-B] and then press the [ENTER] key to select the sensor setup screen.

In the sensor setup screen, select a corrective sensor having the same model name and serial number as the sensor to be used, and then press the [ENTER] key.

3. Complete the setup.

Upon completion of setup, press the [COND] key to return to the measurement mode.

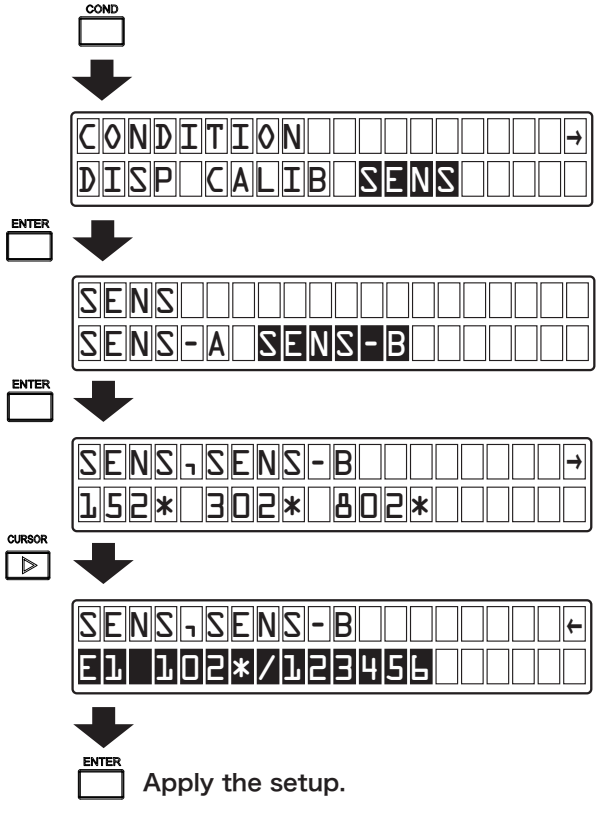
If you press the [EXIT] key, the current setting is canceled and then the previous screen resumes.

Settings in the SENS>SENS-B screen (E1 102*/123456) are shown below.

E1	Registration address of corrective sensor
102*	Sensor model name VE-102* (* is any number.)
123456	Serial number of sensor

CAUTION !

- **Sensors without correction data description (model name only) are also displayed as settings in the SENS>SENS-B screen. If any of these sensors is selected, the accuracy cannot be guaranteed.**



Apply the setup.

5. Other Measurement Conditions Setup: OTHER

The following describes procedures for setting conditions for each specific purpose in the other measurement conditions setup screen.

5.1 Numerical Setup of Measurement Reference Value

The CL-5610/5610S allows you to set a measurement reference value to be used for deviation value display.

For measurement reference values used for deviation value display, 0.00 μm is displayed as initial values.

The settable range is shown below.

Model Name	Standard Display Resolution	High Display Resolution
VE2011	0 to 99999.9 μm	0 to 9999.99 μm
VE5010		
VE5011		
VE1020		0 to 99999.9 μm
VE1021		
VE1520		
VE3020	0 to 999999 μm	
VE3021		
VE8020		0 to 999999 μm
VE8021		

1. Change the mode.

Press the [COND] key to select the setup mode.

2. Select the reference value setup screen and set a numeric value of the measurement reference value.

First, select items [OTHER], [MEAS], [DEVI], and [THICK] in this order to select the reference value setup screen.
Then, select [ABS] when setting a numeric value from a measurement value or [SET-VALUE] when setting a desired numeric value, and then press the [ENTER] key. The numerical setup screen appears.

In the numerical setup screen for measurement reference value, change the setting using the cursor keys.

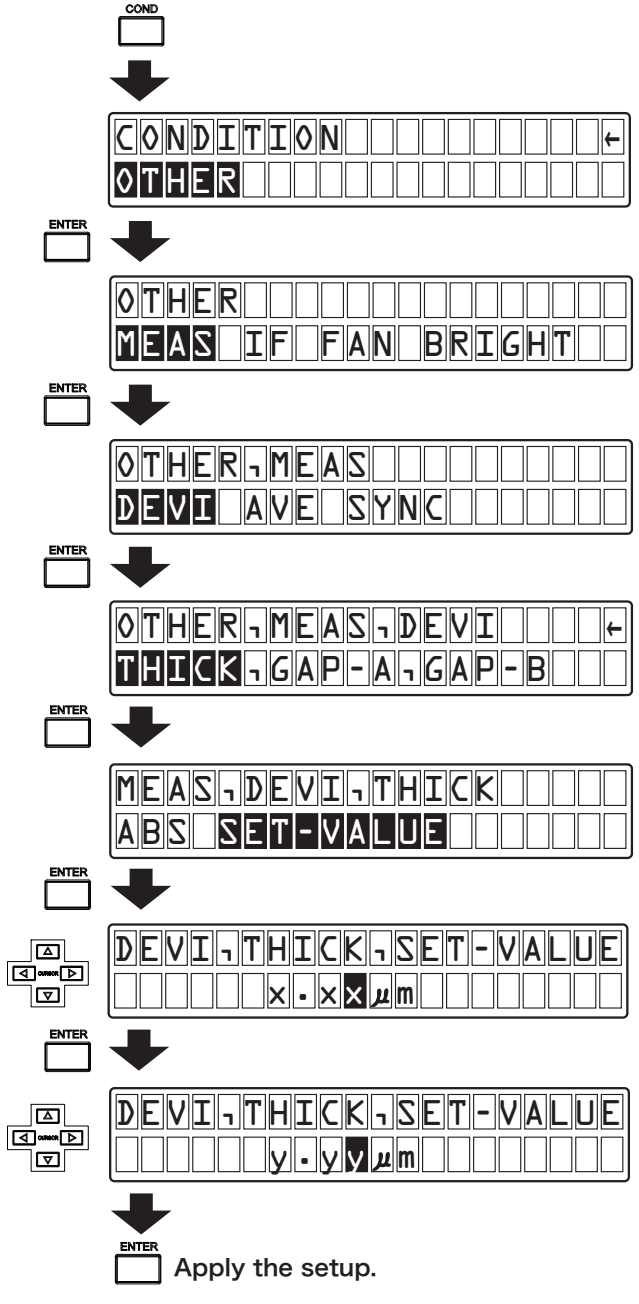
Press the [◁] and [▷] cursor keys to select a target digit (highlighted).
Press the [△] and [▽] cursor keys to change (increment or decrement) the numeric value.

After changing the value, press the [ENTER] key to apply the specified measurement reference value.

3. Complete the setup.

Upon completion of setup, press the [COND] key to return to the measurement mode.

If you press the [EXIT] key, the current setting is canceled and then the previous screen resumes.


COND
CONDITION
OTHER
ENTER
OTHER
MEAS IF FAN BRIGHT
ENTER
OTHER,MEAS
DEVI AVE SYNC
ENTER
OTHER,MEAS,DEVI
THICK,GAP-A,GAP-B
ENTER
MEAS,DEVI,THICK
ABS SET-VALUE
ENTER
DEVI,THICK,SET-VALUE
x.xxμm
ENTER
DEVI,THICK,SET-VALUE
y.yyμm
ENTER
Apply the setup.

5.2 Numerical Setup of Moving Average

The CL-5610/5610S allows you to set a simple moving average for measurement data.

The moving average is set to 1 (initial value) and can be set to any desired numeric value from 1 to 64.

1. Change the mode.

Press the [COND] key to select the setup mode.

2. Select the moving average setup screen and then set a numeric value of moving average.

First, select items [OTHER], [MEAS], and [AVE] in this order to select the moving average setup screen.

Then, change the setting in the moving average setup screen using the cursor keys.

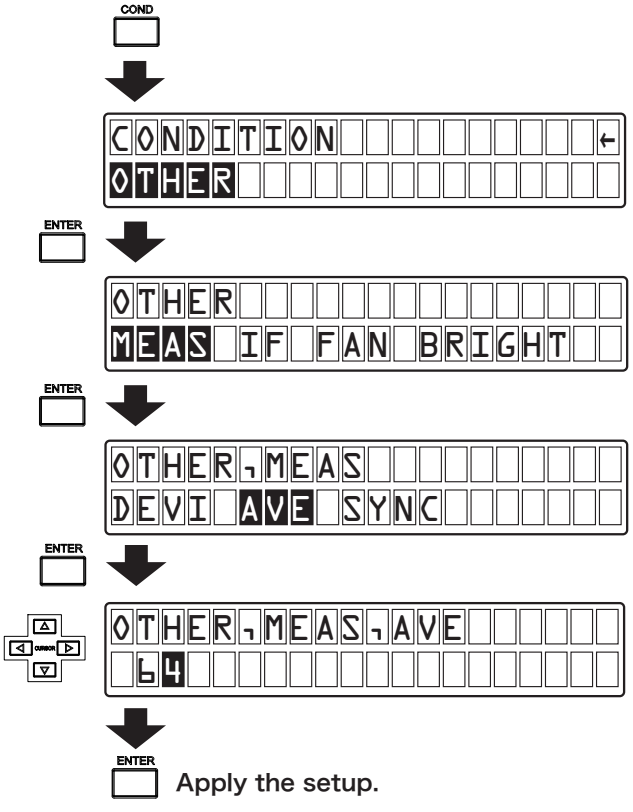
Press the [◁] and [▷] cursor keys to select a target digit (highlighted).
Press the [△] and [▽] cursor keys to change (increment or decrement) the numeric value.

After changing the value, press the [ENTER] key to apply the specified moving average.

3. Complete the setup.

Upon completion of setup, press the [COND] key to return to the measurement mode.

If you press the [EXIT] key, the current setting is canceled and then the previous screen resumes.



5.3 Setting Carrier Signal Conditions

When measuring the same single test piece using multiple CL-5610/5610S Non-Contact Thickness Meters, sensors may interfere with each other since a carrier signal for measurement is output separately, resulting in unstable measurement data.

In order to prevent interference between sensors and stabilize measurement data, perform synchronous operation using a common carrier signal by setting one CL-5610/5610S Non-Contact Thickness Meter as MASTER and the others as SLAVE. As a result, effects of interference can be reduced.

The following describes procedure for selecting the carrier signal.

1. **Change the mode.**

Press the [COND] key to select the setup mode.

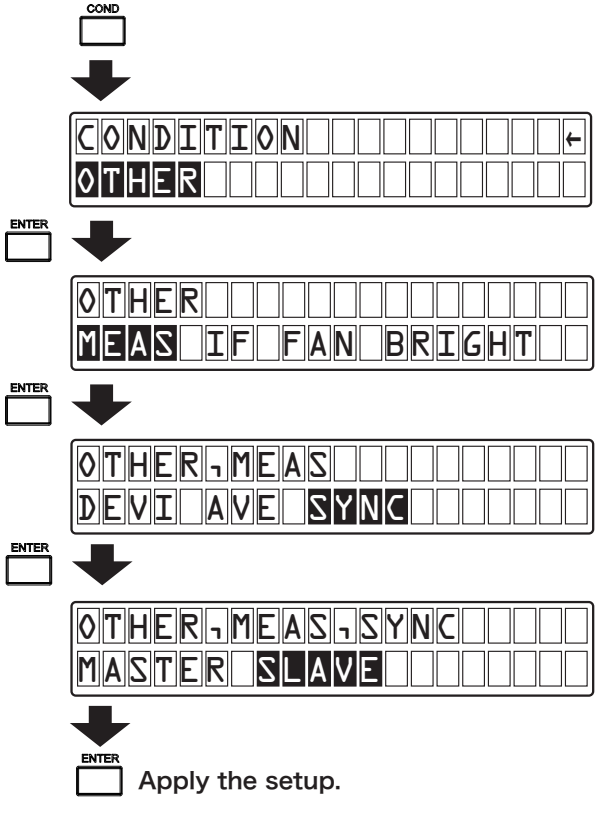
2. **Select the carrier signal setup screen.**

First, select items [OTHER], [MEAS], and [SYNC] in this order to select the carrier signal setup screen.

Select [MASTER] or [SLAVE] in the carrier signal setup screen, and then press the [ENTER] key to set the carrier signal as master or slave.

3. **Complete the setup.**

Upon completion of setup, press the [COND] key to return to the measurement mode.
If you press the [EXIT] key, the current setting is canceled and then the previous screen resumes.



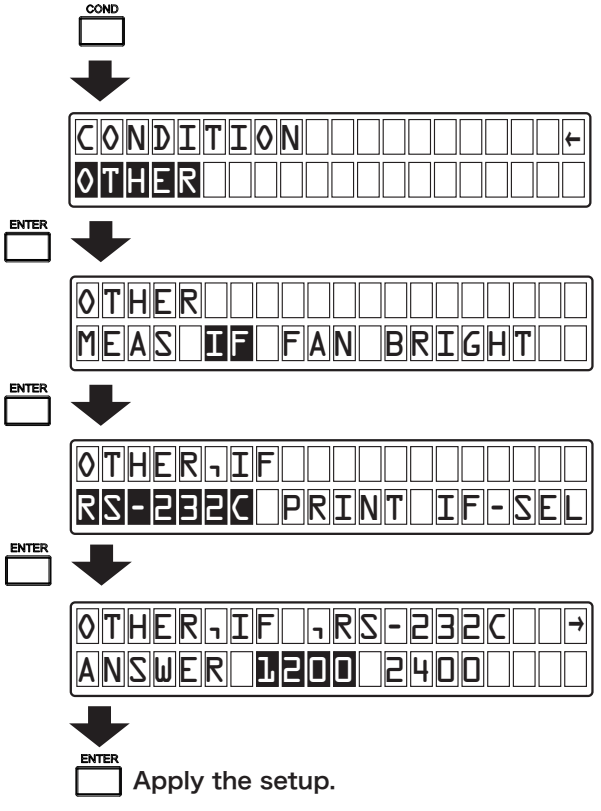
5.4 Setting Interface Conditions

■ Setting RS-232C conditions

As RS-232C conditions, the baud rate, flow control ON/OFF, and ANSWER function (return value) ON/OFF can be set.

● Setting baud rate

Set baud rate conditions with the following procedures:



1. Change the mode.

Press the [COND] key to select the setup mode.

2. Select the baud rate setup screen.

First, select [OTHER], [IF], and [RS-232C] in this order to display the RS-232C setup screen.

Select [BAUD RATE] in the RS-232C setup screen to display the bard rate setup screen.

Select any baud rate (1200/2400/9600/19200/38400) in the bard rate setup screen and then press the [ENTER] key. The selected baud rate is set.

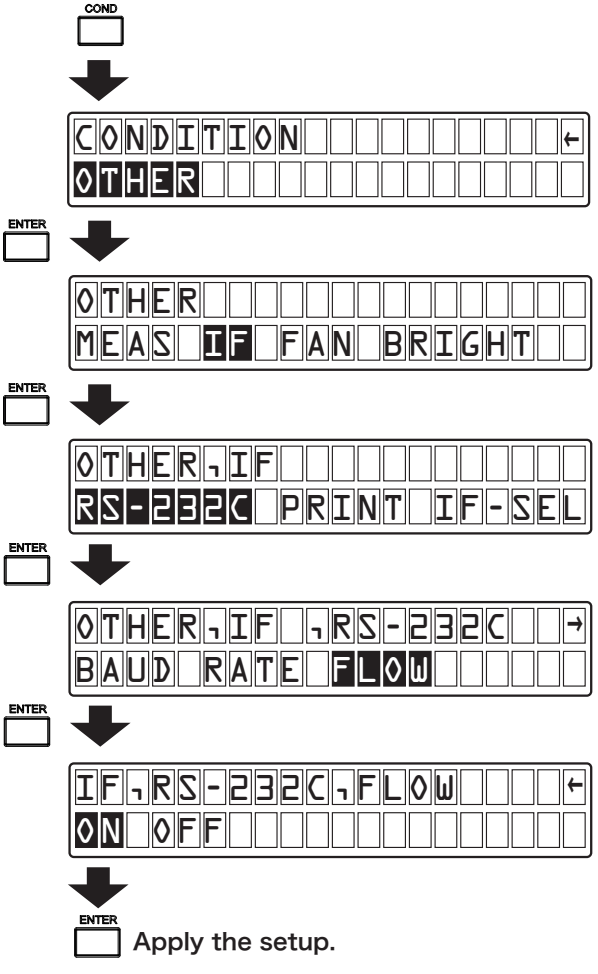
3. **Complete the setup.**

Upon completion of setup, press the [COND] key to return to the measurement mode.
If you press the [EXIT] key, the current setting is canceled and then the previous screen resumes.

● **Setting flow control ON or OFF**

Set flow control to ON or OFF with the following procedures.

When flow control is set to ON, the CL-5610/5610C performs flow control.



1. Change the mode.

Press the [COND] key to select the setup mode.

2. Select the flow control setup screen.

First, select items [OTHER], [IF], and [RS-232C] in this order to display the RS-232C setup screen.

Then, select [FLOW] in the RS-232C setup screen to display the flow control ON/OFF setup screen.

Select ON or OFF in the flow control ON/OFF setup screen and then press the [ENTER] key. Flow control is set.

3. Complete the setup.

After completion of setup, press the [COND] key to return to the measurement mode. Here, if you press the [EXIT] key, the current setup is canceled and then the previous screen resumes.

● Setting the ANSWER function (return value) to ON or OFF

Set RS-232C command transmission return value to ON (enabled) or OFF (disabled) with the following procedure.

When set to ON, the CL-5610/5610C returns "G" after normal command reception.

1. Change the mode.

Press the [COND] key to select the setup mode.

2. Select the RS-232C command transmission return value ON/OFF setup screen.

First, select [OTHER], [IF], [RS-232C], and [ANSWER] in this order to display the RS-232C command transmission return value ON/OFF setup screen.

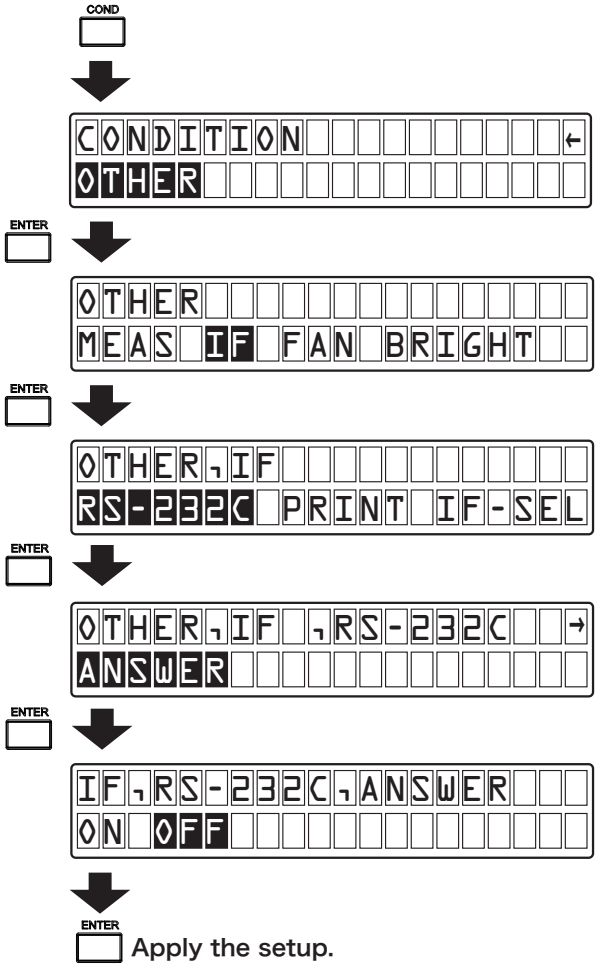
Then, select [ANSWER] in the RS-232C setup screen to display the ANSWER function ON/OFF setup screen.

Select ON or OFF in the ANSWER function ON/OFF setup screen and then press the [ENTER] key. The ANSWER function is set to ON (enabled) or OFF (disabled).

3. Complete setup.

After completion of setup, press the [COND] key to return to the measurement mode.

Here, if you press the [EXIT] key, the current setup is canceled and then the previous screen resumes.


