KEYENCE

635GB

High-accuracy Digital Contact Sensor

GT2-100 Series

User's Manual

Read this manual before use.
Keep this manual in a safe place for future reference.

Introduction

This manual describes the basic operations and hardware functions of the GT2-100 Series. Read the manual carefully to ensure performance and function of the GT2-100 Series for safe use.

Keep this manual in a safe place for future reference.

Ensure that the end user of this product receives this manual.

■ Symbols

The following symbols alert you to matters concerning the prevention of human injury and product damage.

WARNING	**Indicates a hazardous situation which, if not avoided, could result in death or serious injury.**
CAUTION	**Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.**
NOTICE	**Indicates a situation which, if not avoided, could result in product damage as well as property damage.**

Reference — Indicates tips for better understanding or useful information.

Safety Information for GT2-100 Series

⚠ CAUTION	**Turn off the power immediately in the following cases. Using the unit in an abnormal condition could cause fire, or electric shock.** **• If liquid including water, chemicals or debris enters the unit.** **• If the unit is dropped or the case is damaged.** **• If smoke or unpleasant odor is present.**

Precautions for Usage

⚠ CAUTION	**• Apply the correct power voltage. Failure to do so may cause fire, electric shock, or malfunction.** **• Do not attempt to open or modify the GT2-100 Series. Doing so may cause fire or electric shock.** **• Do not use this product for the purpose to protect a human body or a part of human body.** **• This product is not intended for use as explosion-proof product. Do not use this product in a hazardous location and/ or potentially explosive atmosphere.**
NOTICE	**• Be sure to turn the power off when you plug/unplug the cable that leads to the unit and its accessories.** **• Do not turn off the power while setting items. Otherwise, the data being set or all the data may be lost.** **• At startup and during operation, be sure to monitor the functions and performance of the GT2-100 Series.** **• Do not attempt to open or modify the GT2-100 Series or use it in any way other than as described in the specifications. If the GT2-100 Series is modified or used other than as described, the warranty will be voided.** **• When the GT2-100 Series is used in combination with other devices, its function and performance may be degraded, depending on the operating conditions and surrounding environment.** **• When the GT2-100 Series is used in combination with other instruments, function performance may be degraded, depending on operating conditions and the surrounding environment. Use the GT2-100 Series after fully studying the effect of combined use with other instruments.** **• To aid in preventing malfunction, do not expose the GT2-100 Series to extreme temperature fluctuations.** **Installation environment** To use the GT2-100 Series correctly and safely, avoid installing it in the following locations; doing so may lead to breakdown of the unit. • Locations outside • Location that is humid, dusty or poorly ventilated • Location with a high temperature such as a place exposed to direct sunlight • Location where there are flammable or corrosive gases • Location where the unit may be directly subjected to vibration or shock • Location where water, oil or chemicals may splash onto the unit • Location where static electricity is present

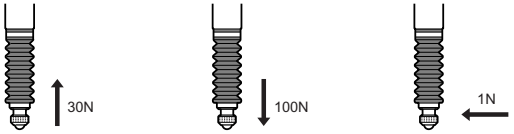
NOTICE

Corrective action for electromagnetic noise

Do not install the GT2-100 Series near a power source or high-voltage cable, otherwise electromagnetic noise may cause the GT2-100 Series to malfunction. Take corrective action for noise by using noise filters, laying cables separately, and/or installing insulation on the amplifier and the sensor head.

Handling of the sensor head

- The GT2-100 Series and peripheral devices are precision machines. Do not drop, or cause any other impact to these devices. Doing so may cause damage or malfunction.
- Do not apply force greater than what is listed below to the spindle part. Do not apply torque in the rotation direction. Otherwise the spindle may break.
- The GT2-P12KL(F)/P12L(F)/PA12K/PA12 spindle can rotate a maximum of about 4.5°, the GT2-S1/S5 spindle can rotate a maximum of about 2°. When using an offset contact (OP-77683) or similar, if pressure in the rotational direction is applied to the contact, the measurement position may change.
- Although the GT2-PA12K/PA12/H12K/H12KF/H12/H12F/H32/H50/A12K/A12/A32/A50 has a protection rating of IP67, avoid using it immersed in water or in places where liquid such as oil may come into contact with it.
- Although the GT2-P12K(F)/P12(F) has a protection rating of IP67G/NEMA Type 13 and the GT2-S1/S5 has a protection rating of IP67G, some types of oil may damage the device.
- If dust, metal powder, or a similar substance becomes attached to the spindle of the GT2-PA12K/PA12, mechanical responses may become slow. If this happens, replace the dust seal. Refer to the instruction manual included with the replacement dust seal (OP-87932) for instructions on how to replace the dust seal.
- Applying an external magnetic field to the GT2-S1/S5 may affect the measured value. Avoid installations close to motors and other such devices that generate strong magnetic fields.
- Iron and other such ferromagnets being close to the GT2-S1/S5 may affect the measured value. In the case of an installation next to a ferromagnet, perform calibration after installation.
  For the calibration procedure, see "Calibration setting mode."



Other Precautions

Effects of surrounding air temperature

To use the GT2-100 Series with high accuracy, do not use the GT2-100 Series in an environment in which the surrounding air temperature changes sharply.

It will take about 20 minutes on the 1 mm/5 mm type, 40 minutes on the 12 mm type, and 60 minutes on the 32 mm/50 mm type for the internal temperature distribution of the equipment to be completely adjusted when the surrounding air temperature has changed by 10°C.

Warming up

The circuit is not stable immediately after the power turns ON, which sometimes causes the indicated value to gradually fluctuate.

Wait about 20 minutes when using the GT2-S1/S5, about 5 minutes when using the GT2-P12K(L)(F)/P12(L)(F)/PA12K(L)/PA12(L)/H12K(L)(F)(LF)/H12(L)(F)(LF)/A12K(L)/A12(L), and about 10 minutes when using the GT2-H32(L)/H50/A32/A50 after the power turns on before starting operation.

GT2-PA12K(L)/PA12(L) (See illustration 1 for the pneumatic circuit)

- This model uses a single-acting cylinder. The internal spring will return the sensor head to its home position.
- The air supply hole cannot be removed.
- Use an air filter, mist separator, etc. to provide clean dry air. Empty the drainage from the filter regularly, before it exceeds the specified line.
- Before connecting the air tube to the air supply hole, be sure to blow plenty of air through the pipes (flushing) to remove any foreign matter.
- Make sure that the air pressure of the supplied air is constant and in the range of 0.24 to 0.26 MPa for the GT2-PA12K/PA12 and in the range of 0.05 to 0.07 MPa for the GT2-PA12KL/P12L. Use a precision regulator to control the air pressure. If the air pressure is below the minimum pressure given above, the spindle may not extend fully.
- When supplying air (with the spindle extended), up to 3 L/min of air will be emitted from the tip for the GT2-PA12(K) and up to 0.4 L/min of air will be emitted from the tip for the GT2-PA12(K)L.
- The measuring ability of the device changes according to the air pressure of the air supply. Refer to "Specifications" (page 6-1) for details.