COND
CONDITION
OTHER
ENTER
OTHER
MEAS IF FAN BRIGHT
ENTER
OTHER,IF
RS-232C PRINT IF-SEL
ENTER
OTHER,IF,RS-232C
ANSWER
ENTER
IF,RS-232C,ANSWER
ON OFF
ENTER
Apply the setup.

■ Setting printer conditions

It is possible to print data of DISP1 or DISP2 from an optional printer (DPU-414 recommended by Ono Sokki) connected to RS-232C.

The following describes procedure for selecting DISP1/DISP2 print setup screen.

1. **Change the mode.**

Press the [COND] key to select the setup mode.

2. **Select the print details setup screen.**

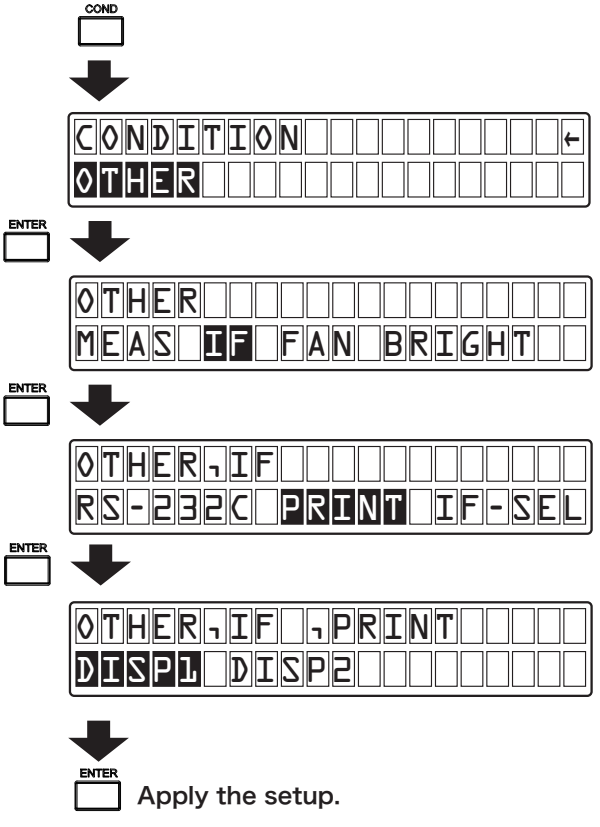
First, select items [OTHER], [IF], and [PRINT] in this order to select the DISP1/DISP2 print setup screen.

Then, select [DISP1] or [DISP2] in the DISP1/DISP2 setup screen, and then press the [ENTER] key to select DISP1 or DISP2.

3. **Complete the setup.**

Upon completion of setup, press the [COND] key to return to the measurement mode.

If you press the [EXIT] key, the current setting is canceled and then the previous screen resumes.



■ Setting interface conditions

Select RS-232C or PRINT (printer DPU-414 recommended by Ono Sokki) according to a device connected to the RS-232C connector.

The following describes procedures for selecting the interface.

1. **Change the mode.**

Press the [COND] key to select the setup mode.

2. **Select the interface setup screen.**

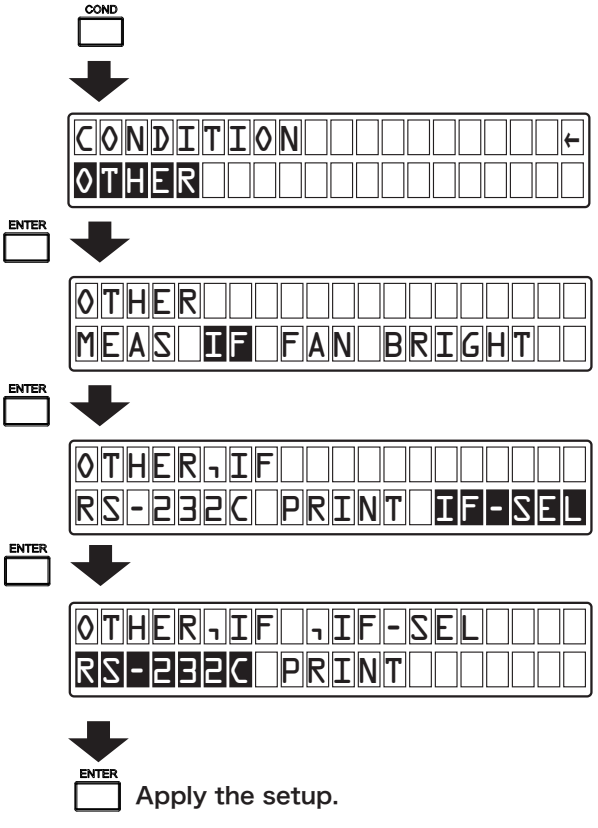
First, select items [OTHER], [IF], and [IF-SEL] in this order to select the interface setup screen.

Then, select RS-232C or PRINT in the interface setup screen, and then press the [ENTER] key to select RS-232C or PRINT as the interface.

3. **Complete the setup.**

Upon completion of setup, press the [COND] key to return to the measurement mode.

If you press the [EXIT] key, the current setting is canceled and then the previous screen resumes.



5.5 Setting Hardware Conditions

Hardware-related condition settings include FAN operation and brightness of the display.

The following describes procedures for setting hardware conditions.

■ Setting FAN conditions

Set the ON/OFF condition of the internal cooling FAN mounted in the CL-5610/5610S Non-Contact Thickness Meter.

In order to maintain stable measurement, we recommend the ON condition. Do not frequently change the ON/OFF condition of the FAN.

The following describes procedures for setting FAN conditions.

1. Change the mode.

Press the [COND] key to select the setup mode.

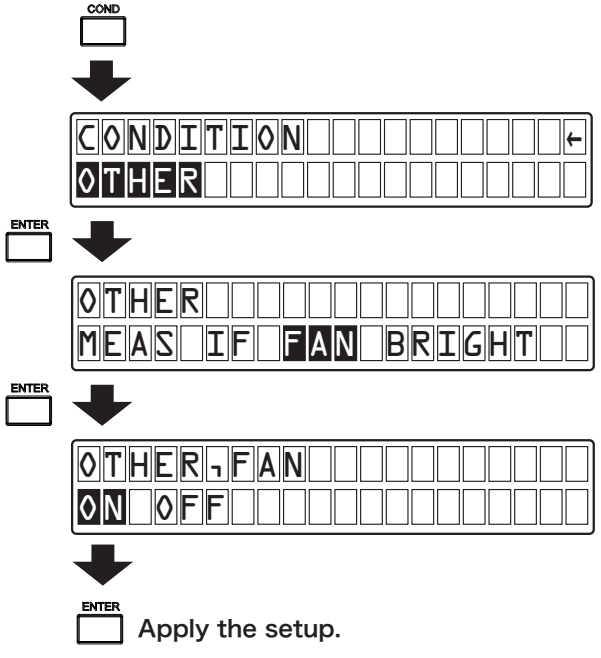
2. Select the FAN control conditions setup screen.

First, select items [OTHER] and [FAN] in this order to select the FAN control setup screen.

Then, select ON/OFF in the FAN control setup screen, and then press the [ENTER] key to select ON/OFF as FAN control.

3. Complete the setup.

Upon completion of setup, press the [COND] key to return to the measurement mode.
If you press the [EXIT] key, the current setting is canceled and then the previous screen resumes.



■ Setting brightness conditions

The brightness of the display can be set to 25 to 100% (100%/75%/50%/25%) of the range according to your measurement environment.

The following describes procedures for changing the brightness.

1. **Change the mode.**

Press the [COND] key to select the setup mode.

2. **Select the display brightness setup screen.**

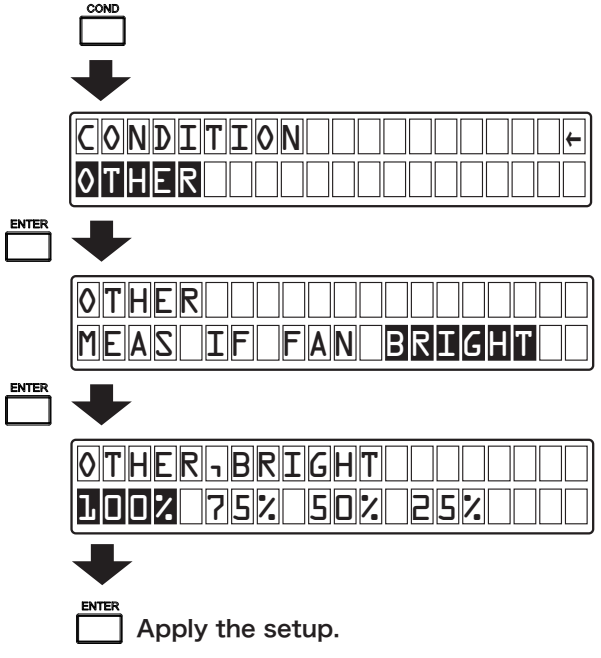
First, select items [OTHER] and [BRIGHT] in this order to select the display brightness setup screen.

Then, select 100%, 75%, 50%, or 25% in the brightness setup screen, and then press the [ENTER] key to set the brightness of the display to 100%, 75%, 50%, or 25%.

3. **Complete the setup.**

Upon completion of setup, press the [COND] key to return to the measurement mode.

If you press the [EXIT] key, the current setting is canceled and then the previous screen resumes.



6. Option Setup: OPTI

The following describes procedures for setting conditions for each specific purpose in the option conditions setup screen.

6.1 Setting Conductor and Insulator Conditions

Before starting thickness measurement, select the type of object under measurement: THK-C (conductor measurement) or THK-I (insulator measurement).

The following describes procedures for selecting conductor or insulator as the type of object under measurement.

1. Change the mode.

Press the [COND] key to select the setup mode.

2. Select the conductor or insulator setup screen.

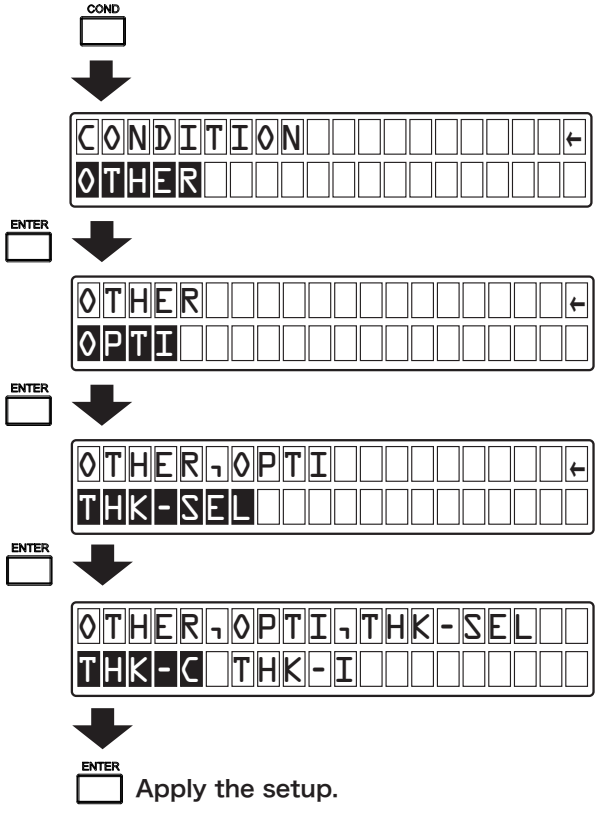
First, select items [OTHER], [OPTI], and [THK-SEL] in this order to select the conductor or insulator setup screen.

Then, select conductor or insulator in the conductor or insulator setup screen, and then press the [ENTER] key to select conductor or insulator as the type of object under measurement.

3. Complete the setup.

Upon completion of setup, press the [COND] key to return to the measurement mode.

If you press the [EXIT] key, the current setting is canceled and then the previous screen resumes.


COND
CONDITION
OTHER
ENTER
OTHER
OPTI
ENTER
OTHER,OPTI
THK-SEL
ENTER
OTHER,OPTI,THK-SEL
THK-C THK-I
ENTER
Apply the setup.

6.2 Setting Reference Gap Ga (or Gb)

The CL-5610/5610S allows you to set a desired numeric value as the value of gap (Ga or Gb) between the VE sensor and the reference floor.

The gap between the VE sensor and the reference floor is set to 0.00 μm as initial value. It can be set to any numerical value.

The settable range is shown below.

Model Name	Standard Display Resolution	High Display Resolution
VE-2011	0 to 99999.9 μm	0 to 9999.99 μm
VE-5010		
VE-5011		
VE-1020		0 to 99999.9 μm
VE-1021		
VE-1520		
VE-3020	0 to 999999 μm	
VE-3021		
VE-8020		0 to 999999 μm
VE-8021		

Memo

- **If the measurement value set by selecting [GAP-SET] is less than zero, an error message (INPUT RANGE ERROR) appears. If an error message appears, press the [ENTER] key and then set a numeric value again. The initial value is 0.00 μm.**

The following describes procedures for setting a gap between the VE sensor and the reference floor.

1. Change the mode.

Press the [COND] key to select the setup mode.

2. Select the setup screen for gap between the VE sensor and the reference floor and then set a desired numeric value.

First, select items [CALIB], [REF-G], and [GAP-SET] in this order.

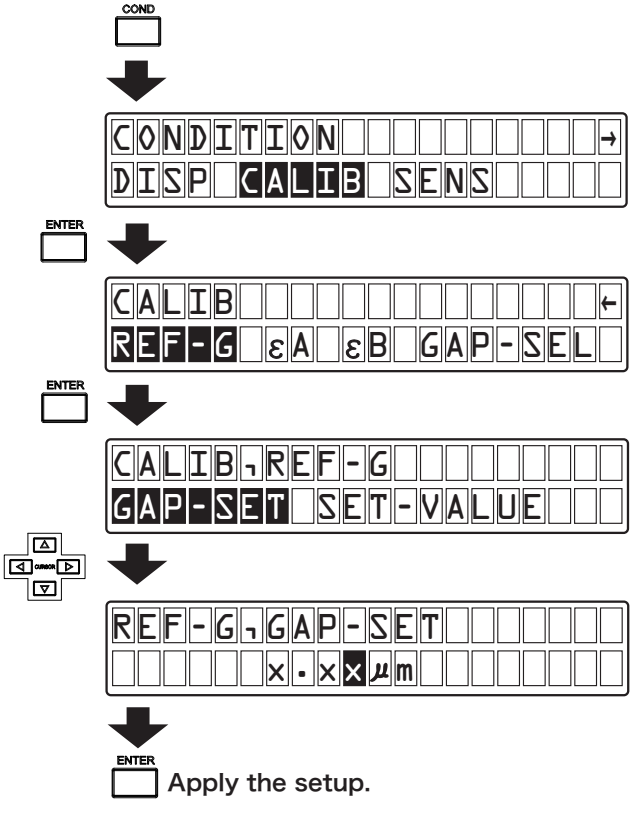
Then, select [GAP-SET] when setting a numeric value from a measurement value or [SET-VALUE] when setting a numeric value from a desired setting, and then press the [ENTER] key to select the setup screen for gap between the VE sensor and the reference floor.

Subsequently, change the setting in the setup screen for gap between the VE sensor and the reference floor using the cursor keys.
Press the [◁] and [▷] cursor keys to select a target digit (highlighted).
Press the [△] and [▽] cursor keys to change (increment or decrement) the numeric value.
Since the unit (μm) and decimal point (.) cannot be changed, the selection cursor cannot be moved thereto.

Finally, after changing the value, press the [ENTER] key to apply the specified gap between the VE sensor and the reference floor.

3. Complete the setup.

Upon completion of setup, press the [COND] key to return to the measurement mode.
If you press the [EXIT] key, the current setting is canceled and then the previous screen resumes.


COND
CONDITION
DISP CALIB SENS
ENTER
CALIB
REF-G εA εB GAP-SEL
ENTER
CALIB ┐REF-G
GAP-SET SET-VALUE
CURSOR
REF-G ┐GAP-SET
x.xx µm
ENTER
Apply the setup.

6.3 Numerical Setup of Relative Permitivity

The CL-5610/5610S allows you to set the thickness of the insulator reference piece and the relative permitivity of the object under measurement to be used during calibration in insulator measurement.

The reference piece is set to 0.00 μm as initial value. It can be set to any numerical value.

The settable range is shown below.

Model name	Standard Display Resolution	High Display Resolution
VE-2011	0 to 99999.9 μm	0 to 9999.99 μm
VE-5010		
VE-5011		
VE-1020		0 to 99999.9 μm
VE-1021		
VE-1520		
VE-3020	0 to 999999 μm	
VE-3021		
VE-8020		0 to 999999 μm
VE-8021		

The relative permitivity is set to 2.000 (initial value) and can be set to any desired numeric value from 1.001 to 100.000.

Memo

- **If the relative permitivity calculated by selecting [MASTER] is out of the setup range, an error message (INPUT RANGE ERROR) appears.**
  If an error message appears, press the [ENTER] key and then set a numeric value again.

The following describes procedures for setting the thickness of the insulator reference piece and the relative permitivity of the object under measurement to be used during calibration in insulator measurement.

1. Change the mode.

Press the [COND] key to select the setup mode.

2. Select the relative permitivity value setup screen and then set a desired numeric value.

First, select item [CALIB] to change the screen.

Then, select item [ε A] or [ε B] to change the screen, select [MASTER] when calculating the relative permitivity from the reference piece or [SET-VALUE] when setting a numeric value from a desired setting, and then press the [ENTER] key to select the relative permitivity value setup screen.

Subsequently, change the setting in the relative permitivity value setup screen using the cursor keys.

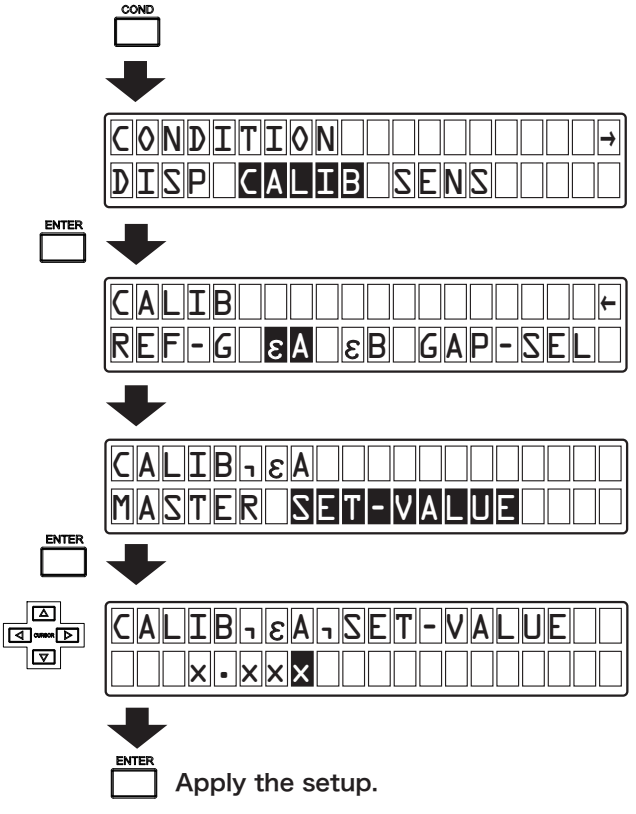
Press the [$\triangleleft$] and [$\triangleright$] cursor keys to select a target digit (highlighted).
Press the [$\triangle$] and [$\triangledown$] cursor keys to change (increment or decrement) the numeric value.

Finally, after changing the value, press the [ENTER] key to apply the specified relative permitivity value.

3. Complete the setup.

Upon completion of setup, press the [COND] key to return to the measurement mode.

If you press the [EXIT] key, the current setting is canceled and then the previous screen resumes.


COND
CONDITION
DISP CALIB SENS
ENTER
CALIB
REF-G εA εB GAP-SEL
CALIB┐εA
MASTER SET-VALUE
ENTER
CALIB┐εA┐SET-VALUE
x.xxx
ENTER
Apply the setup.

6.4 Selecting Gap A/B

At the time of insulator thickness measurement, only one of sensors A or B is enabled.

The following describes procedures for selecting Sensor A or B as a sensor to be used in insulator thickness measurement.

1. Change the mode.

Press the [COND] key to select the setup mode.