GT2-A12K(L)/A12(L)/A32/A50 (See illustration 1 for the pneumatic circuit)

- This model uses a single-acting cylinder. The internal spring will return the sensor head to its home position when air pressure is removed. DO NOT supply air to the exhaust valve.
- The air cylinder cannot be removed.
- Use the regulator to supply the stable air pressure to the sensor head.
- Use the air filter and mist separators to supply dry air.
- Make sure that the air pressure of the air supply is constant and in the range of 0.25 MPa to 0.5 MPa.
- The coupling socket and the exhaust valve that are supplied with the air cylinder are dedicated for this product. They cannot be removed.

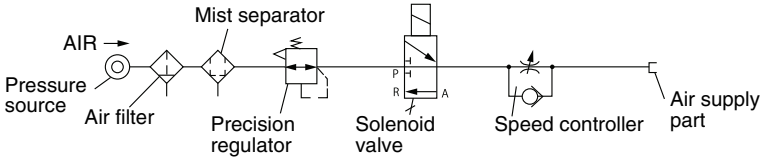


Illustration 1 - Pneumatic circuit

Power supply

- Noise superimposed on the power supply may cause malfunction. Be sure to use the DC stabilized power supply with an insulation transformer.
- In the case of a commercially available switching regulator, be sure to ground the frame ground terminal or the ground terminal.

About dust boot

When the dust boot of the sensor head is damaged, use an optional dust boot sold separately (For the GT2-S1: OP-88063 (Material: NBR). For the GT2-S5: OP-88065 (Material: NBR).) For GT2-P12K(F)/P12(F)/H12K(F)/H12(F)/A12K/A12: OP-84332 (Material: NBR (attached when shipped)). For GT2-P12K(F)/P12(F): OP-87859 (Material: Fluororubber). For GT2-H32/A32: OP-84459 (Material: NBR (attached when shipped)). For GT2-H50/A50 (Material: NBR (attached when shipped)).) Attach the dust boot correctly.

The dust boot may deteriorate, depending on the environment it is used in. In this case, replace the dust boot regularly.

* Do not use the dust boot on the GT2-P12KL/P12L/PA12K(L)/PA12(L)/H12KL(F)/H12L(F)/H32L.

Precautions on Regulations and Standards

CE Marking

Keyence Corporation has confirmed that this product complies with the essential requirements of the applicable EC Directive, based on the following specifications. Be sure to consider the following specifications when using this product in the Member State of European Union.

● EMC Directive

- Applicable standard EN61326-1, Class A
- This product is designed for use in industrial environments.
- The length of cable connected to the power supply terminal block must be less than or equal to 30 m.

Remarks: These specifications do not give any guarantee that the end-product with this product incorporated complies with the essential requirements of EMC Directive. The manufacturer of the end-product is solely responsible for the compliance on the end-product itself according to EMC Directive.

UL Certificate

The GT2-100N and GT2-100P are UL Recognized products.

- UL File No. E120439 (Category: NRNT2/NRNT8)

Be sure to consider the following specifications when using these products as an UL recognized products.

- Use the power supply with Class 2 output defined in NFPA70 (NEC: National Electrical Code).
- GT2 series are evaluated as open type devices. These products can not be a part of an enclosure.

Contents

Chapter 3 Basic Usage of the GT2-100 Series

Chapter 4 Using Detection Modes

Chapter 5 Setting Various Functions

Chapter 6 Specifications

Appendix

Before Use

1

This chapter describes the package contents of the GT2-100 Series and the name and function of each part.

1-1 Checking the Package Contents

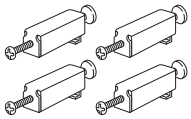
Before using the unit, make sure that the following equipment and accessories are included in the package.

Sensor Amplifier

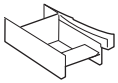
■ Amplifier

GT2-100N/100P

Amplifier x 1
Instruction manual x 1



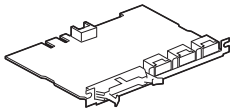
Mounting bracket x 4



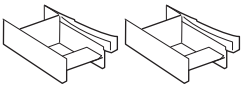
Dummy connector x 1
(Mounted on the amplifier)

■ Head expansion board

GT2-E3N/E3P



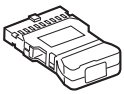
Head expansion board x 1



Dummy connector x 2
(Mounted on the board)

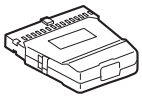
■ I/O connector

OP-22185
(MIL socket connector 20-pin)



Hood cover, Housing x 1
Contact x 25

OP-84456
(MIL socket connector 30-pin)



Hood cover, Housing x 1
Contact x 35

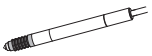
We have thoroughly inspected the package contents before shipment. However, in the event of defective or broken items, contact your nearest KEYENCE office.

Sensor Head

GT2-S1

Sensor head x 1
Precautions for usage x 2

GT2-S5



Sensor head x 1
Precautions for usage x 2

GT2-P12K/P12

Sensor head x 1
Precautions for usage x 1

GT2-P12KL/P12L

Sensor head x 1
Precautions for usage x 1

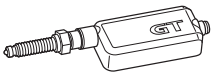
GT2-P12KF/P12F

Sensor head x 1
Precautions for usage x 1
Nut x 1
Key spanner x 1

GT2-PA12K(L)/PA12(L)

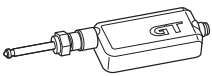
Sensor head x 1
Precautions for usage x 2

GT2-H12KF/H12F



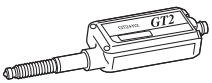
Sensor head x 1
Precautions for usage x 1
Nut x 1
Key spanner x 1

GT2-H12KLF/H12LF



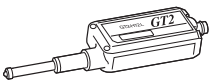
Sensor head x 1
Precautions for usage x 1
Nut x 1
Key spanner x 1

GT2-H12



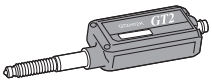
Sensor head x 1
Precautions for usage x 1

GT2-H12L (Low stress type)



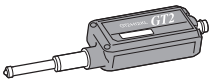
Sensor head x 1
Precautions for usage x 1

GT2-H12K (High accuracy type)



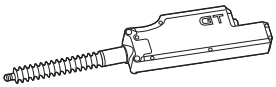
Sensor head x 1
Precautions for usage x 1

GT2-H12KL (High accuracy type/ low stress type)



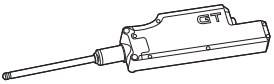
Sensor head x 1
Precautions for usage x 1

GT2-H32



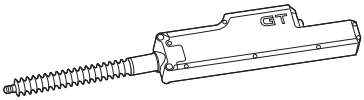
Sensor head x 1
Precautions for usage x 1

GT2-H32L (Low stress type)



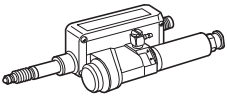
Sensor head x 1
Precautions for usage x 1

GT2-H50



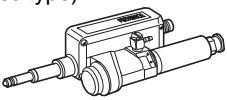
Sensor head x 1
Precautions on Handling x 1

GT2-A12 (Air cylinder type)



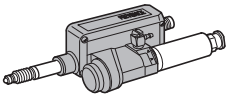
Sensor head x 1
Precautions on Handling x 1

GT2-A12L (Air cylinder, low stress type)



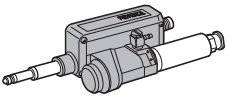
Sensor head x 1
Precautions on Handling x 1

GT2-A12K (Air cylinder, high accuracy type)



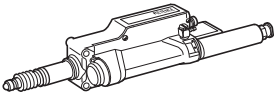
Sensor head x 1
Precautions on Handling x 1

GT2-A12KL (Air cylinder, high accuracy, low stress type)



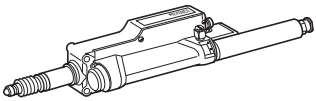
Sensor head x 1
Precautions on Handling x 1

- GT2-A32 (Air cylinder type)



Sensor head x 1
Precautions on Handling x 1

- GT2-A50 (Air cylinder type)



Sensor head x 1
Precautions on Handling x 1

Sensor Head Connection Cable

- GT2-CH2M/5M/10M/20M
(M8 straight connector)

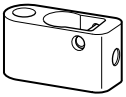
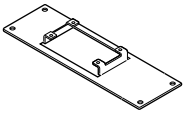
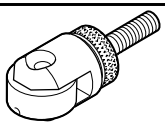
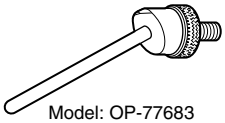
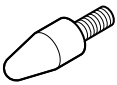
- GT2-CHL2M/5M/10M/20M
(M8 L-shaped connector)

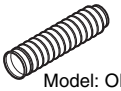
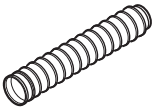
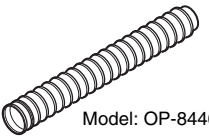
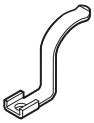
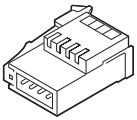
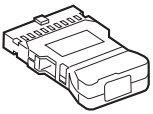
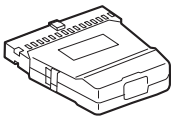
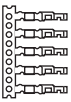
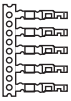
- GT2-CHP2M/5M/10M
(M8 oil-resistant straight connector)

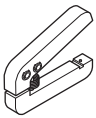
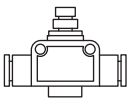
NOTICE	• **The M8 L-shaped connector type cable cannot be used with the GT2-H32(L)/H50/A32/A50.** • **When a protection rating of IP67G and NEMA Type 13 enclosure is required for GT2-P12K(F)/P12(F), or a protection rating of IP67G is required for GT2-S1/S5 use an M8 oil-resistant straight connector type cable. Other cables do not meet the IP67G protection rating or NEMA Type 13 enclosure rating.**

We have thoroughly inspected the package contents before shipment. However, in the event of defective or broken items, contact your nearest KEYENCE office.

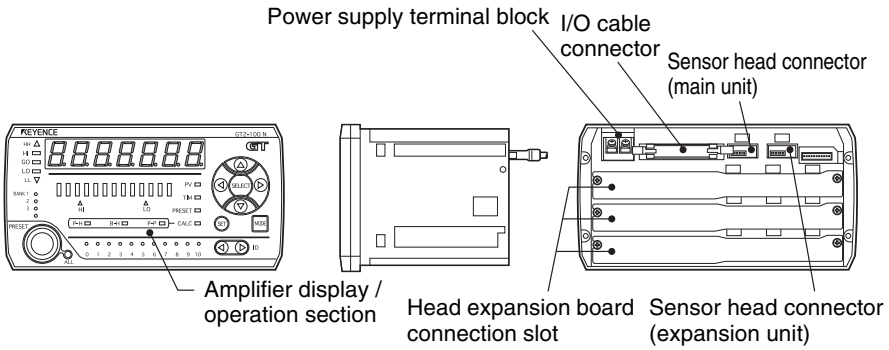
List of Optional Parts

 Model: OP-76874 For use with a 1/5/12 mm stroke Mounting bracket A (Key wrench supplied)	 Model: OP-76875 For use with a 1/5/12 mm stroke Mounting bracket B	 Model: OP-84396 For use with a 1/5/12 mm stroke Mounting bracket C (Key wrench supplied)
 Model: OP-84327 GT2-H32(L)/H50/A32/A50 Mounting bracket D (Key wrench supplied)	 Model: OP-87220 For use with a 1/5/12 mm stroke Mounting bracket E	 Model: OP-87863 For GT2-S1/S5 and GT2-P** (Screw and hexagonal wrench supplied) Mounting bracket F
 Model: OP-84331 GT2-100 Fixture (4 tapping screws supplied)	 Model: OP-77678 Standard contact (Key wrench supplied) Included with the GT2-P12(L)(F)/PA12(L)/H12(L)/H32(L)/H50/A12(L)/A32/A50 as standard equipment.	 Model: OP-77679 Flat plate contact (Key wrench supplied) A flat type contact with the surface roughness of 1 µm.
 Model: OP-77680 Roller contact (Key wrench supplied) A contact with the roller eccentricity of 10 µm.	 Model: OP-93332 High accuracy roller contact (Key wrench supplied) A contact with the roller eccentricity of 5 µm.	 Model: OP-77681 Needle contact (Key wrench supplied) Carbide (tungsten alloy) is used at the tip.
 Model: OP-77682 Carbide contact (Key wrench supplied) Included with the GT2-S1/S5/P12K(L)(F)/PA12K(L)/H12K(L)/A12K(L) as standard equipment. Carbide (tungsten alloy) is used at the tip.	 Model: OP-77683 Offset contact (Key wrench supplied) Used to detect multiple small targets.	 Model: OP-80228 Fluorine resin contact (Key wrench supplied) A contact that uses fluorine resin.

 Model: OP-81970 Ceramic contact (Key wrench supplied) A ceramic ball is used at the tip.	 Dust boot for GT2-S1 Model: OP-88063 Included with (mounted on) the sensor head.	 Dust boot for GT2-S5 Model: OP-88065 Included with (mounted on) the sensor head.
 Model: OP-84332 Dust boot for GT2-P12K/ P12KF/P12/P12F/H12K/ H12KF/H12/H12F/A12K/A12 (Key wrench supplied) Included with (mounted on) the sensor head.	 Model: OP-84459 Dust boot for GT2-H32/A32 (Key wrench supplied) Included with (mounted on) the sensor head.	 Model: OP-84460 Dust boot for GT2-H50/A50 (Key wrench supplied) Included with (mounted on) the sensor head.
 Model: OP-87859 Dust boot for GT2-P12K/ P12KF/P12/P12F (Key wrench supplied) Fluorine coated dust boot.	 Model: OP-87932 Replacement dust seal for GT2-PA12K/PA12 (Key wrench and replacement packing supplied) Replacement dust seal.	 Model: OP-77684 Spacer (Key wrench supplied) Used to extend the spindle for 12.2 mm.
 Model: OP-84397 Lift lever (Key wrench supplied)	 Model: OP-84338 Connector for GT2 (two pieces) Replacement connector for the sensor head connection cable	 Model: OP-22185 20-pin MIL socket connector I/O connector for GT2-100.
 Model: OP-84456 30-pin MIL socket connector I/O connector for head expansion board.	 Model: OP-22186 AWG24-22 contact (200 pcs.) Backup contacts for OP-22185/84456.	 Model: OP-30594 AWG28-26 contact (200 pcs.) Thin contacts for OP-22185/84456.