2. Select the sensor A/B setup screen.

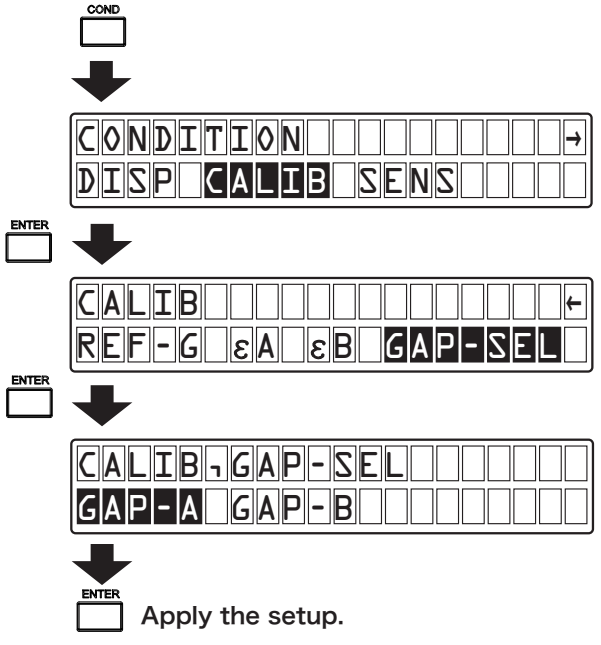
First, select items [CALIB] and [GAP-SET] in this order to select the sensor A/B setup screen.

Select [Sensor A] or [Sensor B] in the sensor setup screen, and then press the [ENTER] key to select Sensor A or B as a sensor to be used for insulator thickness measurement.

3. Complete the setup.

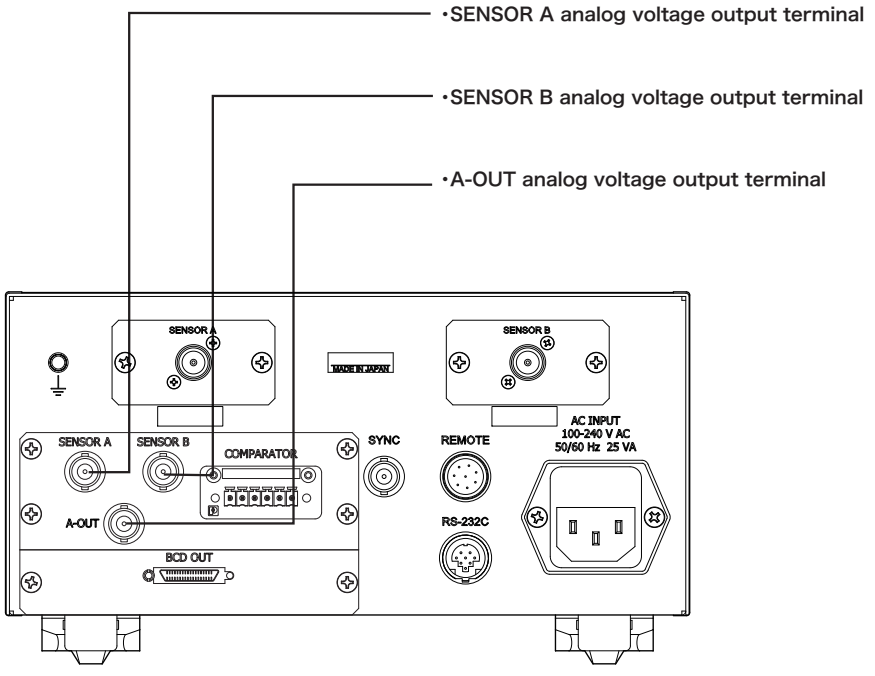
Upon completion of setup, press the [COND] key to return to the measurement mode.

If you press the [EXIT] key, the current setting is canceled and then the previous screen resumes.



6.5 Setting Analog Output Conditions

By adding the optional analog output terminal (THICK/SENSOR A/SENSOR B) to the rear panel of the CL-5610/5610S Non-Contact Thickness Meter, it becomes possible to output updated data for each sampling.



■ Selecting analog output items

Any one of THICK, GAP-A, and GAP-B/A-B can be output from the analog output terminal (A-OUT).
The following describes procedures for selecting analog output items.

1. **Change the mode.**
Press the [COND] key to select the setup mode.

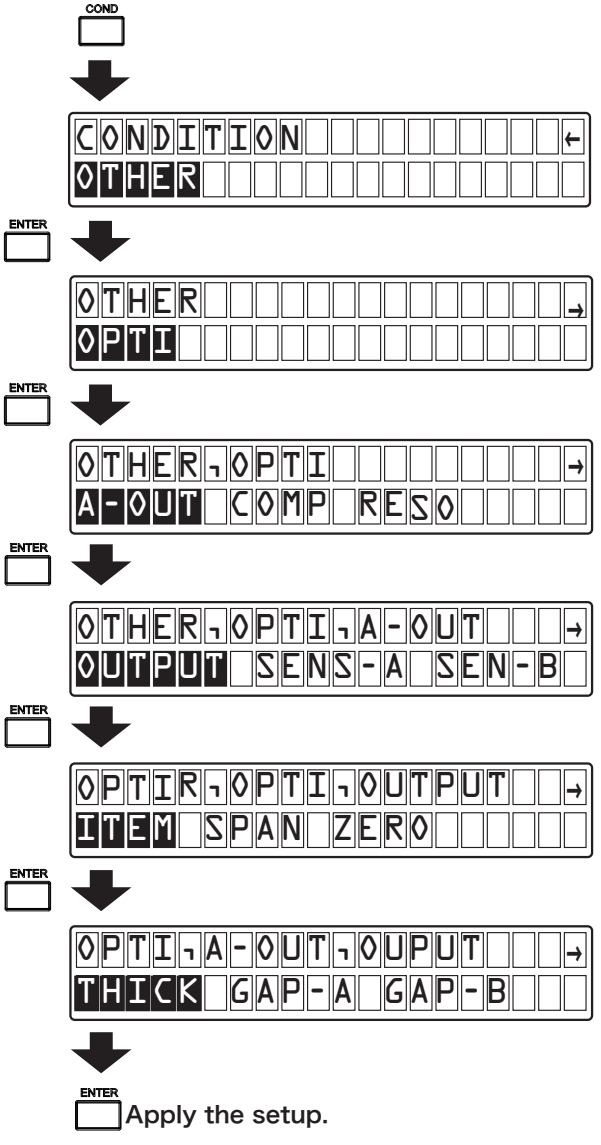
2. **Display the analog output item selection screen.**
Select [OTHER], [OPTI], [A-OUT], [OUTPUT], and [ITEM] in this order.

Then, select an analog output item on the analog output item selection screen and then press the [ENTER] key. The selected analog output item is applied.

3. Complete setup.

Upon completion of setup, press the [COND] key to return to the measurement mode.

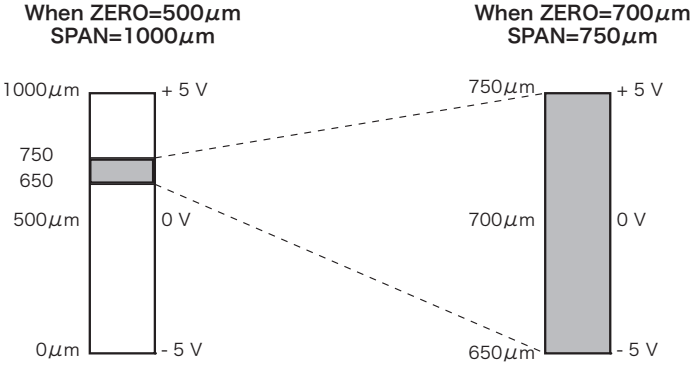
If you press the [EXIT] key, the current setup is canceled and then the previous-level screen resumes.



■ Setting SPAN and ZERO output ranges from analog output

A ± 5V analog voltage with any full scale can be output from the analog output (A-OUT) terminal.

For example, when the SPAN and ZERO output ranges are set as shown below, a ± 5V analog voltage for the set value is output from the analog output (A-OUT) terminal..



The following describes procedures for setting the SPAN and ZERO output ranges from the analog output (A-OUT) terminal.

The SPAN and ZERO output ranges from the analog output (A-OUT) terminal are initially set to 0.00 μm. These values can be set within a range from -999999.99 to 999999.99 μm.

1. Change the mode.

Press the [COND] key to select the setup mode.

2. Display the setup screen for setting the SPAN or ZERO output range from the analog output (A-OUT) terminal, and then set desired values.

Select [OTHER], [OPTI], [A-OUT], and [OUTPUT] in this order.

Then, select SPAN when setting the SPAN value from the analog output (A-OUT) terminal or ZERO when setting the ZERO value from the analog output (A-OUT) terminal, and then press the [ENTER] key. The setup screen for setting the SPAN or ZERO output range from the analog output (A-OUT) terminal appears.

Subsequently, change the setting in the output range value setup screen using the cursor keys.

Press the [◁] and [▷] cursor keys to select a target digit (highlighted).
Press the [△] and [▽] cursor keys to change (increment or decrement) the numeric value.

After setting numerical values, press the [ENTER] key. The set SPAN or ZERO output range from the analog output (A-OUT) terminal is applied.

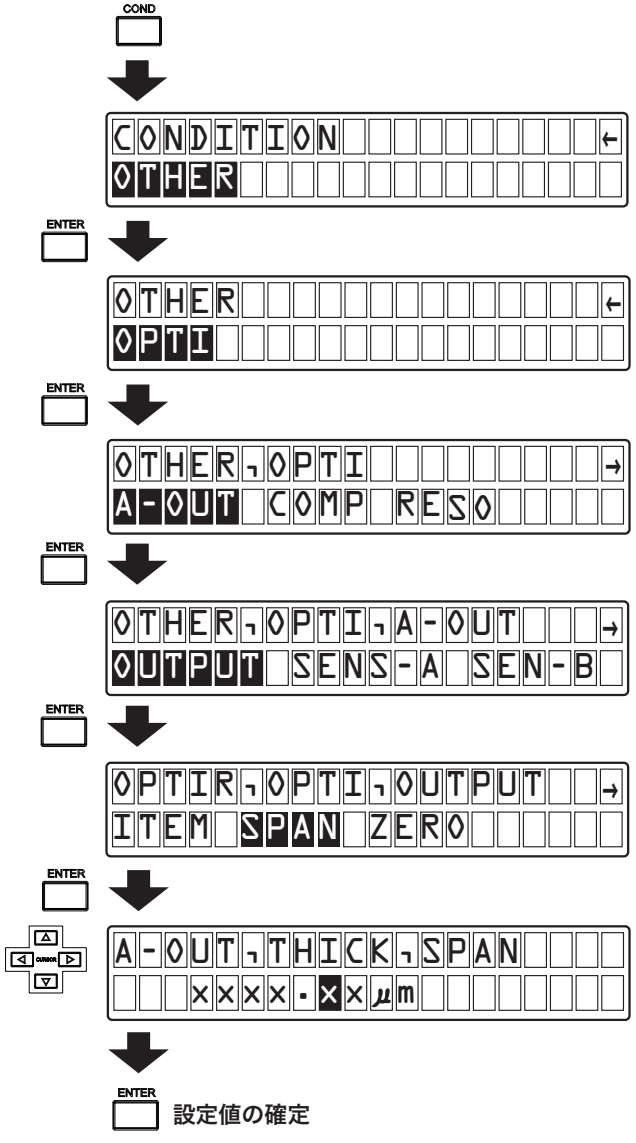
3. Complete the setup.

Upon completion of setup, press the [COND] key to return to the measurement mode.

If you press the [EXIT] key, the current setting is canceled and then the previous screen resumes.

Memo

- **If the zero value exceeds the span value, an error message (INPUT RANGE ERROR) appears. If an error message appears, press the [ENTER] key and then set a numeric value again so that condition "SPAN value > ZERO value" is satisfied.**



■ Setting an offset value

It is possible to give an offset of 0 to −5V to the output voltage of SENSOR A or SENSOR B.

The following describes procedures for giving an offset of 0 to −5V to the output voltage of SENSOR A or SENSOR B.

The offset value in the output voltage of SENSOR A or SENSOR B is set to 0% (initial value) and can be set to any desired numeric value from 0 to 100% (0 to −5V).

1. Change the mode.

Press the [COND] key to select the setup mode.

2. **Select the offset value setup screen and set a desired numeric value.**

First, select items [OTHER], [OPTI], and [A-OUT] in this order.

Then, select [SENS-A] and [A-OFS] when setting an offset in the output voltage of SENSOR A, or [SENS-B] and [B-OFS] when setting an offset in the output voltage of SENSOR B, and then press the [ENTER] key. The offset value setup screen appears.

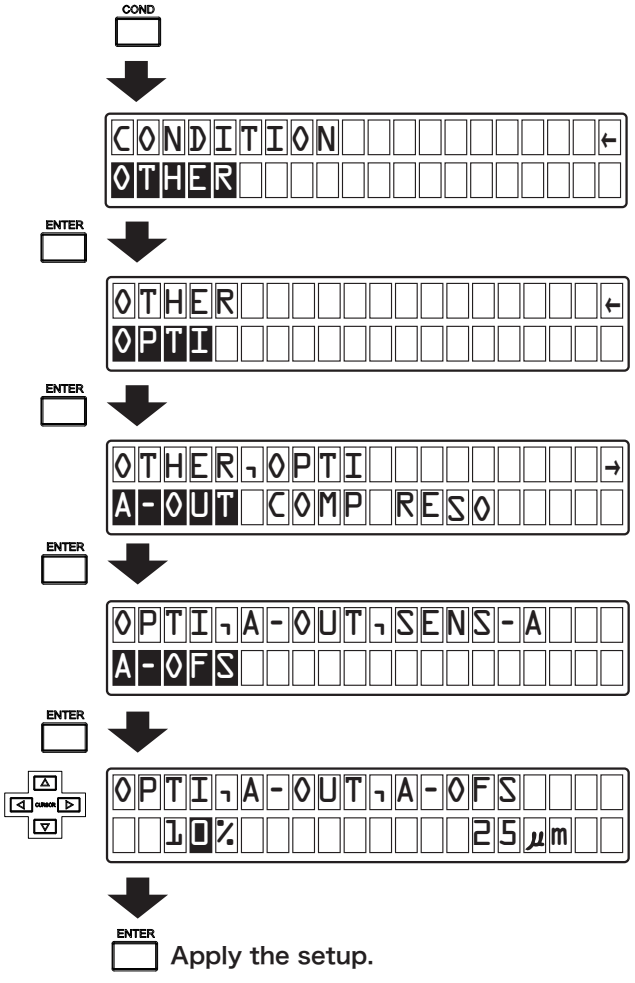
In the example above, [SENS-A] and [A-OFS] are selected.

Subsequently, change the setting in the offset value setup screen using the cursor keys.
Press the [◁] and [▷] cursor keys to select a target digit (highlighted).
Press the [△] and [▽] cursor keys to change (increment or decrement) the numeric value.

Since the unit (%) cannot be changed, the selection cursor cannot be moved thereto.

3. **Complete the setup.**

Upon completion of setup, press the [COND] key to return to the measurement mode.
If you press the [EXIT] key, the current setting is canceled and then the previous screen resumes.

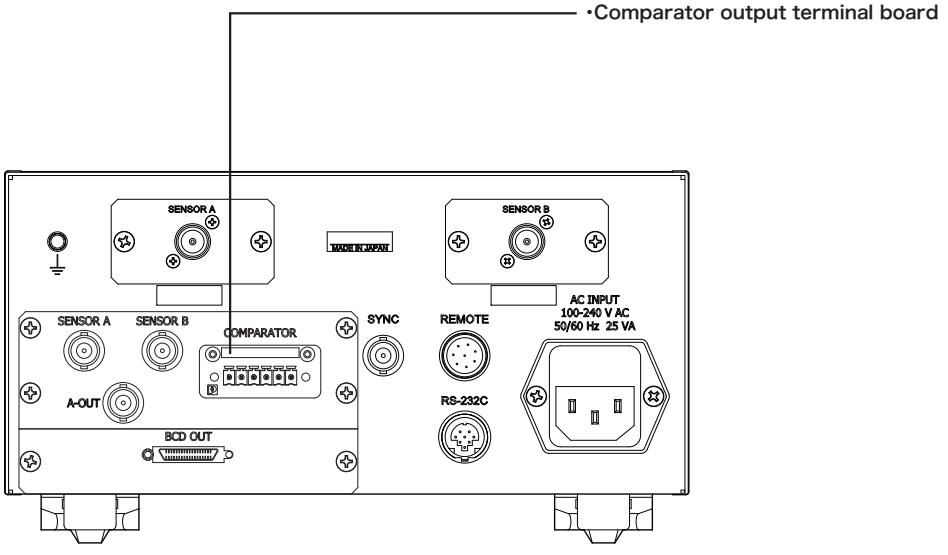


6.6 Setting Comparator Output Conditions

It is possible to add the three-channel comparator output function to the CL-5610/5610S Non-Contact Thickness Meter.

When the comparator output function has been added, it becomes possible to output a result of comparison of a measurement value with a setup value from the comparator output terminal board on the rear panel of CL-5610/5610S Non-Contact Thickness Meter.

Comparison is performed for each sampling and the result is output as a non-voltage contact (1a).



■ Setting comparator conditions

For the comparator terminal on the rear panel of the CL-5610/5610S Non-Contact Thickness Meter to which the comparator output function has been added, select comparator condition COMP1/2/3 (using comparator 1/2/3 independently: initial value) or COMP-ALL (using comparator 1/2/3 for judgment of UPPER/LOWER).

1. **Change the mode.**

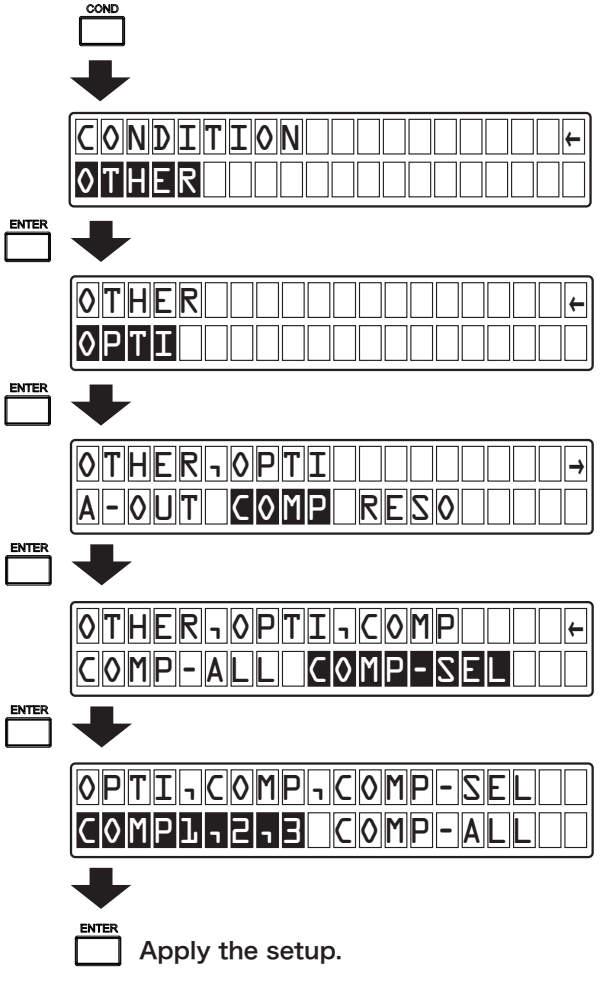
Press the [COND] key to select the setup mode.

2. **Change to the COMP1/2/3 or COMP-ALL setup screen.**

First, select items [OTHER], [OPTI], [COMP], and [COMP-SEL] in this order to select the COMP1/2/3 or COMP-ALL setup screen.
Then, select [COMP1,2,3] or [COMP-ALL] in the COMP1/2/3 or COMP-ALL setup screen, and then press the [ENTER] key to set the comparator to COMP1/2/3 or COMP-ALL.