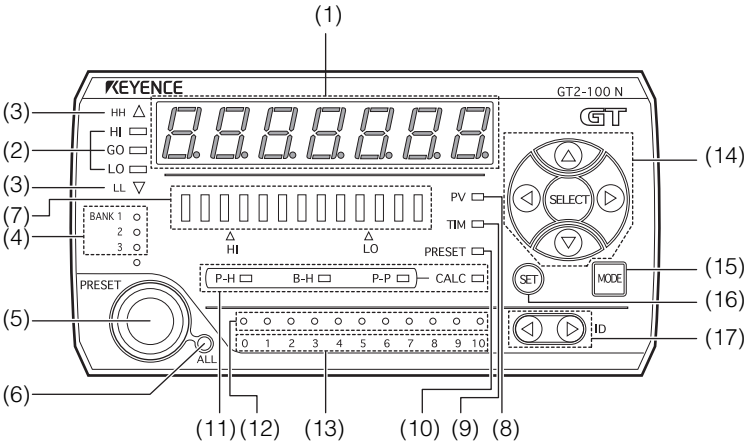
 Model: OP-21734 Dedicated crimping tool Tool used to easily crimp OP-22186/30594.	 Model: OP-87970 Speed controller Adjusts the spindle extension speed. (For the GT2-PA12K/ PA12/A12K(L)/A12(L)/A32/A52)	 Model: OP-87984 Small diameter standard contact Included with the GT2-PA12 as standard.
 Model: OP-87985 Small diameter carbide contact Included with the GT2-PA12K as standard. Carbide (tungsten alloy) is used at the tip.	 Model: OP-88117 Relay amplifier mounting bracket for the GT2-S1/S5	

Sensor Amplifier Unit



Identifying Part Names and Functions

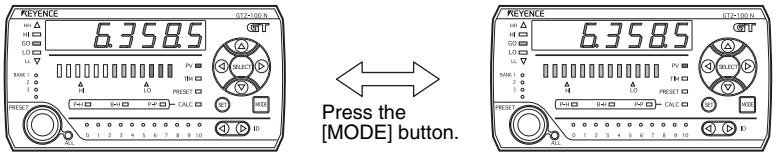
■ **Front (display/operation section)**



Item	Description
(1) Digital LED display	Displays the detected values and setting.
(2) Detection level indicator	Indicates HI/GO/LO positions. When an error occurs, HI and LO light at the same time.
(3) Special output indicator	Lights in red when judged as HH/LL if the option other than "no. USE" is selected for "16. Special Output Setting" in the basic setting mode.
(4) Bank indicator	The indicator of the bank No. being selected lights in green. When all bank indicators are turned off, "Bank 0" is selected.

Item		Description
(5) [PRESET] button		Used when adjusting the origin.
(6) Batch setting indicator		When the batch setting indicator is lit, performing preset or bank switching applies the changes to all ID.
(7) Bar LED	Normal display mode *1	Lights the LEDs according to the measured values. Indicates (lights in green) the position of the setting data of HIGH/LOW by the HIGH/LOW position indicator.
	OK/NG display mode *1	• If the measured value is "GO", all the LEDs are lit in green. • When in a criterion wait state*2, all the LEDs turn off. • If the measured value is "HIGH (or LOW)", all the LEDs are lit in red.
(8) PV indicator		Lights in red when the P.V. value display screen is displayed.
(9) Timing input indicator		• When "04. Timing type" of the function setting mode is set to "t-in", this lights in green while the timing signal is entered. • When using the internal timing, this lights in green when the data exceeds (falls below) the timing level.
(10) Preset indicator		• Lights in green for 0.3 seconds when the preset signal is entered. • Lights in red when the preset value is displayed (set).
(11) Status indicator		When the hold mode is selected for "01. Detection mode" in the function setting mode, the indicator corresponding to the selected hold mode lights in red when the P.V. value display screen is displayed. If the calculation function is used when the expansion unit is added, CALC lights in red when the P.V. value display screen or the calculated value display screen is displayed. "3-2 Main Screens" (page 3-4)
(12) OK/NG indicator for each Head No.		• When the criterion result is "GO", each of the LEDs of the corresponding head lights in green. • During the criterion wait state*2, each of the LEDs of the corresponding head turns off. • When the criterion result is "other than GO", each of the LEDs of the corresponding head lights in red. • When ErH, the LEDs blink in red.
(13) Head ID indicator		• The head ID displayed in the current main screen lights in red. • The valid head connector ID lights in green. • The head connector ID that cannot be used turns off. • When the ID is changed using the [Head select] button, the changed ID number blinks in red for 10 seconds.
(14) Arrow buttons		Menu selection • Left/right arrow button: Used to select the menu. • Up/down arrow button: Used to change the contents of the menu.
(15) [MODE] button		Used for starting or ending the adjustment when adjusting the settings. This is used also when switching*1 the display mode of the bar LED.
(16) [SET] button		Used to automatically adjust the set point.
(17) [Head select] button		Selects which sensor head to display.*3

*1 Briefly pushing the [MODE] button on the P.V. value display screen will switch the bar LED display mode.

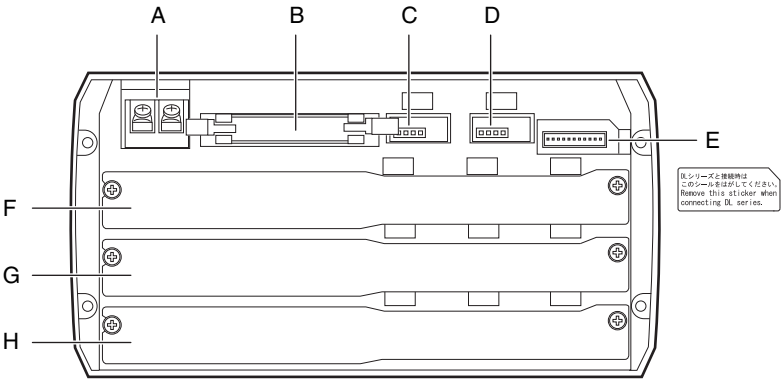


Normal display mode　　OK/NG display mode

*2 The criterion wait state refers to the following cases:
- During the sampling period when using the internal timing
- When "------" is displayed in the P.V. value display screen

*3 The ID whose head ID indicator is lit can be selected.

■ **Rear (connection section)**



	Item	Description
A	Power supply terminal block	Connect the power supply (20 to 30 VDC).
B	I/O cable connector	Connect the I/O cable for the main unit (ID: 00) and expansion unit 1 (ID: 01).
C	Sensor head connector (main unit: ID 00)	Connect the sensor head of the main unit (ID: 00).
D	Sensor head connector (expansion unit: ID 01)	Connect the sensor head of expansion unit 1 (ID: 01). Attach the sensor head connector cover when no sensor head is connected.
E	DL connector *1	Connect the expansion cable (OP-35361) when connecting the DL Series communication unit amplifier.
F	Head expansion board connection slot 1 *2	A slot to connect the optional head expansion board. Used to connect expansion units 2 (ID: 02) to 4 (ID: 04).
G	Head expansion board connection slot 2 *2	A slot to connect the optional head expansion board. Used to connect expansion units 5 (ID: 05) to 7 (ID: 07).

Item		Description
H	Head expansion board connection slot 3 *2	A slot to connect the optional head expansion board. Used to connect expansion units 8 (ID: 08) to 10 (ID: 10).

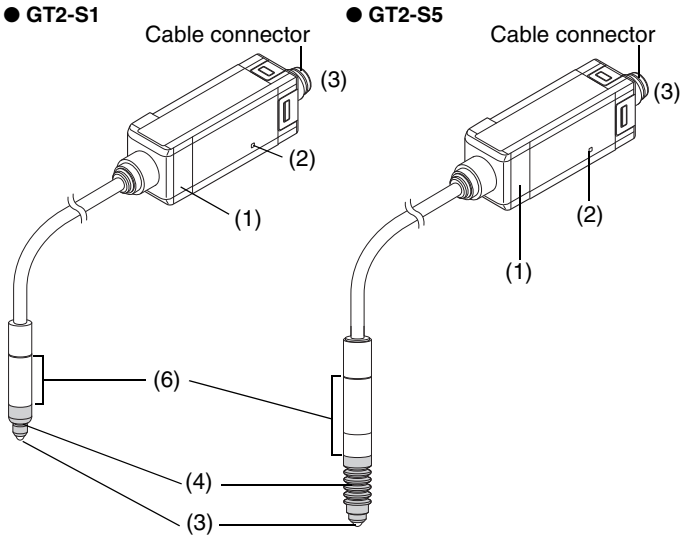
*1 Covered with a sticker at the time of shipment.

*2 A cover is attached at the time of shipment.

NOTICE	• **Connect the head expansion board sequentially (front-justified) from connection slot 1. If there is a skipped slot, the sensor heads other than the main unit (ID: 00) cannot be recognized.** • **Do not connect other devices than the DL Series communication unit to the DL connector.**

Sensor Head Unit

GT2-S1/S5

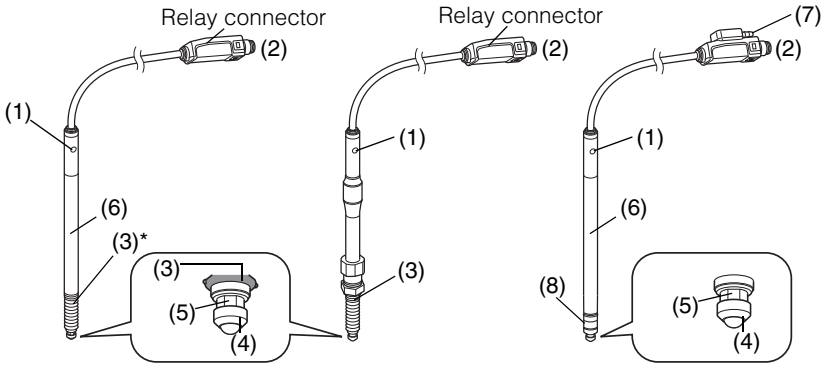


Item		Description
(1) Operation indicator	During normal operations	When judged as HIGH/LOW: Lights red When judged as GO: Lights green In a criterion wait state: Turns off
	During setting	Blinks red or green
	When setting power save function	Turns off
	When an error occurs	Lights red

<table>
<tr><th>Item</th><th>Description</th></tr>
<tr><td>(2) Position indicator</td><td>
<table>
<tr><td rowspan="2">Type</td><td colspan="3">Value displayed on the amplifier*1</td></tr>
<tr><td>Outside of measuring range</td><td>Within measuring range</td><td>Measured center</td></tr>
<tr><td>GT2-S1</td><td>>1 or <0</td><td>0 ≤ measured value ≤ 1</td><td>0.5±0.1</td></tr>
<tr><td>GT2-S5</td><td>>5 or <0</td><td>0 ≤ measured value ≤ 5</td><td>2.5±0.25</td></tr>
<tr><td>Position indicator</td><td>Turns off</td><td>Lights red</td><td>Lights green</td></tr>
</table>
*1 When the preset function, lever ratio setting, and calibration function are not in use
</td></tr>
<tr><td>(3) Sensor head cable connector</td><td>Connects to the sensor head connection cable.</td></tr>
<tr><td>(4) Dust boot</td><td>Complies with IP67G (JIS) and IP67 (IEC)</td></tr>
<tr><td>(5) Contact</td><td>The carbide type (OP-77682) is attached when the product is shipped from the factory.</td></tr>
<tr><td>(6) Mounting fastener</td><td>Use this part to mount the sensor head to a fixture. If the sensor head is fixed at other places than the mounting fastener, the unit may be damaged.</td></tr>
</table>

GT2-P12K(L)(F)/P12(L)(F)/PA12K/PA12

● GT2-P12K(L)/P12(L) ● GT2-P12KF/P12F ● GT2-PA12K(L)/PA12(L)



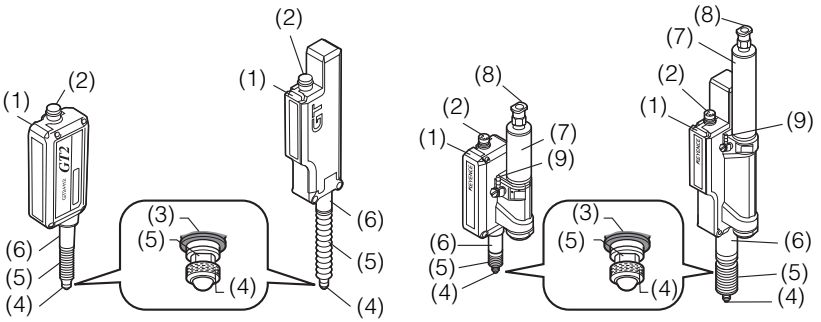
* Not included in the GT2-P12KL/P12L.