3. **Complete the setup.**

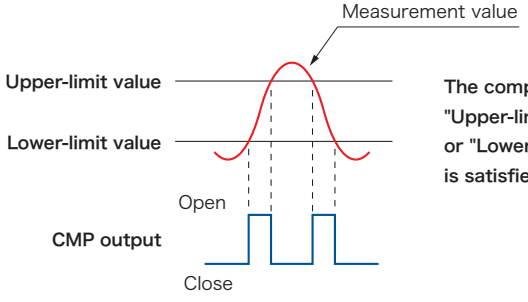
Upon completion of setup, press the [COND] key to return to the measurement mode.
If you press the [EXIT] key, the current setting is canceled and then the previous screen resumes.


COND
CONDITION
OTHER
ENTER
OTHER
OPTI
ENTER
OTHER,OPTI
A-OUT COMP RESO
ENTER
OTHER,OPTI,COMP
COMP-ALL COMP-SEL
ENTER
OPTI,COMP,COMP-SEL
COMP1,2,3 COMP-ALL
ENTER
Apply the setup.

■ Setup for using COMP1/COMP2/COMP3 separately

It is possible to set a comparison item and a threshold value to each of comparators (COMP1, COMP2, and COMP3) for three channels.

Each comparator operates as shown below.



The comparator contact output closes if condition "Upper-limit setting (UPPER) < Measurement value" or "Lower-limit setting (LOWER) > Measurement value" is satisfied.

The following describes procedures for setting a comparison item and a threshold value to each of comparators (COMP1, COMP2, and COMP3) for each channel.

The threshold value for each of comparators (COMP1, COMP2, and COMP3) is set to 0.00 μm (initial value) and can be set to any desired numeric value from 0.00 to 999999.99 μm.

1. Change the mode.

Press the [COND] key to select the setup mode.

2. Select the comparison item setup screen.

First, select items [OTHER], [OPTI], and [COMP] in this order to change the screen.

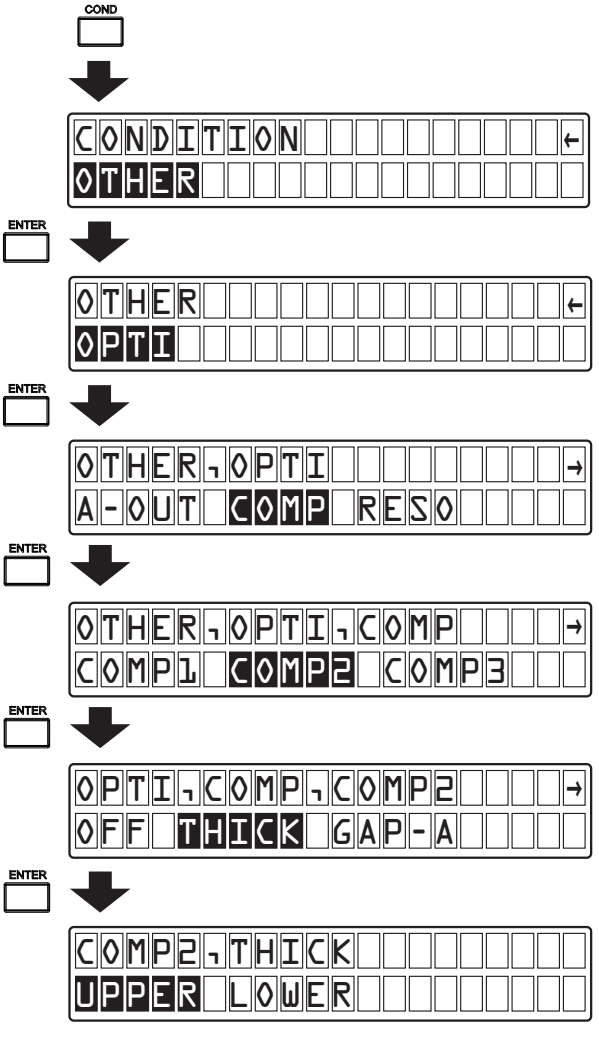
Then, select the comparator (COMP1/COMP2/COMP3) of the target channel, and then press the [ENTER] key to select the comparison item setup screen.

Subsequently, select OFF or a comparison item (THICK/GAP-A/GAP-B/A-B) in the comparison item setup screen, and then press the [ENTER] key to set the comparison item.

3. Set a desired numeric value for UPPER and LOWER as required.

If other than OFF is selected as a comparison item, the UPPER (comparator upper-limit: initial value 0.00 μm) or LOWER (comparator lower-limit: initial value 0.00 μm) comparator value setup screen appears.

Select [UPPER] or [LOWER] for comparator value setup, and then press the [ENTER] key to display the comparator value setup screen.

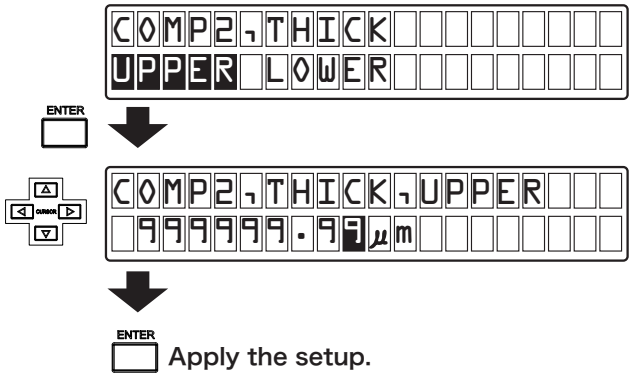


The UPPER (comparator upper-limit: initial value 0.00 μm) comparator value setup screen is shown below. Change the setting using the cursor keys.

Press the [◁] and [▷] cursor keys to select a target digit (highlighted).

Press the [△] and [▽] cursor keys to change (increment or decrement) the numeric value.

After changing the comparator value, press the [ENTER] key to apply the specified UPPER comparator value.



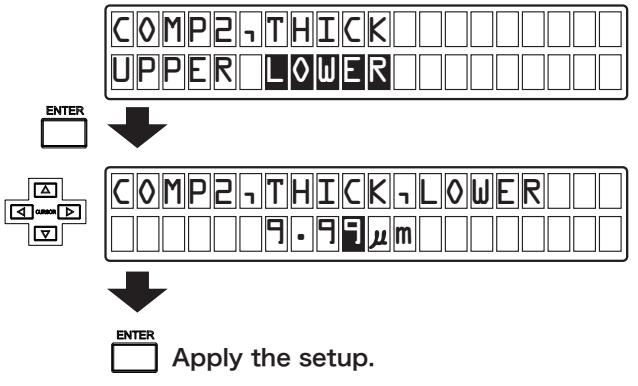
The LOWER (comparator lower-limit: initial value 0.00 µm) comparator value setup screen is shown below. Change the setting using the cursor keys.

Press the [◁] and [▷] cursor keys to select a target digit (highlighted).

Press the [△] and [▽] cursor keys to change (increment or decrement) the numeric value.

Since the unit (µm) and decimal point (.) cannot be changed, the selection cursor cannot be moved thereto.

After changing the comparator value, press the [ENTER] key to apply the specified LOWER comparator value.



4. **Complete the setup.**

Upon completion of setup, press the [COND] key to return to the measurement mode.

If you press the [EXIT] key, the current setting is canceled and then the previous screen resumes.

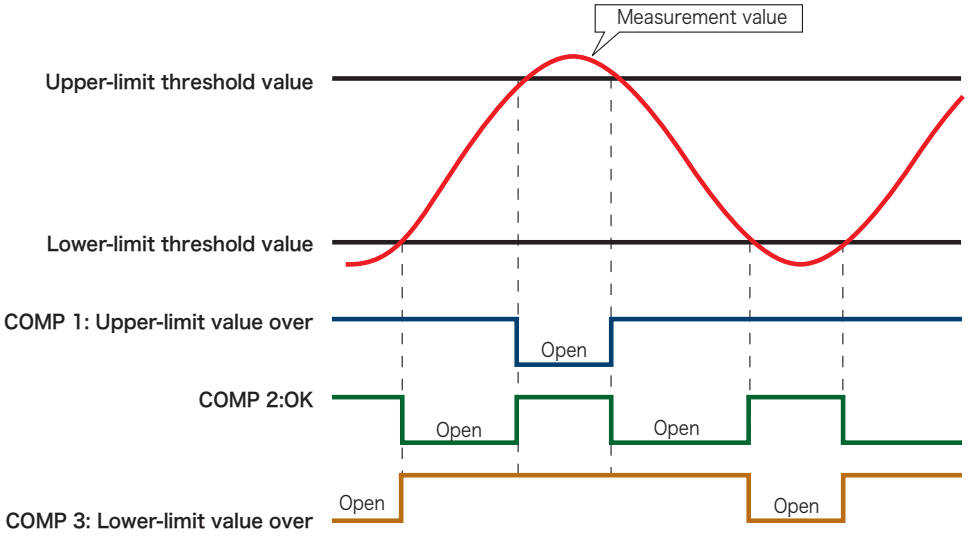
Memo

- **If a value equal to or greater than the upper-limit value (UPPER) is set as the lower-limit value (LOWER), an error message (INPUT RANGE ERROR) appears. If an error message appears, press the [ENTER] key and then set a numeric value again so that condition "Lower-limit value (LOWER) < Upper-limit value (UPPER)" is satisfied.**

■ Comparator ALL (COMP-ALL) mode

When "COMP-ALL" is selected as a condition for the comparator terminal for three channels, operations of COM1, COM2, and COM3 are as shown below. In this case, only one item can be compared.

COMP1	Upper-limit value over
COMP2	OK
COMP3	Lower-limit value over



The following describes procedures for setting upper-limit and lower-limit threshold values.

Each of the upper-limit and lower-limit threshold values is set to 0.00 μm (initial value) and can be set to any desired numeric value from 0.00 to 999999.99 μm.

1. Change the mode.

Press the [COND] key to select the setup mode.

2. Select the comparator setup screen.

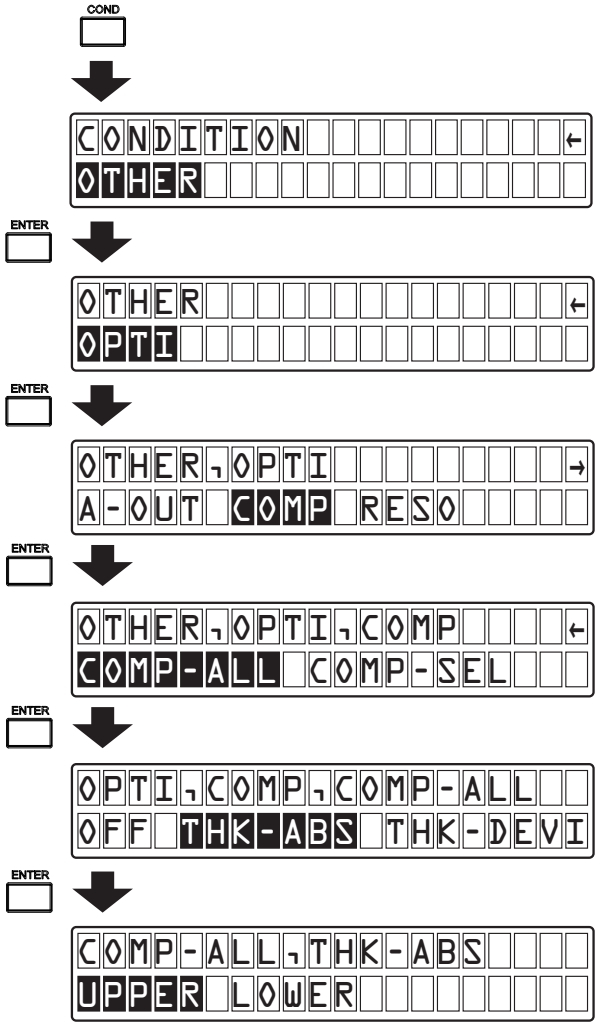
First, select items [OTHER], [OPTI], [COMP], and [COMP-ALL] in this order and then press the [ENTER] key to select the comparator setup screen.

Then, select OFF or a comparator item (THK-ABS/THK-DEVI) in the comparator setup screen, and then press the [ENTER] key to apply the specified comparator setting.

3. Set a desired numeric value for UPPER and LOWER as required.

When [THK-ABS] or [THK-DEVI] is selected in the comparator setup screen, the UPPER (comparator upper-limit: initial value 0.00 μm) or LOWER (comparator lower-limit: initial value 0.00 μm) comparator value setup screen appears.

Select [UPPER] or [LOWER] for comparator value setup, and then press the [ENTER] key to display the comparator value setup screen.

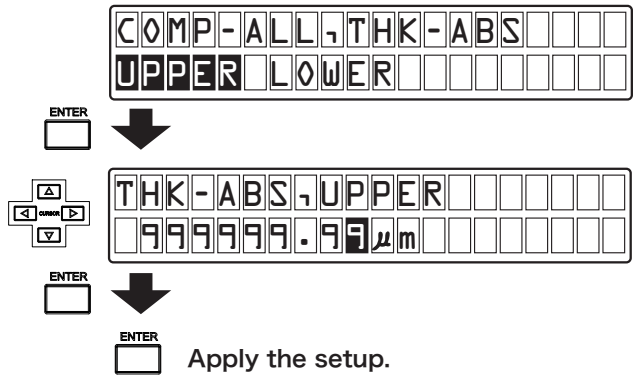


The UPPER (comparator upper-limit: initial value 0.00 μm) comparator value setup screen is shown below. Change the setting using the cursor keys.

Press the [◁] and [▷] cursor keys to select a target digit (highlighted).

Press the [△] and [▽] cursor keys to change (increment or decrement) the numeric value.

After changing the comparator value, press the [ENTER] key to apply the specified UPPER comparator value.

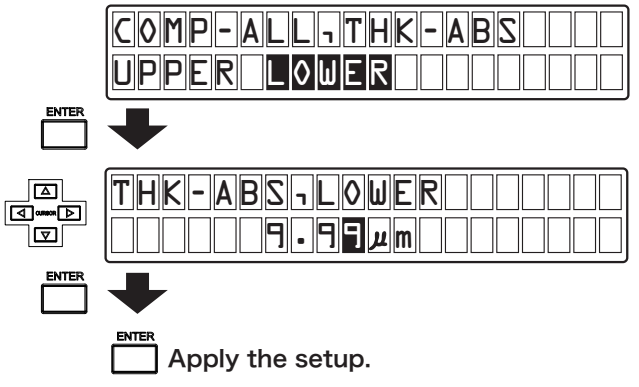


The LOWER (comparator lower-limit: initial value 0.00 μm) comparator value setup screen is shown below. Change the setting using the cursor keys.

Press the [◁] and [▷] cursor keys to select a target digit (highlighted).

Press the [△] and [▽] cursor keys to change (increment or decrement) the numeric value.

After changing the comparator value, press the [ENTER] key to apply the specified LOWER comparator value.



4. **Complete the setup.**

Upon completion of setup, press the [COND] key to return to the measurement mode.

If you press the [EXIT] key, the current setting is canceled and then the previous screen resumes.

Memo

- **If a value equal to or greater than the upper-limit value (UPPER) is set as the lower-limit value (LOWER), an error message appears. If an error message appears, press the [ENTER] key and then set a numeric value again so that condition "Lower-limit value (LOWER) < Upper-limit value (UPPER)" is satisfied.**

6.7 Setting Display Resolution

The display resolution differs for each individual sensor as shown below.

Model	Measuring range	Resolution μm	
		Standard display	High resolution
VE-5010	20 to 200 μm	0.1	0.02
	50 to 500 μm		0.05
VE-1020	100 to 1000 μm		0.1
VE-1520	150 to 1500 μm	0.5	0.2
VE-3020	300 to 3000 μm	1.0	0.5
VE-8020	800 to 8000 μm	2.0	1.0
VE-2011	20 to 200 μm	0.1	0.02
VE-5011	20 to 200 μm		
	50 to 500 μm		0.05
VE-1021	100 to 1000 μm		0.1
VE-3021	300 to 3000 μm	1.0	0.5
VE-8021	800 to 8000 μm	2.0	1.0

The following describes procedures for setting the display resolution: NORMAL (normal resolution: initial value) or HI-RESO (high resolution)

1. Change the mode.

Press the [COND] key to select the setup mode.

2. Select the display resolution setup screen.

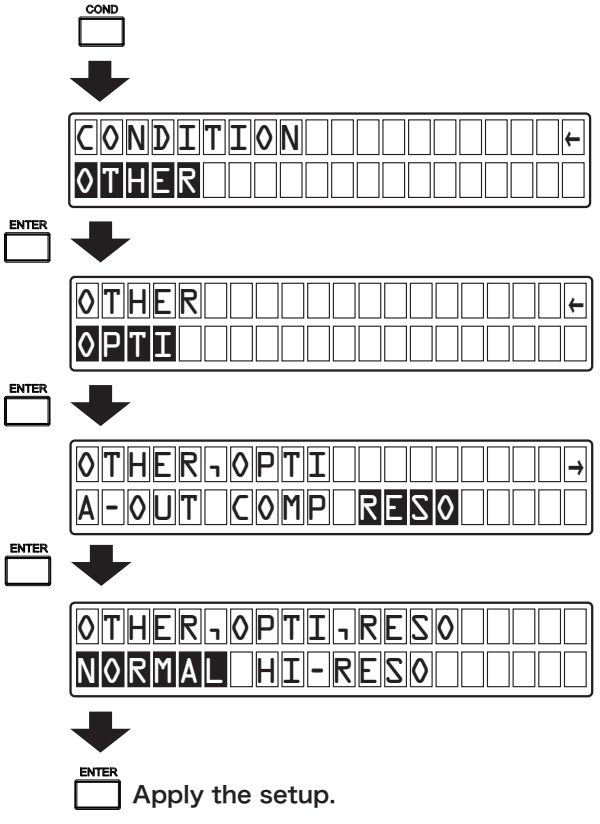
First, select [OTHER], [OPTI], and [RESO] in this order to select the display resolution setup screen (NORMAL (normal resolution: initial value) or HI-RESO (high resolution)).

Then, select [NORMAL] or [HI-RESO] in the display resolution setup screen, and then press the [ENTER] key to set the display resolution to NORMAL (normal resolution: initial value) or HI-RESO (high resolution).

3. Complete the setup.

Upon completion of setup, press the [COND] key to return to the measurement mode.

If you press the [EXIT] key, the current setting is canceled and then the previous screen resumes.


COND
CONDITION
OTHER
ENTER
OTHER
OPTI
ENTER
OTHER,OPTI
A-OUT COMP RESO
ENTER
OTHER,OPTI,RESO
NORMAL HI-RESO
ENTER
Apply the setup.

6.8 Registering Sensor Correction Coefficient Data

The CL-5610/5610S allows you to register again correction data for matching between the sensor and the CL-5610/5610S Non-Contact Thickness Meter.

Normally, matching between the sensor and the CL-5610/5610S Non-Contact Thickness Meter is performed by Ono Sokki because a special jig is required.

However, if registered correction coefficient data for matching has been damaged for a certain reason, the data can be registered again with the following procedures:

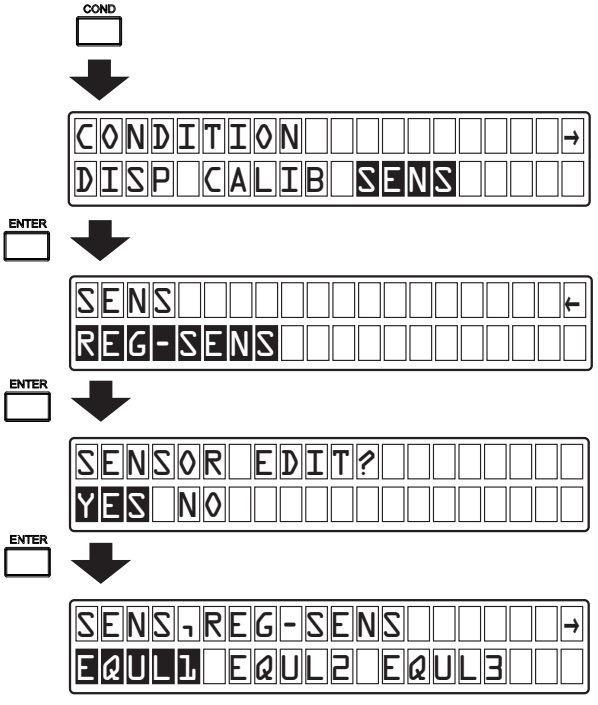
1. **Change the mode.**

Press the [COND] key to select the setup mode.

2. **Select the screen for confirming the re-registration of correction coefficient data.**

First, select items [SENS] and [REG-SENS] in this order to select the screen for confirming the re-registration of correction coefficient data.

Select [YES] and then press the [ENTER] key to select the registration location (EQUL1-6) setup screen.



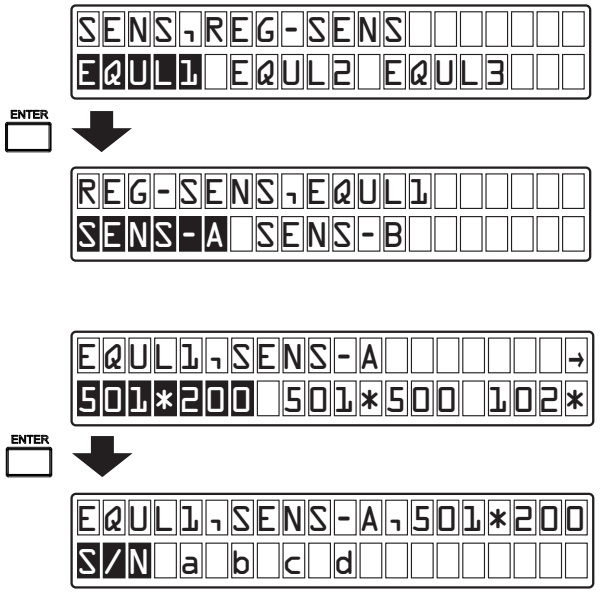
3. **Select registration item S/N (serial number) or a/b/c/d (correction coefficient).**

First, select a registration location (EQUAL1-6) in the registration location setup screen, and then press the [ENTER] key to select the sensor channel (SENS-A/SENSA-B) setup screen.

Then, select sensor channel [SENS-A] or [SENSA-B] in the sensor channel setup screen, and then press the [ENTER] key to select the sensor channel type setup screen.

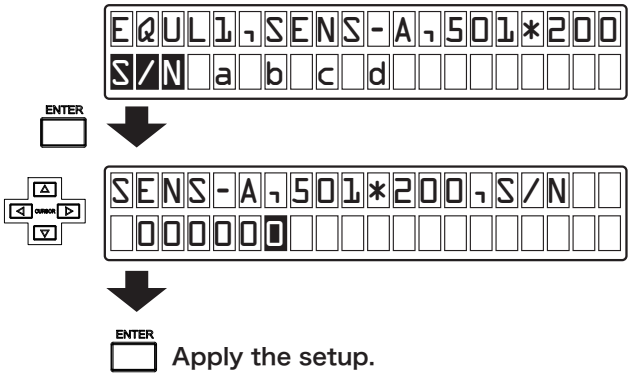
Subsequently, select the sensor channel type (501*200/501*500/102*/152*/302*/802*) in the sensor channel type setup screen, and then press the [ENTER] key to select the registration item setup screen.

Finally, select registration item S/N (serial number) or a/b/c/d (correction coefficient) in the registration item setup screen, and then press the [ENTER] key to select the numerical setup screen for S/N (serial number) or a/b/c/d (correction coefficient).



4. **Set a desired numeric value as S/N (serial number) or a/b/c/d (correction coefficient).**

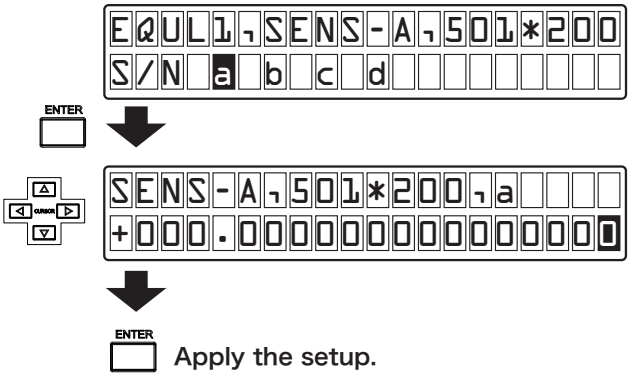
The S/N (serial number) setup screen is shown below. Change the setting using the cursor keys.
Press the [◁] and [▷] cursor keys to select a target digit (highlighted).
Press the [△] and [▽] cursor keys to change (increment or decrement) the numeric value.
After changing the serial number value, press the [ENTER] key to apply the specified (a new) serial number value.



The a/b/c/d (correction coefficient) setup screen is shown below. Change the setting using the cursor keys.

Press the [◁] and [▷] cursor keys to select a target digit (highlighted).
Press the [△] and [▽] cursor keys to change (increment or decrement) the numeric value.
In the case of the correction coefficient, the sign can also be changed.

After changing the correction coefficient value, press the [ENTER] key to apply the specified (a new) correction coefficient value.



4. **Complete the setup.**

Upon completion of setup, press the [COND] key to return to the measurement mode.

If you press the [EXIT] key, the current setting is canceled and then the previous screen resumes.

Memo

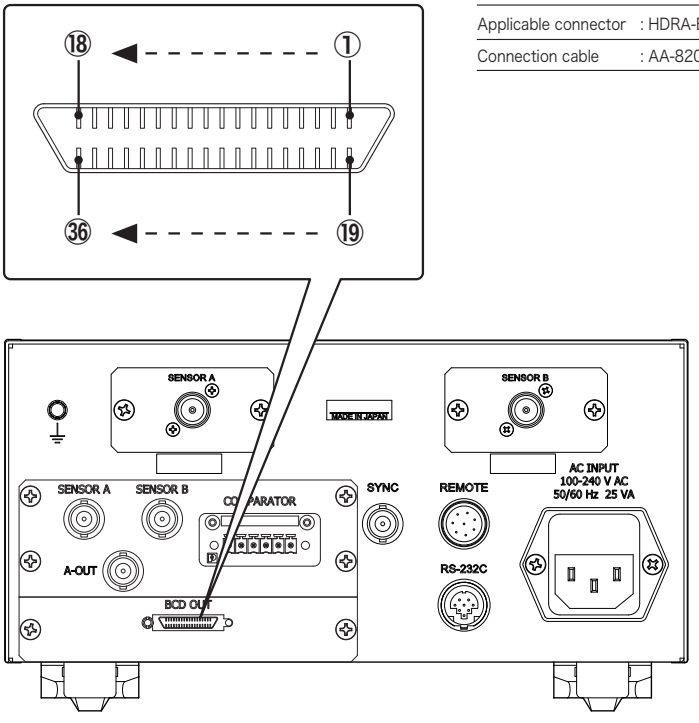
- **If you purchase the CL-5610/5610S Non-Contact Thickness Meter and the VE Series sensor at the same time, equalization is performed by Ono Sokki before shipment.**
  However, if you purchase the sensor after the purchase of the CL-5610/5610S Non-Contact Thickness Meter, you need to perform equalization again. For details, contact Ono Sokki agency or sales office nearby.
- **Equalization refers to matching (fine tuning) of individual deviation of the CL-5610/5610S Non-Contact Thickness Meter and the VE Series sensor, which is performed at the time of shipment. Required measurement accuracy can be obtained by the use of sensors subjected to equalization.**

6.9 BCD Output

There are five different BCD output items: THICK, GAP A, GAP B, A-B and DISP2.

Any one of the five items can be output. Data is updated at 20-ms sampling intervals.

■ BCD I/O connector pin assignments



Applicable connector	: HDRA-E36MA (HONDA TSUSHIN KOGYO)
Connection cable	: AA-8207 (3m, top end open)

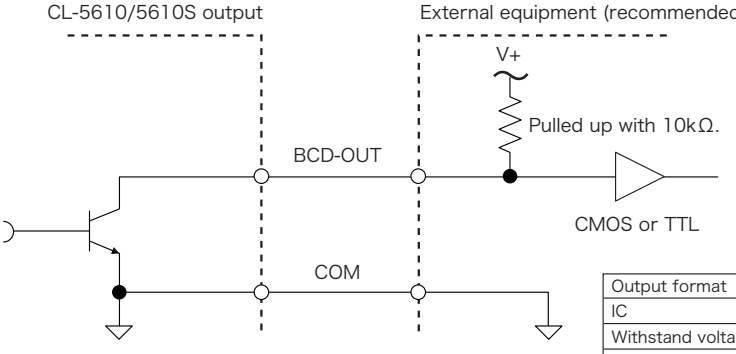
All mass data of the CL-5610/5610S Non-Contact Thickness Meter is open collector output data.

The pin signal line function table indicates the logic recognized by external equipment when each signal is connected to external equipment through a recommended interface.

Pin	I/O	Signal		Function
1	O	1	10^0data output	
2	O	2		
3	O	4		
4	O	8		
5	O	1	10^1data output	
6	O	2		
7	O	4		
8	O	8		
9	O	1	10^2data output	
10	O	2		
11	O	4		
12	O	8		
13	O	1	10^3data output	
14	O	2		
15	O	4		
16	O	8		
17	O	1	10^4data output	
18	O	2		
19	O	4		
20	O	8		
21	O	1	10^5data output	
22	O	2		
23	O	4		
24	O	8		
25	O	–	SIGN	Outputs a sign. • High : (−) /Low : (+)
26	O	0	DP0	Outputs the decimal place of measurement value. • DP 0 1 2 L L H XXXXX.X L H L XXXX.XX L H H XXX.XXX H L L XX.XXXX H L H X.XXXXX H H L XXXXXX
27	O	1	DP1	
28	O	2	DP2	
29	O	0	UNIT0	Outputs the decimal place of measurement value. • UNIT 0 1 2 H H L mm H H H μm
32	O	#START		Set to the L level during the calculation mode.
33	O	#ERROR		Output when the measurement value of Gap A/B exceeds 130% of the sensor rating, when the calculation value of THICK is negative, or when the calculation value exceeds the number of display digits.
34	I	#HOLD		Holds the BCD data.
35	O	#DAV		BCD data is effective at the time of a High level.
36	–	COM		

■ Recommended interfaces

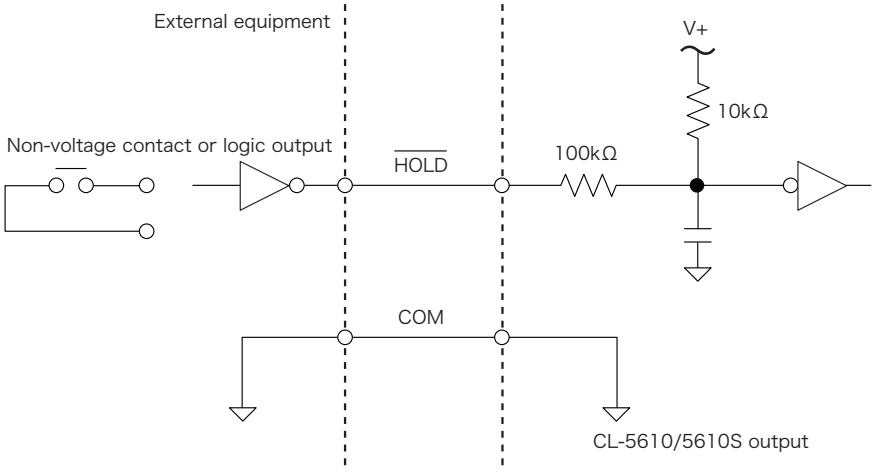
● 100 - 105/SIGN/DP0 - DP2/UNIT0 - 2/START/ERROR/DAV outputs



Output format	Open collector
IC	74LS07
Withstand voltage	24 V max
Sink current	32 mA max
Residual voltage	0.6 V max

● 100 - 105/SIGN/DP0 - DP2/UNIT0 - 2/START/ERROR/DAV outputs

Be sure to input a signal without chattering.



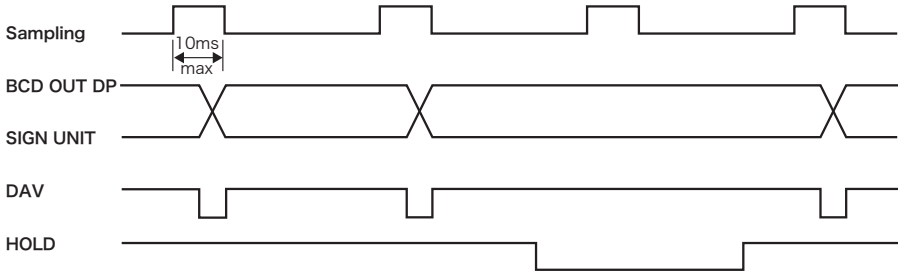
At contact output

Load voltage	5 V DC min
Load current	100 mA min
ON resistance	10Ω max
OFF resistance	1kΩ max

At logic output

Output Lo level voltage	0 to 1.0 V
Output Hi level voltage	3.5 to 5.25 V
Output impedance	1kΩ max

■ BCD output timing chart



■ BCD output setup

1. **Change the mode.**

Press the [COND] key to select the setup mode.

2. **Select the BCD output setup screen.**

First, select [OTHER], [OPTI], and [BCD] in this order to display the screen for selecting an output item.

Then, select the BCD output ([THICK]/[GAP A]/[GAP B]/[A-B],and [DISP2]) in the BCD output setup screen and then press the [ENTER] key. The BCD output is set.

3. **Complete setup.**

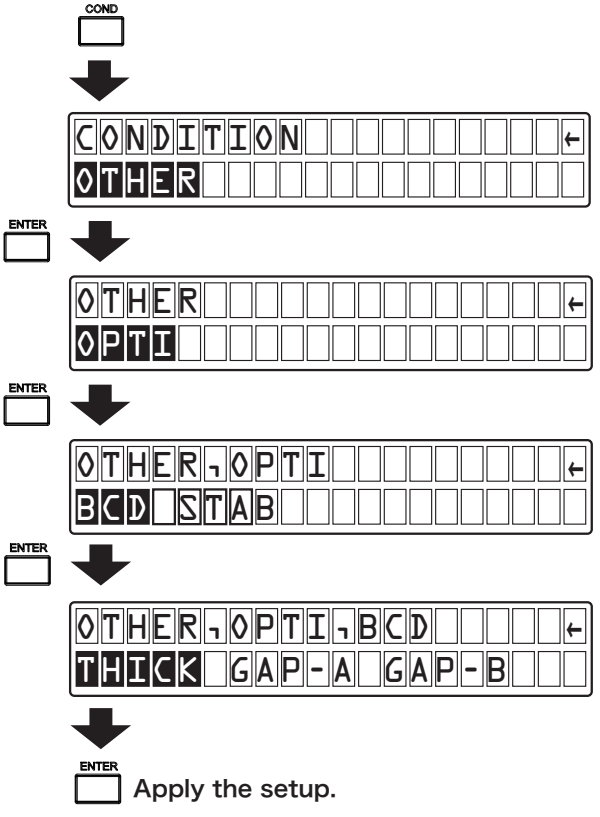
After completion of setup, press the [COND] key to return to the measurement mode.

Here, if you press the [EXIT] key, the current setup is canceled and then the previous screen resumes.

● When COMP is set as DISP2

When COMP (status display of comparator) is set as DISP2, items subjected to BCD output are as follows:

Comparator setting	BCD output
Individual mode (COMP1/2/3 is set for individual mode)	Item set as COMP1
ALL mode (COMP1/2/3 is used as upper-limit/OK/lower-limit)	Item set as COMP-ALL


COND
CONDITION
OTHER
ENTER
OTHER
OPTI
ENTER
OTHER,OPTI
BCD STAB
ENTER
OTHER,OPTI,BCD
THICK GAP-A GAP-B
ENTER
Apply the setup.

6.10 Setting High-impedance Ground Mode

The outer case of the VE sensor or the CL-5610/5610S Non-Contact Thickness Meter and the object under measurement must be maintained at the same potential.

When the high-impedance ground mode is set to (ON), stable measurement can be performed even under a condition where the outer case of the VE sensor or the ground terminal of the CL-5610/5610S Non-Contact Thickness Meter is connected with the object under measurement with a certain impedance.

1. **Change the mode.**

Press the [COND] key to select the setup mode.

2. **Select the high-impedance ground mode setup screen.**

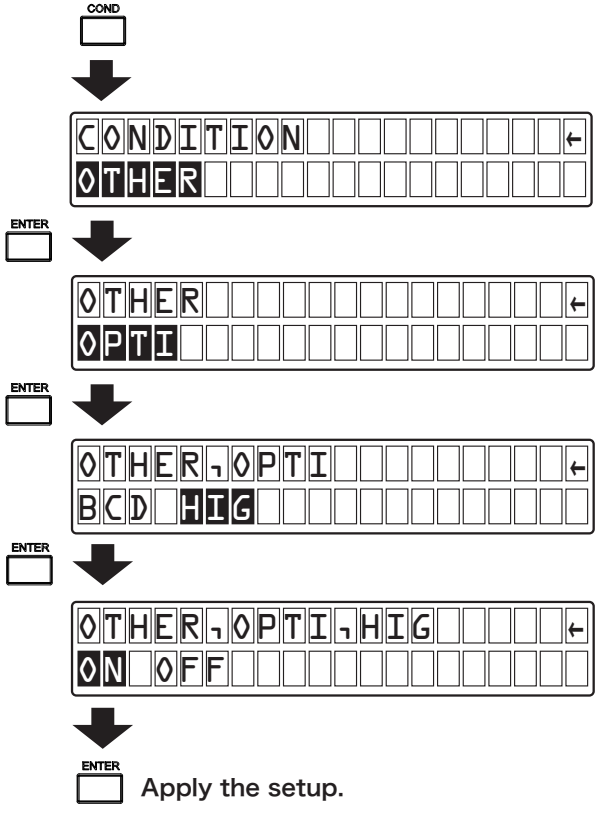
First, select items [OTHER], [OPTI], and [HIG] in this order to select the high-impedance ground mode setup screen.

Then, select ON (enabled) or OFF (disabled) in the high-impedance ground mode setup screen and then press the [ENTER] key.

3. **Complete a setup.**

After completion of setup, press the [COND] key to return to the measurement mode.

Here, if you press the [EXIT] key, the current setup is canceled and then the previous screen resumes.



Chapter 4

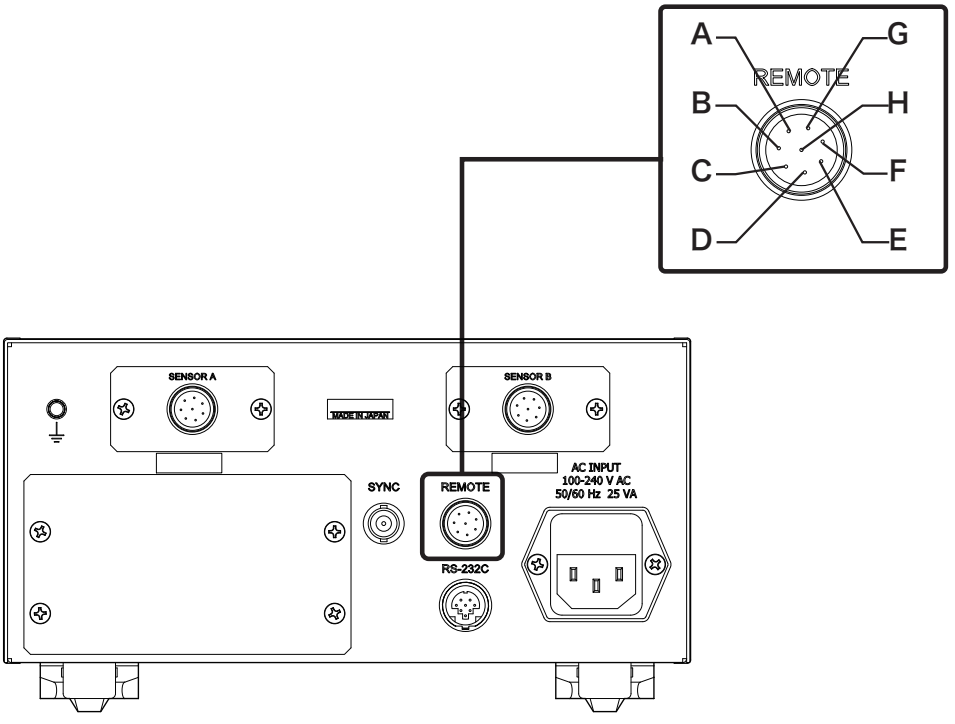
External Interfaces

1. Remote Signals

The following details remote signals input to and output from the REMOTE connector.