<table>
<tr><th colspan="2">Item</th><th>Description</th></tr>
<tr><td rowspan="4">(1) Operation indicator</td><td>During normal operations*1</td><td>When judged as HIGH/LOW : Lights red
When judged as GO : Lights green
In a criterion wait state*2 : Turns off</td></tr>
<tr><td>During setting</td><td>Blinks red or green*3</td></tr>
<tr><td>When setting power save function</td><td>Turns off*4</td></tr>
<tr><td>When an error occurs</td><td>Lights red</td></tr>
<tr><td colspan="2">(2) Sensor head cable connector</td><td>Connects to the sensor head connection cable.</td></tr>
</table>

Item	Description
(3) Dust boot*5	Ensures an IP67G and NEMA Type 13 enclosure rating.
(4) Contact	When shipped from the factory, the standard type (OP-77678) is supplied for the GT2-P12(L)(F)/PA12 and the carbide type (OP-77682) is supplied for the GT2-P12K(L)(F)/PA12K. Various types of contacts are available for different applications. "List of Optional Parts" (page 1-6) "A3 Replacing the Contact" (page A-8)
(5) Spindle	Displays the amount of movement of the spindle as the detection value.
(6) Mounting fastener	Use this part to mount the sensor head to a fixture. If the sensor head is fixed at other places than the mounting fastener, the unit may be damaged. A mounting bracket is attached to GT2-H12KF/H12F/H12KLF/H12LF.
(7) Air port*7	Supplied air extends the spindle*6.
(8) Dust seal	Attached when shipped. When replacing, use the replacement dust seal OP-87932.

*1 When "CALc (calculation mode)" is selected for "A1. APL (calculation mode settings)", the expansion unit operates in the same way as the main unit.
*2 The criterion wait state refers to the following cases:
· During the sampling period when using the internal timing
· When "------" is displayed in the P.V. value display screen
*3 The blinking color changes according to the lighting color of the normal operation. (The indicator blinks in red in a criterion wait state.)
*4 Turns off only when "ALL (Full eco)" is selected in "23.Eco (Power Save Function)".
"23. Power Save Function" (page 5-39)
*5 The dust boot can be replaced.
"A4 Replacing the Dust Boot" (page A-10)
*6 See page 2-20 for the air supply method.
*7 This is not present on the GT2-PA12KL/P12L.

GT2-H12K(L)(F)(LF)/H12(L)(F)(LF)/H32(L)/H50/A12K(L)/A12(L)/A32/A50



Item		Description
(1) Operation indicator	During normal operations[*1]	When judged as HIGH/LOW : Lights red When judged as GO : Lights green In a criterion wait state[*2] : Turns off
	During setting	Blinks red or green[*3]
	When setting power save function	Turns off[*4]
	When an error occurs	Lights red
(2) Sensor head cable connector		Connects to the sensor head connection cable.
(3) Dust boot[*5]		Ensures an IP67 enclosure rating.
(4) Contact		When shipped from the factory, the standard type (OP-77678) is supplied for the GT2-H12(L)/H32(L)/H50/A12(L)/A32/A50 and the carbide type (OP-77682) is supplied for the GT2-H12K(L)/A12K(L). Various types of contacts are available for different applications. "List of Optional Parts" (page 1-6) "A3 Replacing the Contact" (page A-8)
(5) Spindle		Displays the amount of movement of the spindle as the detection value.
(6) Mounting fastener		Use this part to mount the sensor head to a fixture. If the sensor head is fixed at other places than the mounting fastener, the GT2-100 Series unit may be damaged. A mounting bracket is attached to GT2-H12KF/H12F/H12KLF/H12LF.
(7) Air cylinder		This air cylinder is a single-acting push type[*6]. Supplying air extends the spindle.
(8) Coupling socket		This is the socket used to supply air to the air cylinder. Connect an air tube with an inside diameter of 2.5 mm and an outside diameter of 4 mm.
(9) Exhaust valve		This is the exhaust valve[*7] that causes the air cylinder to push out. In order to guarantee the IP67 enclosure rating, connect an air tube with an inside diameter of 2.5 mm and an outside diameter of 4 mm, and place the edge of the tube in a location that will not come into contact with dust or water.

*1 When "CALc (calculation mode)" is selected for "A1. APL (calculation mode settings)", the expansion unit operates in the same way as the main unit.

*2 The criterion wait state refers to the following cases:
- During the sampling period when using the internal timing
- When "------" is displayed in the P.V. value display screen

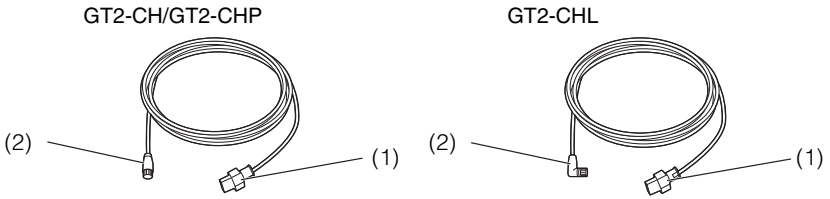
*3 The blinking color changes according to the lighting color of the normal operation. (The indicator blinks in red in a criterion wait state.)

*4 Turns off only when "ALL (Full eco)" is selected in "23.Eco (Power Save Function)".
"23. Power Save Function" (page 5-39)

*5 The dust boot can be replaced, but the IP67 enclosure rating cannot be guaranteed after replacement. If you need the IP67 enclosure rating to be guaranteed, replace the sensor head.
"A4 Replacing the Dust Boot" (page A-10)
*6 Vent air exhaust to the atmosphere.
*7 The air cylinder returns to the previous position by a spring in the air cylinder, so do not supply air to the exhaust valve.

NOTICE	**The GT2-P12KL/P12L/PA12KL/PA12L/H12KL/H12L/H12KLF/ H12LF/H32L/A12KL/A12L does not have the dust boot. The protection rating is equivalent to "IP40". Do not install the dust boot to the GT2-P12KL/P12L/H12KL/ H12L/H12KLF/H12LF/H32L/A12KL/A12L. It can hinder the return movement of the spindle.**

Sensor Head Connection Cable



Item	Description
(1) Amplifier connector	Connects to the amplifier.
(2) Sensor head connector	Connects to the sensor head.

The relationship between the model of the sensor head connector and the cable length is as follows.

Model	Cable length
GT2-CH2M/GT2-CHL2M/GT2-CHP2M	2 m
GT2-CH5M/GT2-CHL5M/GT2-CHP5M	5 m
GT2-CH10M/GT2-CHL10M/GT2-CHP10M	10 m
GT2-CH20M/GT2-CHL20M	20 m

GT2-CHL*M cannot be used with GT2-H32(L)/H50/A32/A50.

Installation and Connection

2

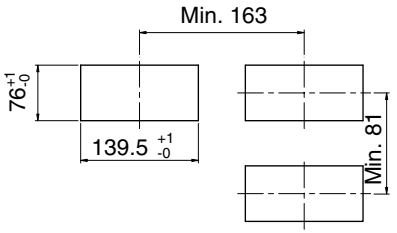
This chapter describes precautions when installing and connecting the GT2-100 Series.