1.1 REMOTE Connector and Input/Output Signals

The REMOTE connector is provided on the rear panel of the CL-5610/5610S Non-Contact Thickness Meter.



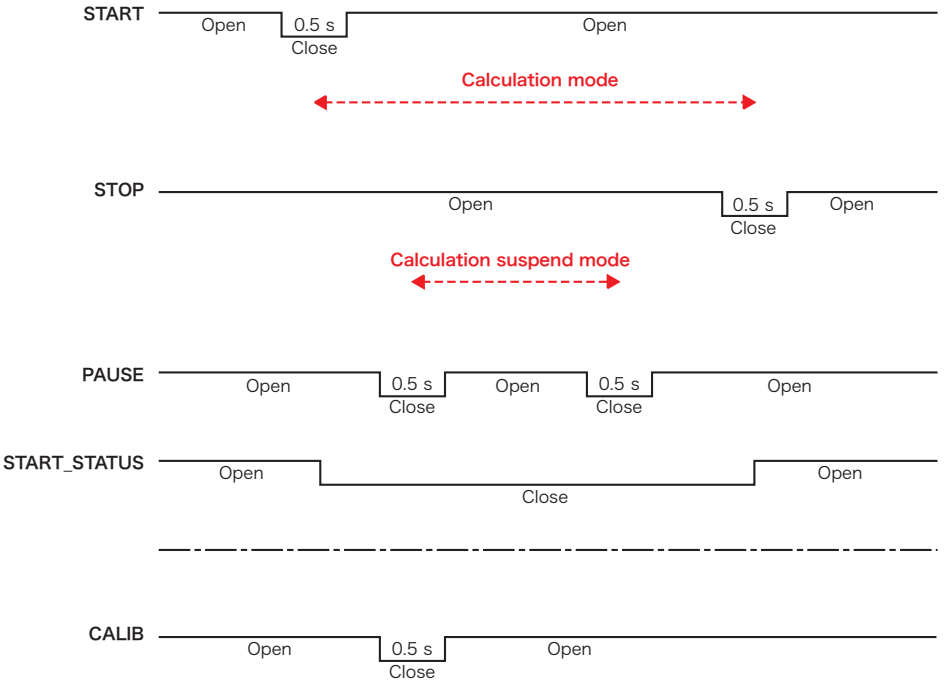
Applicable connector	R03-PB8M (Tajimi Electronics)
Output type	Semiconductor relay (Photo-Mos) non-voltage contact (1a)
Load voltage	60VAC/DC
Load current	400mA
ON resistance	2Ω or less

■ Pin arrangements and input/output signals

Pin	Signal name	Description
A	Power supply	Inputs 5 to 24VDC (refer to "Recommended Interfaces" on page 120). • When supplying 6VDC or higher from external, insert a resistor.
B	START	Same function as the START key.
C	STOP	Deactivates the calculation mode.
D	PAUSE	Same function as the PAUSE key.
E	CALIB	Calibration using data of reference piece of object under measurement registered. • Enabled only in conductor measurement. • Thickness of the reference piece of object under measurement cannot be changed.
F	START STATUS	Activated in the calculation mode and calculation suspend mode.
G	COMMON	Connect 0V.
H	+5V output	Outputs 5V (0.4A max.).

1.2 Input/Output Timing Chart

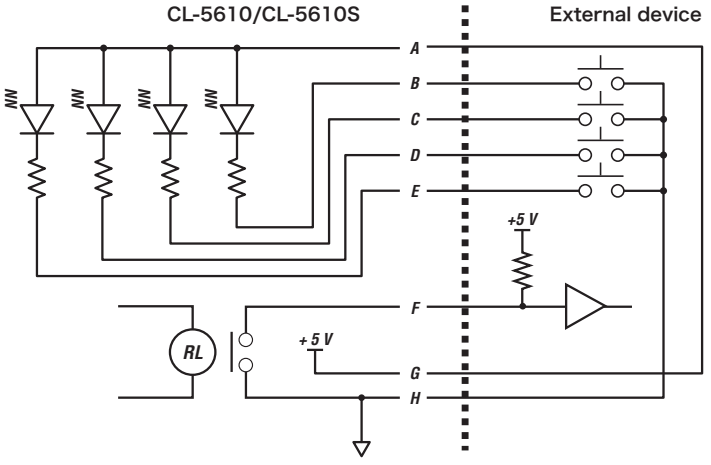
The following shows a timing chart of remote signals input to and output from the REMOTE connector.



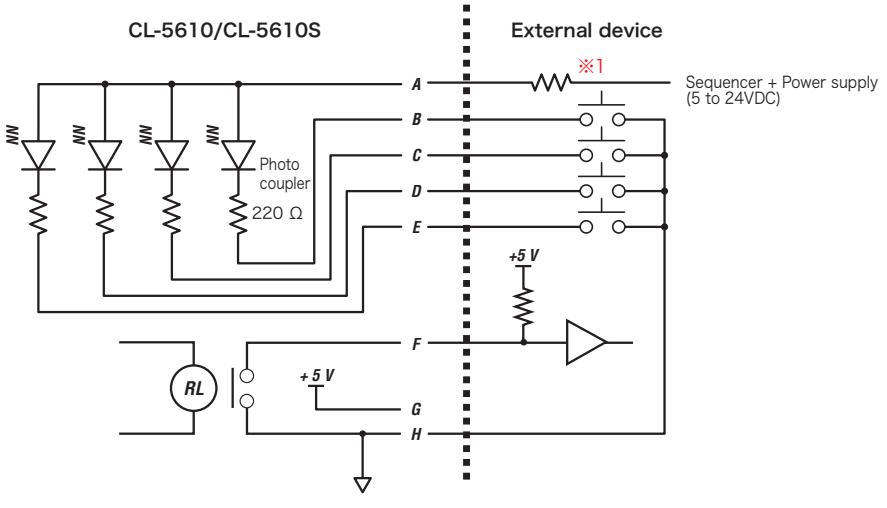
1.3 Recommended Interfaces

The following describes interfaces recommended for a case when the internal power supply is used and a case when an external power supply is used.

■ Recommended interfaces (when the internal power supply is used)



■ Recommended interfaces (when an external power supply is used)



※1 : When operating on 12VDC, insert a 470Ω resistor. When operating on 24VDC, insert a 1kΩ resistor.

2. RS-232C Interface

CAUTION !

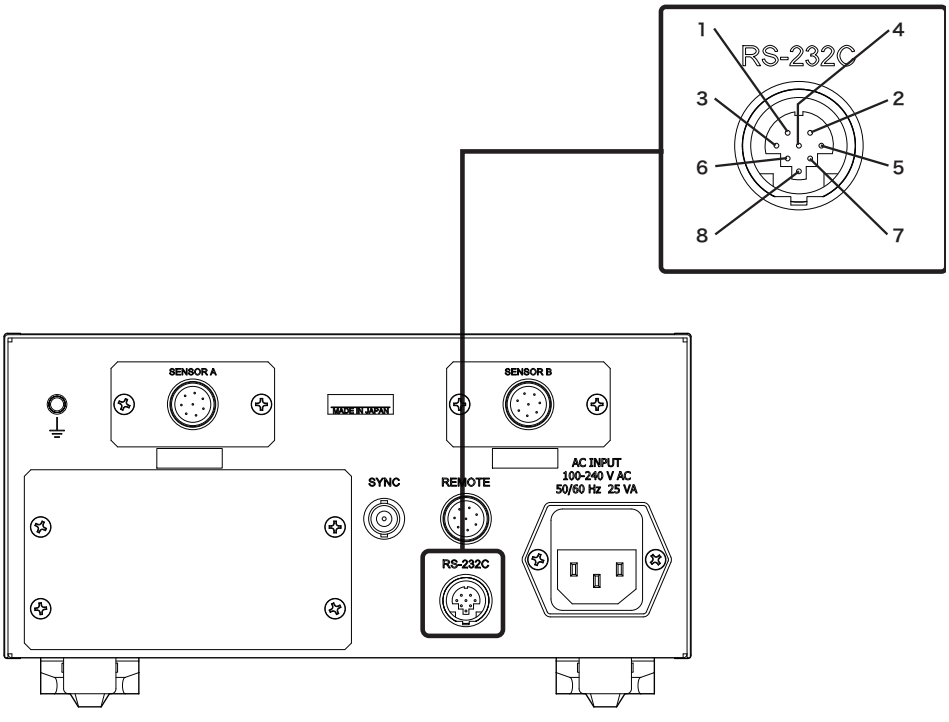
- **When connecting the CL-5610/5610S Non-Contact Thickness Meter with a minicomputer or a personal computer through the RS-232C interface, be sure to use dedicated cable AX-5022 (2m) (option).**
  Purchase the cable at an agency or Ono Sokki sales office nearby.

2.1 Overview and Specifications of RS-232C Interface

The RS-232C is a serial communication interface standardized by EIA (Electronic Industries Association).

The RS-232C interface mounted on the CL-5610/5610S Non-Contact Thickness Meter makes it possible to set the display of the CL-5610/5610S Non-Contact Thickness Meter, control various functions, and perform data reception and transmission through an appropriate program on a minicomputer or a personal computer.

■ RS-232C interface external view



Applicable connector: HR212-10P8PSAT3042 (Hirose Electric)

Connection cable: RS-232C option cable for PC/AT compatibles: AX-5022 (2m)

■ Communication specifications

Baud rate	1200/2400/9600/19200/38400 bps
Data bit	8 bits
Parity	None
Stop bit	1 bit
Flow control	Hardware
Terminator	CR+LF

■ Connector specifications

Pin No.	Signal	Function	Input/output
1	FG	No Connect	–
2	Rxd	Receive Data	Input
3	Txd	Transmit Data	Output
4	CTS	Clear to Send	Input
5	RTS	Request to Send	Output
6	NC	Non Connect	–
7	COM	Common	–
8	NC	Non Connect	–

Memo

- **For baud rate (transfer rate) setup, refer to "Setting RS-232C conditions" on page 90.**
- **Select RS-232C for interface selection. For details,refer to "Setting interface conditions" on page 95.**

2.2 Command Reference

Memo

- **After normal command reception with ANSWER set to ON, "G" or response data is returned. Therefore, do not transmit the following command before receiving response data.**
  For details on the ON/OFF setup procedures of ANSWER, refer to "Setting RS-232C conditions" on page 90.

Command	Function	Transmission (+CRLF)	Reception (+CRLF)
CST	Starts operation. Measurement mode → Calculation mode	"CST"	"G" or "ERR∗" • Only when ANSWER is set to ON • ∗ = 21 to 30 (Refer to the error number.)
CSP	Terminates calculation. Calculation mode -> Measurement mode	"CSP"	"G" or "ERR∗" • Only when ANSWER is set to ON • ∗ = 21 to 30 (Refer to the error number.)
CPS	Suspends calculation. Calculation mode -> Calculation suspend mode	"CPS"	"G" or "ERR∗" • Only when ANSWER is set to ON • ∗ = 21 to 30 (Refer to the error number.)
CCS	Restarts the suspended calculation. Calculation mode -> Calculation suspend mode	"CCS"	"G" or "ERR∗" • Only when ANSWER is set to ON • ∗ = 21 to 30 (Refer to the error number.)
CSE	Shifts to the setup mode. Measurement mode -> Setup mode	"CSE"	"G" or "ERR∗" • Only when ANSWER is set to ON • ∗ = 0 to 5 (Refer to the error number.)
CME	Shifts to the measurement mode. Setup mode -> Measurement mode	"CME"	"G" or "ERR∗" • Only when ANSWER is set to ON • ∗ = 21 to 30 (Refer to the error number.)
REL	Sets the current measurement value as the measurement reference value.	"REL ①" ① = 0 DISP1 = 1 DISP2	"G" or "ERR∗" • Only when ANSWER is set to ON • ∗ = 21 to 30 (Refer to the error number.)
REG	Sets the current measurement value as the insulator reference gap value.	"REG"	"G" or "ERR∗" • Only when ANSWER is set to ON • ∗ = 21 to 30 (Refer to the error number.)
MDR	Reads the measurement result.	"MDR ①" ① = 0 THICK = 1 GAP-A = 2 GAP-B = 3 A-B	"○○○○○○○○○○" • ○ : 10 characters including the sign and decimal point. • The current unit setting is used.
ADR	Reads the measurement data.	"ADR"	"①" ① = THICK、GAP-A、GAP-B、A-B、DISP1
MOR	Reads the current mode.	"MOR"	"①" ① = 0 Measurement Mode = 1 Calculation mode = 2 Calculation suspend mode = 3 Setup mode = 4 Calibration mode = 5 Measurement reference setup mode"

Command	Function	Transmission (+CRLF)	Reception (+CRLF)
DDR	Reads the display value.	"DDR ① " ① = 0 Display1 = 1 Display2	" ○○○○○○○○ " • ○ : 8 characters including the sign and decimal point. • The current unit setting is used.
CSR	Reads the comparator status.	"CSR ① " ① = 0 CMP1 = 1 CMP2 = 2 CMP3 = 3 ALL • Enabled only in the calculation mode.	" ① " ① = 0 OFF = 1 UPPER = 2 OK = 3 LOWER
DIR	Reads the contents of the display.	"DIR ① " ① = 0 Display1 = 1 Display2	" ① " ① = 0 THICK = 1 GAP-A = 2 GAP-B = 3 A-B = 4 COMP
DMR	Reads the display mode of the display.	"DMR ① " ① = 0 Display1 = 1 Display2	" ①, ② " ① = 0 ABS = 1 DEVIATION ② = 0 REAL = 1 MAX = 2 MIN = 3 RANGE
DTR	Reads the display type of the display.	"DTR"	" ① " ① = 0 SINGLE = 1 DUAL
UNR	Reads the unit of the display.	"UNR"	" ① " ① = 0 μm = 1 mm = 2 mil = 3 Inch
MAR	Reads the thickness of the reference piece of object under measurement.	"MAR ① " ① = 0 Conductor reference piece = 1 Insulator reference piece sensor A = 2 Insulator reference piece sensor B	" ○○○○○○○○○○ " • ○ : 10 characters including the decimal point. • The current unit setting is used.
GAR	Reads the gap value between sensors.	"GAR"	" ○○○○○○○○○○ " • ○ : 10 characters including the decimal point. • The current unit setting is used.
RER	Reads the insulator reference gap value.	"RER"	" ○○○○○○○○○○ " • ○ : 10 characters including the decimal point. • The current unit setting is used.
RDR	Reads the insulator relative permittivity.	"RDR ① " ① = 0 εA = 1 εB	" ○○○○○○○○ " • ○ : 9 characters including the decimal point.
GPR	Reads the insulator measurement use gap.	"GPR"	" ① " ① = 0 GAP-A = 1 GAP-B

Command	Function	Transmission (+CRLF)	Reception (+CRLF)
STR	Reads the sensor type.	"STR ① " ① = 0 SENS-A = 1 SENS-B	" ① " ① = 0 VE501∗200μm = 1 VE501∗ = 2 VE102∗ = 3 VE152∗ = 4 VE302∗ = 5 VE802∗ = 6 Equl 1 = 7 Equl 2 = 8 Equl 3 = 9 Equl 4 = A Equl 5 = B Equl 6 = C VE201∗
SSR	Reads the channel used, sensor model name, and serial number of the corrective sensor.	"SSR ① " ① = 0 Equl 1 = 1 Equl 2 = 2 Equl 3 = 3 Equl 4 = 4 Equl 5 = 5 Equl 6	" ① , ② , ○○○○○○ " ① = 0 SENS-A = 1 SENS-B ② = 0 VE5010∗200μm = 1 VE5010 = 2 VE1020 = 3 VE1520 = 4 VE3020 = 5 VE8020 = 6 VE2011 = 7 VE5011∗200μm = 8 VE5011 = 9 VE1021 = A VE3021 = B VE8021 ○○○○○○ = Serial No.
SCR	Reads the coefficient of polynomial of the corrective sensor.	"SCR ① , ② " ① = 0 Equl 1 = 1 Equl 2 = 2 Equl 3 = 3 Equl 4 = 4 Equl 5 = 5 Equl 6 ② = 0 Coefficient a = 1 Coefficient b = 2 Coefficient c = 3 Coefficient d	" ±○○○ . ○○○○○○○○○○○○○○○ " • 20 characters including the sign and decimal point.
RLR	Reads the measurement reference value.	"RLR ① " ① = 0 THICK = 1 GAP-A = 2 GAP-B = 3 A-B	" ○○○○○○○○○○ " • ○ : 10 characters including the decimal point. • The current unit setting is used.
ANR	Reads the moving average.	"ANR"	" ○○ "
SYR	Reads the clock for measurement.	"SYR"	" ① " ① = 0 MASTER = 1 SLAVE
FFR	Reads ON/OFF of the fan.	"FFR"	" ① " ① = 0 ON = 1 OFF
BRR	Reads the brightness.	"BRR"	" ① " ① = 0 100% = 1 75% = 2 50% = 3 25%

Command	Function	Transmission (+CRLF)	Reception (+CRLF)
AFR	Reads analog output SPAN.	"AFR"	" ○○○○○○○○○○ " • ○ : 10 characters including the decimal point. • The current unit setting is used.
AZR	Reads analog output ZERO.	"AZR"	" ○○○○○○○○○○ " • ○ : 10 characters including the decimal point. • The current unit setting is used.
OFR	Reads the offset value.	"OFR ① " ① = 0 Offset A = 1 Offset B	" ○○○ "
CMR	Reads the comparator function mode.	"CMR ① " ① = 0 CMP1 = 1 CMP2 = 2 CMP3 = 3 ALL	" ① " ① = 0 OFF = 1 THICK (ALL setup: THICK-ABS) = 2 GAP A (ALL setup: THICK-DEVIATION) = 3 GAP B = 4 A-B
CHR	Reads the upper-limit value of the comparator.	"CHR ① " ① = 0 CMP1 = 1 CMP2 = 2 CMP3 = 3 ALL	" ○○○○○○○○○○ " • ○ : 10 characters including the decimal point. • The current unit setting is used.
CLR	Reads the lower-limit value of the comparator.	"CLR ① " ① = 0 CMP1 = 1 CMP2 = 2 CMP3 = 3 ALL	" ○○○○○○○○○○ " • ○ : 10 characters including the decimal point. • The current unit setting is used.
COR	Reads the comparator selection.	"COR"	" ① " ① = 0 Comparators 1, 2, and 3 = 1 Comparator ALL
RSR	Reads the resolution selection.	"RSR"	" ① " ① = 0 NORMAL = 1 HI-RESO (High resolution)
THR	Reads the conductor and insulator selections.	"THR"	" ① " ① = 0 TTHK-C (Conductor) = 1 THK-I (Insulator)
ARR	Reads ON/OFF of the RS command return value.	"ARR"	" ① " ① = 0 ON = 1 OFF
DIS	Sets the contents of the display.	"DIS ① , ② " ① = 0 DISPLAY1 = 1 DISPLAY2 ② = 0 THICK = 1 GAP-A = 2 GAP-B = 3 A-B = 4 COMP	"G" or "ERR∗" • Only when ANSWER is set to ON • ∗ = 21 to 30 (Refer to the error number.)
DMS	Sets the display mode of the display.	"DMS ① , ② , ③ " ① = 0 Display1 = 1 Display2 ② = 0 ABS = 1 DEVIATION ③ = 0 REAL = 1 MAX = 2 MIN = 3 RANGE	"G" or "ERR∗" • Only when ANSWER is set to ON • ∗ = 21 to 30 (Refer to the error number.)

Command	Function	Transmission (+CRLF)	Reception (+CRLF)
DTS	Sets the display type of the display.	"DTS ① " ① = 0 SINGLE = 1 DUAL	"G" or "ERR∗" • Only when ANSWER is set to ON • ∗ = 21 to 30 (Refer to the error number.)
UNS	Sets the unit of the display.	"UNS ① " ① = 0 μm (Disabled for inch-system option.) = 1 mm (Disabled for inch-system option.) = 2 mil (Enabled for inch-system option.) = 3 Inch (Enabled for inch-system option.)	"G" or "ERR∗" • Only when ANSWER is set to ON • ∗ = 21 to 30 (Refer to the error number.)
MAS	Sets the thickness of the reference piece of object under measurement.	"MAS ① , ○○○○○○○ ○ " ① = 0 Conductor reference piece = 1 Insulator reference piece sensor A = 2 Insulator reference piece sensor B • : Up to 8 characters including the decimal point. • The current unit setting is used. • Calculates and updates sensor gap value at the time of conductor setup. • Calculates and updates relative permittivity at the time of insulator setup.	"G" or "ERR∗" • Only when ANSWER is set to ON • ∗ = 21 to 30 (Refer to the error number.)
GAS	Sets the gap value between sensors.	"GAS ○○○○○○○○ " • The current unit setting is used.	"G" or "ERR∗" • Only when ANSWER is set to ON • ∗ = 21 to 30 (Refer to the error number.)
RES	Sets the insulator reference gap value.	"RES ○○○○○○○○ " • The current unit setting is used.	"G" or "ERR∗" • Only when ANSWER is set to ON • ∗ = 21 to 30 (Refer to the error number.)
RDS	Sets the insulator relative permittivity.	"RDS ① , ○○○ . ○○○○ ○ " ① = 0 εA = 1 εB • Setup range 1.00001 ≦ Relative permittivity ≦ 100.00000	"G" or "ERR∗" • Only when ANSWER is set to ON • ∗ = 21 to 30 (Refer to the error number.)
GPS	Sets the gap used for insulator measurement.	"GPS ① " ① = 0 GAP-A = 1 GAP-B	"G" or "ERR∗" • Only when ANSWER is set to ON • ∗ = 21 to 30 (Refer to the error number.)

Command	Function	Transmission (+CRLF)	Reception (+CRLF)
STS	Sets the sensor type.	"STS ①, ②" ① = 0 GAP-A = 1 GAP-B ② = 0 VE501∗200μm = 1 VE501∗ = 2 VE102∗ = 3 VE152∗ = 4 VE302∗ = 5 VE802∗ = 6 Equl 1 = 7 Equl 2 = 8 Equl 3 = 9 Equl 4 = A Equl 5 = B Equl 6 = C VE201∗ • The same corrective sensor cannot be selected for GAP-A and GAP-B. • 6 to B: Enabled only when corrective sensor is enabled.	"G" or "ERR∗" • Only when ANSWER is set to ON • ∗ = 21 to 30 (Refer to the error number.)
SSS	Sets the channel used, sensor model name, and serial number of the corrective sensor.	"SSS ①, ②, ③, ○○○○○○" ① = 0 Equl 1 = 1 Equl 2 = 2 Equl 3 = 3 Equl 4 = 4 Equl 5 = 5 Equl 6 ② = 0 SENS-A = 1 SENS-B ③ = 0 VE5010∗200μm = 1 VE5010 = 2 VE1020 = 3 VE1520 = 4 VE3020 = 5 VE8020 = 6 VE2011 = 7 VE5011∗200μm = 8 VE5011 = 9 VE1021 = A VE3021 = B VE8021 • ○○○○○○ = Serial number	"G" or "ERR∗" • Only when ANSWER is set to ON • ∗ = 21 to 30 (Refer to the error number.)

Command	Function	Transmission (+CRLF)	Reception (+CRLF)
SCS	Sets the coefficient of polynomial of the corrective sensor.	"SCS ①, ②, ±○○○.○○○○○○○○○○○○○○" ① = 0 Equl 1 = 1 Equl 2 = 2 Equl 3 = 3 Equl 4 = 4 Equl 5 = 5 Equl 6 ② = 0 Coefficient a = 1 Coefficient b = 2 Coefficient c = 3 Coefficient d ③ • 20 characters including the sign and decimal point.	"G" or "ERR∗" • Only when ANSWER is set to ON • ∗ = 21 to 30 (Refer to the error number.)
RLS	Sets the measurement reference value.	"RLS ①, ○○○○○○○○" ① = 0 THICK = 1 GAP-A = 2 GAP-B = 3 A-B • The current unit setting is used.	"G" or "ERR∗" • Only when ANSWER is set to ON • ∗ = 21 to 30 (Refer to the error number.)
ANS	Sets the moving average.	"ANS ○○" • Setup range 1 ≦ Number of moving average ≦ 64	"G" or "ERR∗" • Only when ANSWER is set to ON • ∗ = 21 to 30 (Refer to the error number.)
SYS	Sets the clock for measurement.	"SYS ①" ① = 0 MASTER = 1 SLAVE	"G" or "ERR∗" • Only when ANSWER is set to ON • ∗ = 21 to 30 (Refer to the error number.)
FFS	Sets ON/OFF of the fan.	"FFS ①" ① = 1 ON = 2 OFF	"G" or "ERR∗" • Only when ANSWER is set to ON • ∗ = 21 to 30 (Refer to the error number.)
BRS	Sets the brightness.	"BRS ①" ① = 0 100% = 1 75% = 2 50% = 3 25%	"G" or "ERR∗" • Only when ANSWER is set to ON • ∗ = 21 to 30 (Refer to the error number.)
AFS	Sets analog output SPAN.	"AFS ○○○○○○○○" • The current unit setting is used.	"G" or "ERR∗" • AOnly when ANSWER is set to ON • ∗ = 21 to 30 (Refer to the error number.)
AZS	Sets analog output ZERO.	"AZS ○○○○○○○○" • The current unit setting is used.	"G" or "ERR∗" • Only when ANSWER is set to ON • ∗ = 21 to 30 (Refer to the error number.)
OFS	Sets the offset value.	"OFS ①, ○○○" ① = 0 Offset A = 1 Offset B • ○ : Up to 3 characters. • The unit is "%". • Setup range 0 ≦ Offset value ≦ 100	"G" or "ERR∗" • Only when ANSWER is set to ON • ∗ = 21 to 30 (Refer to the error number.)

Command	Function	Transmission (+CRLF)	Reception (+CRLF)
CMS	Sets the comparator function mode.	"CMS ①, ②" ① = 0 CMP1 = 1 CMP2 = 2 CMP3 = 3 ALL ② = 0 OFF = 1 THICK (ALL setup: THICK-ABS) = 2 GAP A (ALL setup: THICK-DEVIATION) = 3 GAP B (Disabled with ALL setup.) = 4 A-B (Disabled with ALL setup.)	"G" or "ERR*" • Only when ANSWER is set to ON • * = 21 to 30 (Refer to the error number.)
CHS	Sets the upper-limit value of the comparator.	"CHS ①, ○○○○○○○○" ① = 0 CMP1 = 1 CMP2 = 2 CMP3 = 3 ALL • The current unit setting is used. • Lower-limit value < Upper-limit value	"G" or "ERR*" • Only when ANSWER is set to ON • * = 21 to 30 (Refer to the error number.)
CLS	Sets the lower-limit value of the comparator.	"CLS ①, ○○○○○○○○" ① = 0 CMP1 = 1 CMP2 = 2 CMP3 = 3 ALL • The current unit setting is used. • Lower-limit value < Upper-limit value	"G" or "ERR*" • Only when ANSWER is set to ON • * = 21 to 30 (Refer to the error number.)
COS	Sets the comparator selection.	"COS ①" ① = 0 Comparators 1, 2, and 3 = 1 Comparator ALL	"G" or "ERR*" • Only when ANSWER is set to ON • * = 21 to 30 (Refer to the error number.)
RSS	Sets the resolution selection.	"RSS ①" ① = 0 NORMAL = 1 HI-RESO (High resolution)	"G" or "ERR*" • AOnly when ANSWER is set to ON • * = 21 to 30 (Refer to the error number.)
THS	Sets the conductor and insulator selections.	"THS ①" ① = 0 THK-C (Conductor) = 1 THK-I (Insulator)	"G" or "ERR*" • Only when ANSWER is set to ON • * = 21 to 30 (Refer to the error number.)
ARS	Sets ON/OFF of the RS command return value.	"ARS ①" ① = 0 ON = 1 OFF	"G" or "ERR*" • Only when ANSWER is set to ON • * = 21 to 30 (Refer to the error number.)
VER	Reads the CPU version.	"VER"	"○.○○"
UNT	Reads the model name of the product.	"UNT"	"CL-5610" or "CL-5610S
INT	Initializes the backup memory.	"INT ①" ① = 0 Condition Setup = 1 Condition setting + Correction value registration	"G" or "ERR*" • Only when ANSWER is set to ON • * = 21 to 30 (Refer to the error number.)

Command	Function	Transmission (+CRLF)	Reception (+CRLF)
BOS	Sets a BCD output item.	"BOS ① " ① = 0 THICK = 1 GAP A = 2 GAP B = 3 A-B = 4 DISP1	"G" or "ERR∗" • Only when ANSWER is set to ON ∗ = 21 to 30 (Refer to error No.)
BOR	Reads a set BCD item.	"BOR ① " ① = 0 THICK = 1 GAP A = 2 GAP B = 3 A-B = 4 DISP1	"G" or "ERR∗" • Only when ANSWER is set to ON ∗ = 21 to 30 (Refer to error No.)
SBS	Sets the high-impedance ground mode to ON or OFF.	"SBS ① " ① = 0 ON = 1 OFF	"G" or "ERR∗" • Only when ANSWER is set to ON ∗ = 21 to 30 (Refer to error No.)
SBR	Reads the ON/OFF condition of the high-impedance ground mode.	"SBR ① " ① = 0 ON = 1 OFF	"G" or "ERR∗" • Only when ANSWER is set to ON ∗ = 21 to 30 (Refer to error No.)
OPT	Reads the presence or absence of option.	"OPT ①, ②, ③, ④, ⑤ " ① = 0 CL-0110 ON = 1 CL-0110 OFF ② = 0 CL-0120 ON = 1 CL-0120 OFF ③ = 0 CL-0200 ON = 1 CL-0200 OFF ④ = 0 CL-0210 ON = 1 CL-0210 OFF ⑤ = 0 CL-0300 ON = 1 CL-0300 OFF	"G" or "ERR∗" • Only when ANSWER is set to ON ∗ = 21 to 30 (Refer to error No.)

2.3 Error Response

If no command is normally received with ANSWER set to ON, one of the following error commands is returned.

Command	Function
ERR21	Communication error
ERR22	Time-out error
ERR23	Receive buffer overflow
ERR24	Invalid command
ERR25	Setup parameter out of range
ERR26	Condition error (example: Parameter setup in the calculation mode)
ERR27	Format error (example: DIS0-0)
ERR28	Reserved
ERR29	Reserved
ERR30	Terminator error

Memo

- **For details on the ON/OFF setup procedures of ANSWER, refer to "Setting RS-232C conditions" on page 88.**

■ Details of error and solution

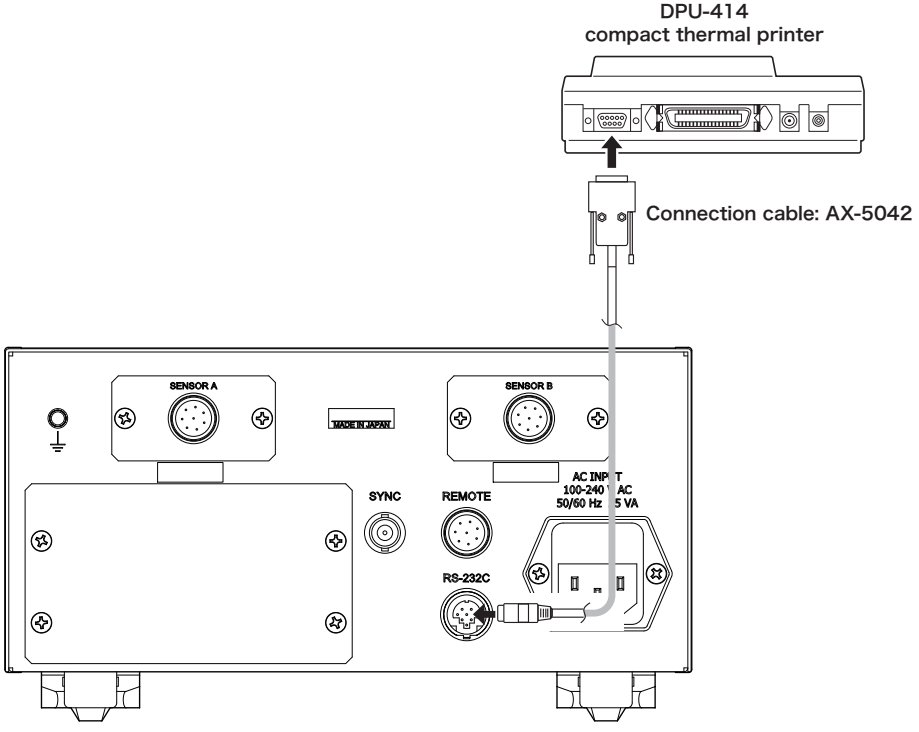
Command	Details	Solution
ERR21	CPU internal error, such as overrun error, framing error, parity error, etc.	Insert a wait when transmitting commands continuously.
ERR22	Microcomputer CPU internal error caused by time-out	Insert a wait when transmitting commands continuously.
ERR23	The transmit command length exceeds the receive buffer.	Adjust the command length.
ERR24	The command is not registered in the command table.	Check the command.
ERR25	The upper limit or lower limit of parameter is exceeded.	Check the parameters.
ERR26	Conditonal error, such as parameter setup in the calculation mode, option setup when option is disabled, etc.	Check the mode and conditions.
ERR27	Error caused by the "," position or exceeded number of characters.	Check the transmission format.
ERR30	The terminator "CR+LF" (for identifying the end of command) includes only "CR" or "LF."	Add "CR+LF" to the command before tranmission.

3. Printer Setup

The following details the function to print the contents of the display of the CL-5610/5610S Non-Contact Thickness Meter on a printer connected to the RS-232C connector.

3.1 Printer Connection

The contents of the display can be printed by connecting the optional compact thermal printer DPU-414 to the RS-232C connector, as shown below.



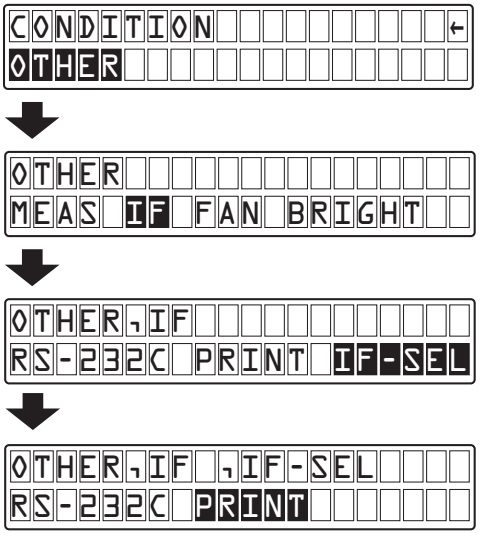
CAUTION !

- **Use the compact thermal printer DPU-414 and the dedicated cable AX-5042 (2m) to print data of the CL-5610/5610S Non-Contact Thickness Meter.**
  The compact thermal printer DPU-414 and the dedicated cable AX-5042 are options. Purchase them at an agency or Ono Sokki sales office nearby.

3.2 Printing Procedures

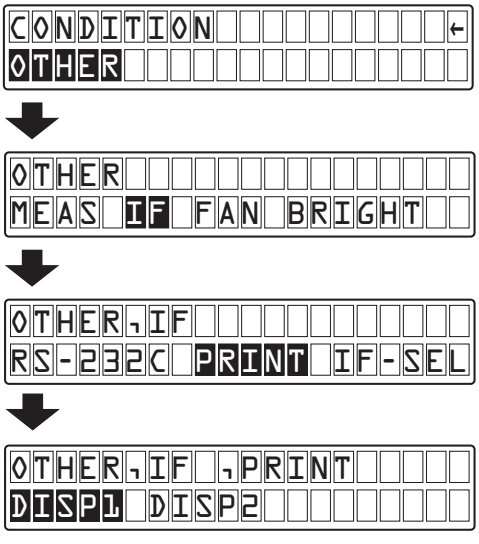
1. Select PRINT as the device interface.

Press the [COND] key to select the setup mode. Then, press the keys as shown below to select PRINT (DPU-414 recommended by Ono Sokki) as the interface for the device to be connected to the RS-232C connector.
For detailed procedures, refer to "Setting RS-232C conditions" on page 88.



2. Select DISP1 or DISP2 as the screen contents to be printed.

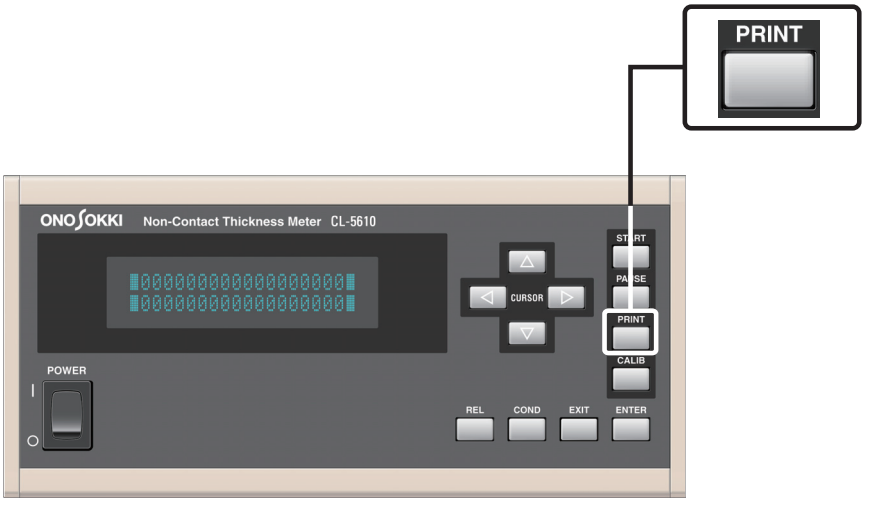
Press the [COND] key to select the setup mode. Then, press the keys as shown below to select screen contents to be printed (DISP1) from the optional printer DPU-414 (recommended by Ono Sokki) connected to RS-232C.
For detailed procedures, refer to "Setting printer conditions" on page 90.



3. **Execute printing.**

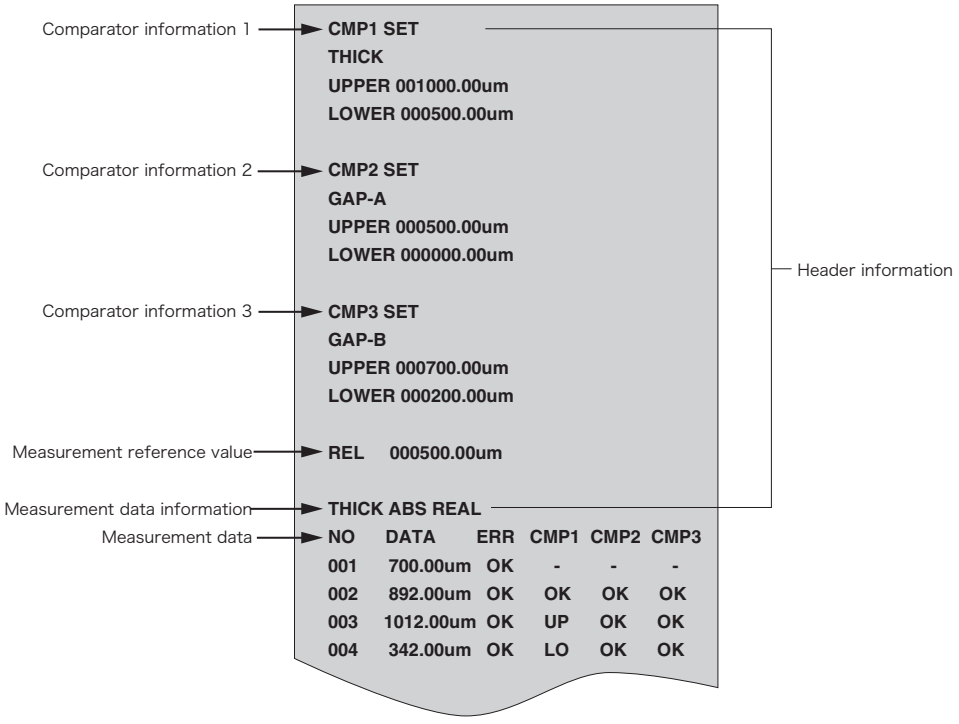
Press the [PRINT] key. The selected screen contents (DISP1) is printed on the specified printer DPU-414 (recomended by Ono Sokki).