Mounting the Sensor Amplifier

■ **Mounting on a panel**

1 **Cut panel openings based on the dimensions below.**

• Panel cutout when mounting the unit vertically

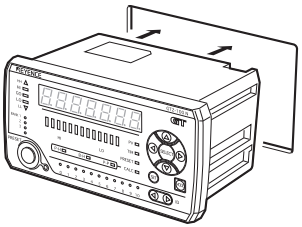


Panel thickness of mounting area
1 to 6 mm

(Unit: mm) Panel cut dimension

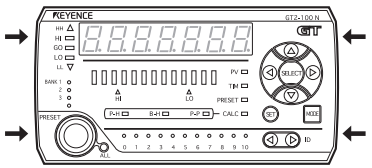
Reference When mounting the units side by side, ensure the center pitch between the sensor amplifiers is 163 mm or more.

2 **Insert the main unit from the front side of the panel into the opening for mounting.**

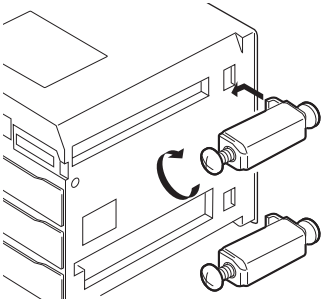


3 **Secure the main unit on the panel using the included mounting bracket.**

Attach the mounting brackets on the sides of the unit (2 points on each side).



4 **Tighten the screw of the mounting bracket.**

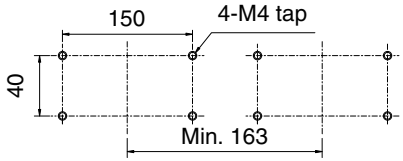


Tightening torque
0.5 to 0.8 N•m

■ Mounting on a table

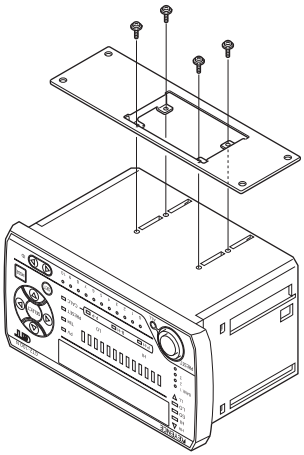
When mounting the amplifier on a table, use the large amplifier mounting bracket (OP-84331).

1 **Create on a table opening for mounting referring to the dimensions below.**



(Unit: mm)

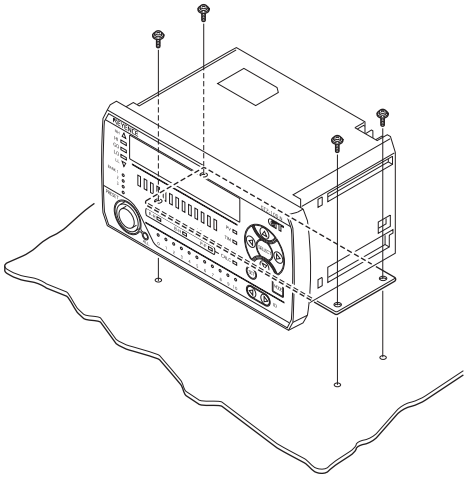
2 **Attach the large amplifier mounting bracket (OP-84331) on the amplifier.**
Use the four tapping screws supplied with the large amplifier to attach the mounting bracket.



Tightening torque
0.8 to 1.0 N•m

Secure with the included four screws.

3 **Secure the amplifier with M4 screws.**



Sensor Amplifier Wiring

Reference Insulate the unused I/O lines individually.

■ Connecting the power supply

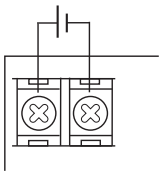
● Applicable wire

For the wire for the power supply, use the wire that meets the following specifications for the power supply wire.

Wire size : AWG22 to16

Tightening torque : 0.4 to 0.8 N•m

20 to 30 V DC

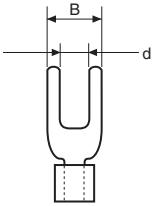


● Crimp-type terminal

The power supply terminal of the amplifier uses M3 screws.

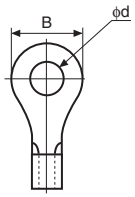
Use the Y or round terminal in the following size

Y terminal



	Applicable dimension
B: Outer size of Y area	6 mm max.
d: Width of inner Y area (joint area with screw)	3.2 mm min.

Round terminal

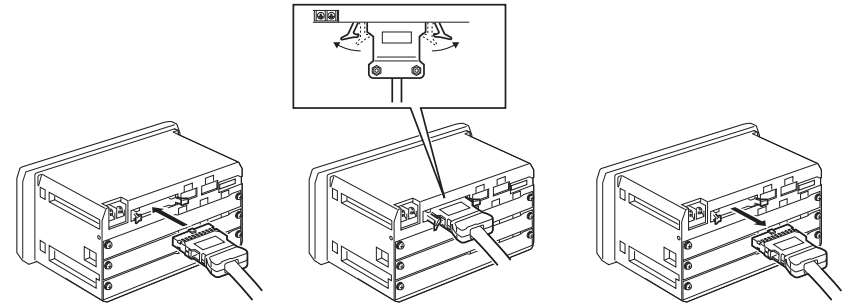


	Applicable dimension
B: Outer size of round area	6 mm max.
d: Diameter of inner round area (joint area with screw)	3.2 mm min.

■ Connecting the I/O connector

For the input and output of the GT2-100N/100P, use OP-22185 (MIL socket connector 20-pin) sold separately.

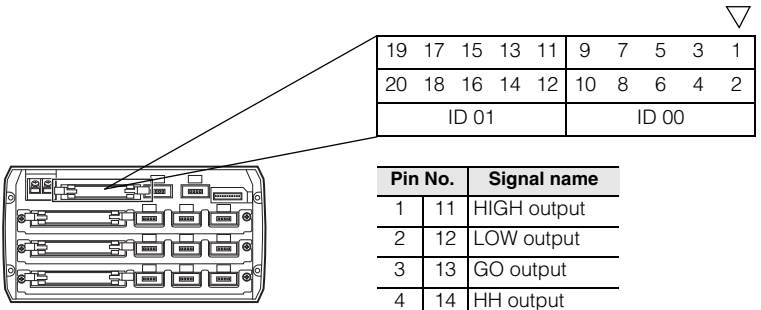
"Combining and Wiring Connectors" (page 2-10)



(When connecting the I/O connector) (When disconnecting the I/O connector)

● Pin arrangement of I/O connector

"6-2 I/O Circuit Diagram" (page 6-13)



Pin No.		Signal name
1	11	HIGH output
2	12	LOW output
3	13	GO output
4	14	HH output
5	15	LL output
6	16	PRESET input
7	17	BANK A input
8	18	BANK B input
9	19	RESET input
10	20	TIMING input

Reference

When you turn on the power for the first time or after the number of the connected sensor head is changed, be sure to set the valid ID setting. For details about the valid ID setting, refer to "Valid ID Setting" (page 3-2).