Printing is repeated each time you press the [PRINT] key.



3.3 Print Data Format

An exemplary print format printed on the DPU-414 printer (recommended by ONOSOKKI) is shown below.



- The header is printed when any comparator setting has been changed or when printing is performed first after the power is turned on.
- NO starts with 1. When NO exceeds 999, it returns to 1.
- The measurement reference value is printed only for deviation (DEVI) display setup of measurement data.

- Error display

ERR (error display)	Function	Remarks
OK	Normal operation	
OF	Overflow	Calcution display digit over
CAL	CAL error	Calculation result is less than zero.
OA	GAP-A over	110% or more of sensor A rating
OB	GAP-B over	110% or more of sensor B rating
NA	GAP-A under	Less than 10% of sensor A rating
NB	GAP-B under	Less than 10% of sensor B rating

- Comparator result display

Function	ERR (error display)
Other than the calculation mode and calculation suspend mode; when the comparator is OFF	-
Within the range	OK
LOWER under	LO
UPPER over	UP

Chapter 5

Error and Warning Messages/ Troubleshooting

1. Error and Warning Messages

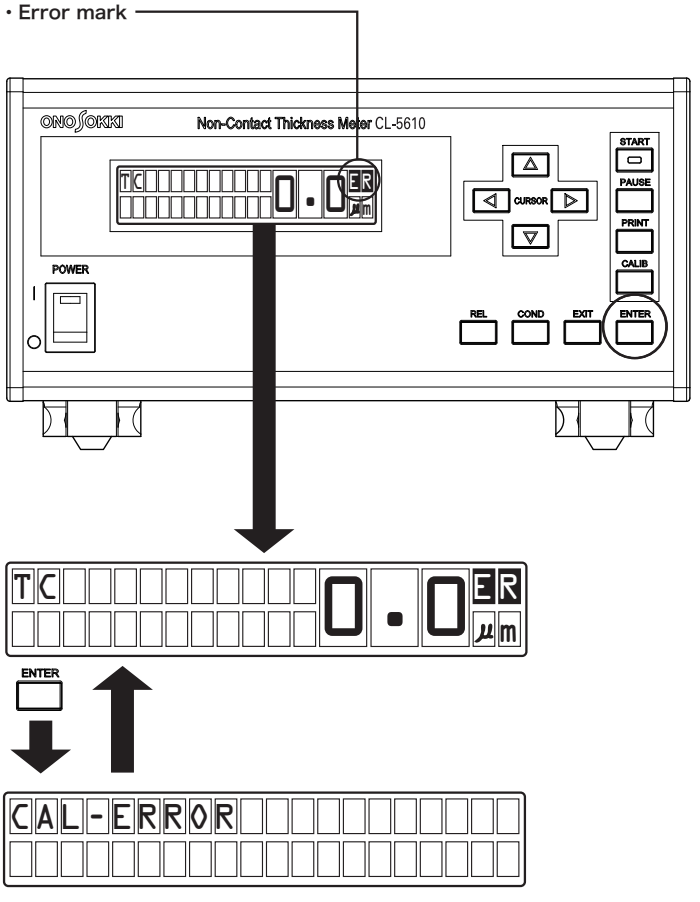
The following details messages displayed if an error or warning occurs.

1.1 Error Display and Details

■ Error mark and error message display

If an error occurs, the error mark [ER] appears at the top right of the display.

If you press and hold the [ENTER] key during error mark [ER] display, details of the error appear.



■ Error messages and details

Error messages and details are shown below.

Check the details of error and then take appropriate measures according to the details.

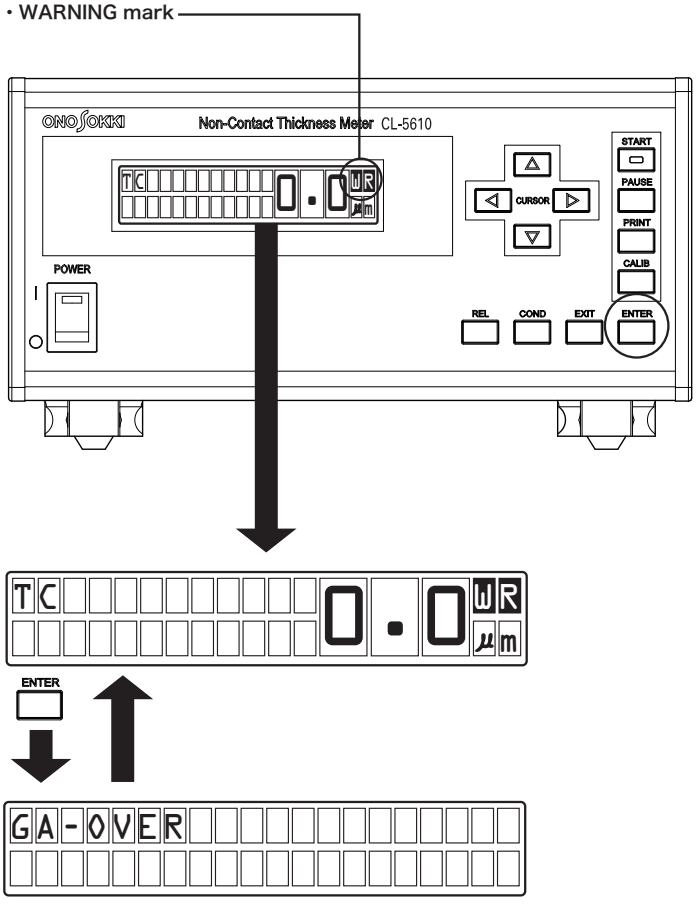
Error display	Details	Solution
CAL ERROR	Displayed if the calculation value of THICK is negative.	• Does the sensor setup suit the sensor to be used ? • Is the setup of gap between sensors set correctly ? • Is Ref-Gap set correctly in insulator measurement ? • Is the relative permitivity set correctly in insulator measurement ? • Is the sensor attached correctly ?
GA OVER	Displayed if measurement value (Ga) exceeds 130% of the sensor rating.	• Install the sensor close to the object under measurement.
GB OVER	Displayed if measurement value (Gb) exceeds 130% of the sensor rating.	• Install the sensor close to the object under measurement.
OVER FLOW	Displayed if the calculation value exceeds the number of display digits.	• The object under measurement is too thick.

1.2 Warning Display and Details

■ Warning mark and warning message display

If a warning occurs, the warning mark [WR] appears at the top right of the display.

If you press and hold the [ENTER] key during warning mark [WR] display, details of the warning appear.



■ Warning messages and details

Warning messages and details are shown below.

Check the details of warning and then take appropriate measures according to the details.

Warning display	Contents	Solution
GA-OVER	Displayed if measurement value (Ga) exceeds 110% of the sensor rating.	• Install the sensor close to the object under measurement.
GB-OVER	Displayed if measurement value (Gb) exceeds 110% of the sensor rating.	• Install the sensor close to the object under measurement.
GA-UNDER	Displayed if measurement value (Ga) decreases to 10% or less of the sensor rating.	• Keep away the sensor from the object under measurement.
GB-UNDER	Displayed if measurement value (Gb) decreases to 10% or less of the sensor rating.	• Keep away the sensor from the object under measurement.
INTERNAL	The internal circuit or a part fails.	• Contact the agency where you bought the product or Ono Sokki sales office nearby.

2. Troubleshooting

If a condition judged to be a failure of the CL-5610/5610S Non-Contact Thickness Meter occurs, check first the following troubleshooting table and then take measures according to the relevant condition.

If an unknown condition occurs or if the unit does not operate normally even after corresponding measures have been taken, contact your dealer or Ono Sokki sales office nearby.

Condition	Check point	Solution
The power supply does not turn on.	Is the power cable connected ?	Connect the power cable.
	Has the fuse blown ?	Replace the fuse with a new one.
The system does not start.	Is the power supplied ?	Check the above points.
Unstable measurement value	Is the object under measurement a conductor ?	Check the material of the object under measurement.
	Is the sensor used a mating VE sensor for the CL-5610/5610S ?	Check an applicable VE sensor.
	Is the object under measurement electrically connected with the VE sensor case or the ground terminal ?	Electrically connect the object under measurement with the VE sensor case or the ground terminal.
	Is the sensor end face or the measurement surface of the object under measurement dirty ?	Clean the VE sensor end face and the measurement surface of the object under measurement with a soft cloth, etc. with the power turned OFF.
	Is the object under measurement a flat surface larger than the minimum diameter under measurement of the VE sensor ?	The object under measurement needs to be larger than the minimum diameter under measurement of the VE sensor.
	Is the VE sensor cable cracked or damaged ?	If cracked or damaged, purchase a new cable and a new VE sensor.
	When measuring the same object under measurement using multiple CL-5610/5610S units, is a common carrier signal used ?	Use a common carrier signal. Refer to "Setting Carrier Signal Conditions" on page 89.
	Is the selection of VE sensor appropriate ?	Check the setup. Refer to "Setting Sensor Conditions" on page 84.
The comparator function does not work.	Is the calculation mode selected ?	Select the calculation mode.
	Is the calculation suspend mode selected ?	Select the calculation mode.
The setup mode does not start.	Is the measurement mode selected ?	Select the measurement mode.

Chapter 6

Specifications

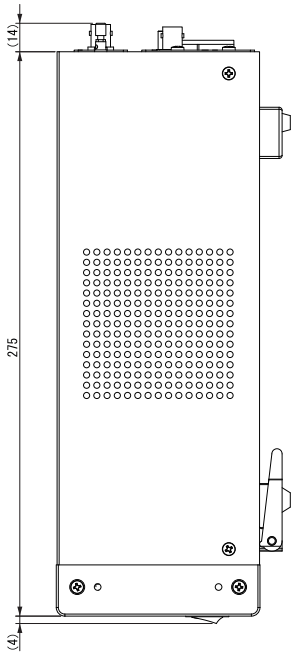
1. Specifications

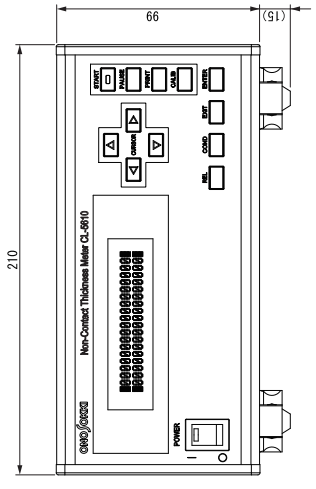
Item	Specification		
Applicable sensor	VE Series sensor		
Detection type	Capacitive type		
Object under measurement	Conductors, semiconductors, and insulators (option)		
Measurement item	Conductors/ semiconductors	THICK	Thickness of object under measurement
		GAP A	Gap between sensor A and object under measurement
		GAP B	Gap between sensor B and object under measurement
		A-B	Difference between A and B
	Insulator (option)	THICK	Thickness of object under measurement
Display mode 1	ABS	Measurement value	
	DEVI	Difference of between measurement value and set measurement reference value	
Display mode 2	REAL	Measurement value without calculation	
	MAX	Maximum value from start of calculation	
	MIN	Minimum value from start of calculation	
	RANGE	Difference between maximum and minimum values from start of calculation	
Display resolution	0.1 μm	When combined with the VE-5010/1020/2011/5011/ 1021	
	0.5 μm	When combined with the VE-1520	
	1 μm	When combined with the VE-3020/3021	
	2 μm	When combined with the VE-8020/8021	
High display resolution (option)	0.02 μm	When the VE-5010/5011 is combined and the measuring range of 200 μm, and when the VE2011 is combined	
	0.05 μm	When combined with the VE-5010/5011 with a mesaurement range of 200 μm	
	0.1 μm	When combined with the VE-1020/1021	
	0.2 μm	When combined with the VE-1520	
	0.5 μm	When combined with the VE-3020/3021	
	1 μm	When combined with the VE-8020/8021	
Measurement accuracy	± 0.15% F.S.	Standard	
	± 0.12% F.S.	When CL-0200 High-Resolution Calculation Function Option is installed (excluding VE-8020/8021)	
Sampling time	20 ms		
Averaging	Moving average (1 to 64 times)		

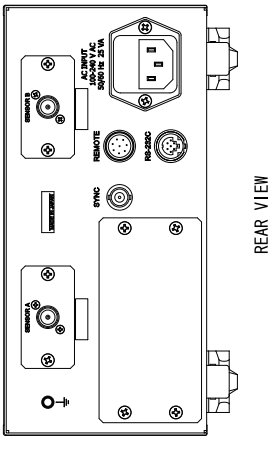
Comparator function (option)	COMP 1,2,3	Uses comparators 1, 2, and 3 indenpendently.	
	COMP-ALL	Uses comparators 1, 2, and 3 for distinction of upper-limit over, OK, and lower-limit over.	
	Output type	Semiconductor relay (Photo-Mos)	
	Maximum load capacity	60VAC/DC/400mA	
Analog output (option)	A-OUT	Outputs ± 5V voltage in any full scale.	
	GAP A	Outputs ± 5V voltage with the offset function.	
	GAP B	Outputs ± 5V voltage with the offset function.	
	Accuracy	± 0.25% F.S. • The output accuracy of SENSOR A and SENSOR B is limited to the combination with a respective registered sensor. The accuracy is not guaranteed when other sensors are connected.	
External interfaces	RS-232C	Reads measurement data, writes settings, and reads parameters.	
	Remote	START/STOP/PAUSE/CALIB Calculation mode status output • Applicable connector: R03-PB8M (Tajimi Electronics Co.,Ltd.)	
	SYNC	Inputs/outputs carrier signal when connecting the CL-5610 units in cascade.	
	BCD output	Output method	6-digit parallel BCD, open collector
		Output items	THICK/GAP-A/GAP-B/A-B/DISP2
		Refresh interval	20 ms
		Applicable cable	AA-8207 (3m/one-side open)
High-impedance grounding function (option)	Stable measurement is possible even under measurement conditions with a large grounding resistance.		
Display	Fluorescence display tube with a display range of 69.85 mm x 11.45 mm		
Power voltage	100 to 240VAC, 50/60Hz		
Power consumption	30VA or less		
Operating temperature range	0 to 40 ℃ (with a guaranteed accuracy range of 23 ± 2 ℃)		
Temperature characteritics	± 0.05%F.S./ ℃ or less		
Operating humidity range	20 to 80% (without condensation)		
Outside dimensions	CL-5610	210(W) x 290(D) x 114(H) mm	
	CL-0420	56(W) x 42.4(D) x 122(H) mm	
Weight	CL-5610	Approx. 4.2 kg	
	CL-0420	Approx. 0.5 kg	
Accessories	Power cable x1		
	Instruction manual x1		
	Remote control connector x1		
	2.5m dedicated connection cable (CL-5610S)		

2. Outside Dimensions

2.1 CL-5610 Outside Dimensions

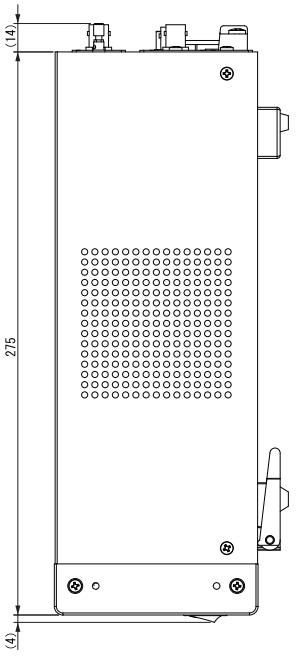


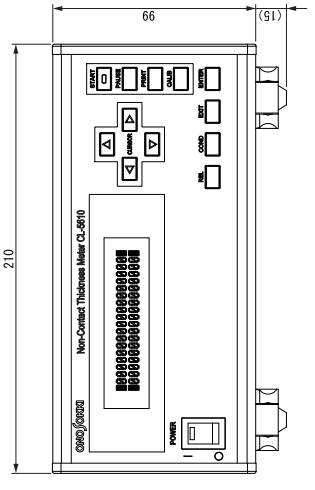


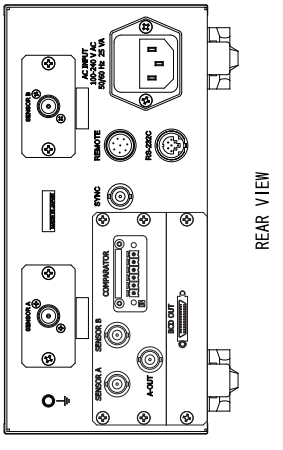


REAR VIEW

2.2 CL-5610 Outside Dimensions (with Option)

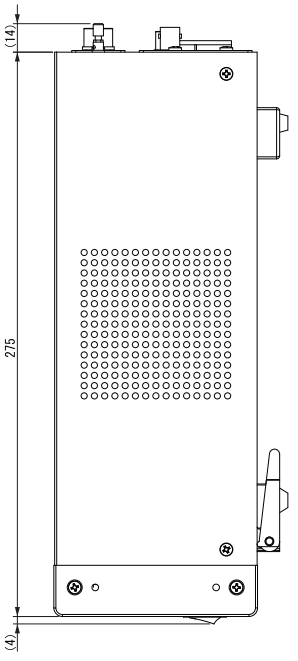


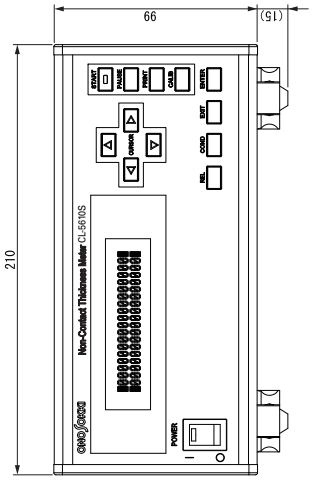


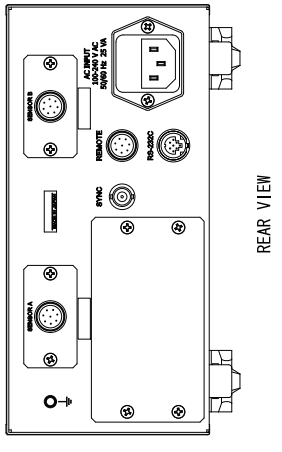


REAR VIEW

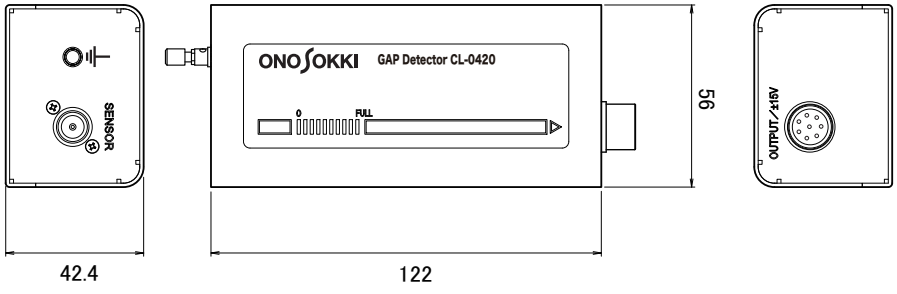
2.3 CL-5610S Outside Dimensions







2.4 CL-0420 Outside Dimensions



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ONO SOKKI

*Outer appearance and specifications are subject to change without prior notice.
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