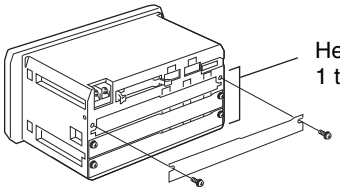
Connecting Three or More Heads

- Two heads can be connected to the amplifier unit (GT2-100N/100P) as standard.
- When adding three or more heads, use the optional head expansion board (GT2-E3N/E3P) sold separately to the rear of the amplifier.
- Three heads can be added to one head expansion board. Up to three head expansion boards can be added, so the maximum of eleven heads can be added.

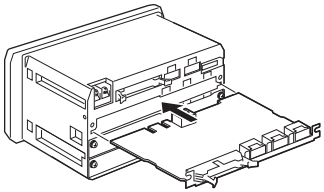
■ Mounting the head expansion board

1 **Detach the head expansion board connection slot cover at the rear of the amplifier.**

The cover is fixed with the M3 screws (2 pieces).



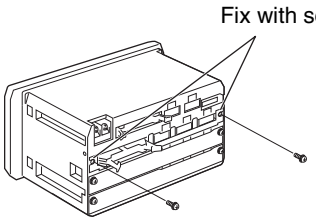
2 **Insert the head expansion board along the guide rail.**



Reference Insert the head expansion board up to the end.

3 **Fix the head expansion board with the screws.**

Fix the head expansion board with the two M3 screws used to fix the cover.

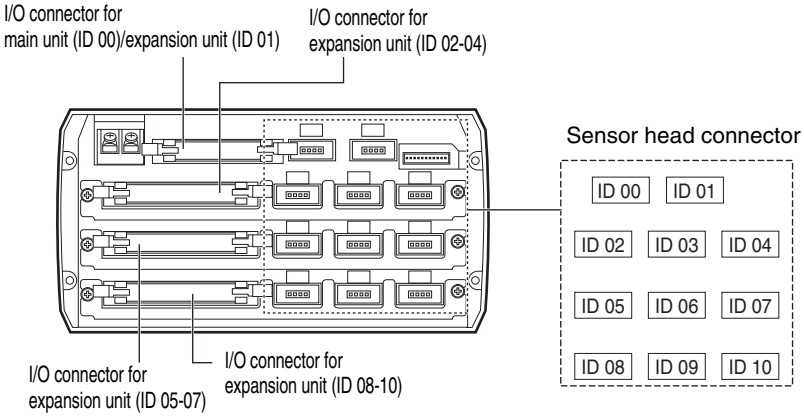


To remove the head expansion board, reverse the steps above.

NOTICE	• **Apply tightening torque of 0.5 to 0.7 N•m** • **Be sure to fix the head expansion board with screws.** • **Be sure to connect the head expansion boards sequentially from the upper slot.**

■ Assigning the head ID

The head ID is assigned according to the position of the connector to which the head is connected.



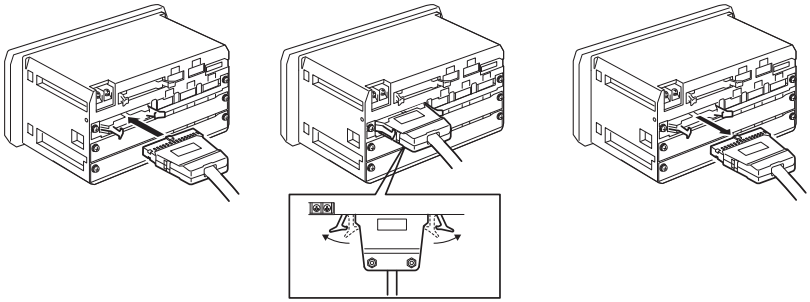
Reference

- The assigned head ID cannot be changed.
- Be sure to connect the sensor heads sequentially without skipping a connector. If the head expansion board has a connector to which no sensor head is connected, disable the unused connector in the valid ID setting.
- The sensor heads exceeding the IDs set in the valid ID setting cannot be recognized.

■ Mounting the I/O connector for expansion units

For the input and output of the GT2-E3N/E3P, use OP-84456 (MIL socket connector 30-pin) sold separately.

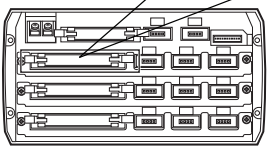
"Combining and Wiring Connectors" (page 2-10)



(When connecting the I/O connector) (When disconnecting the I/O connector)

● Pin arrangement of I/O connector

"6-2 I/O Circuit Diagram" (page 6-13)



29	27	25	23	21	19	17	15	13	11	9	7	5	3	1
30	28	26	24	22	20	18	16	14	12	10	8	6	4	2
ID 04					ID 03					ID 02				

Pin No.			Signal name
1	11	21	HIGH output
2	12	22	LOW output
3	13	23	GO output
4	14	24	HH output
5	15	25	LL output
6	16	26	PRESET input
7	17	27	BANK A input
8	18	28	BANK B input
9	19	29	RESET input
10	20	30	TIMING input

Combining and Wiring Connectors

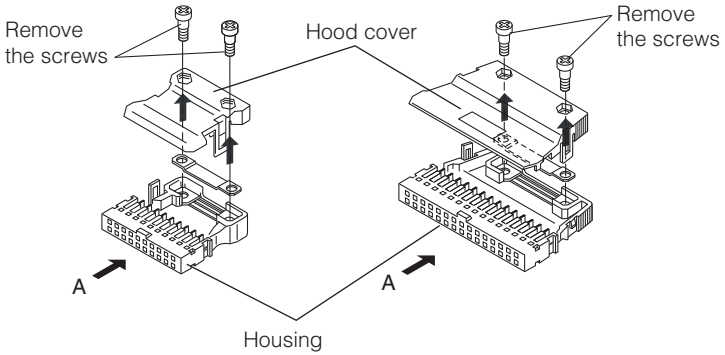
To connect the GT2-100 Series to external devices, the cable from each device must be wired to the connector (MIL socket connector 20-pin/30-pin).

The following connectors can be used.

Model	Matching connector model	Pole number	Structure
GT2-100N/100P	OP-22185	20-pin	1 hood cover, 1 housing, 25 contacts
GT2-E3N/E3P	OP-84456	30-pin	1 hood cover, 1 housing, 35 contacts

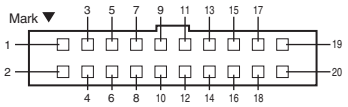
■ Connectors

An upper and lower cover is installed on the connector. When performing the wiring, remove both covers.

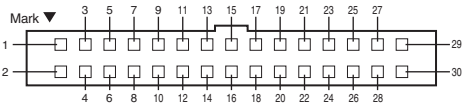


OP-22185 (20-pin) OP-84456 (30-pin)

● I/O connector pin assignments (viewed from A in the above diagram)



OP-22185

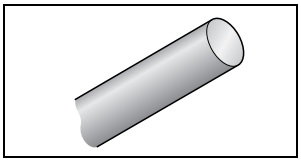


OP-84456

■ **Precautions when wiring (OP-22185 and OP-84456)**

Carefully follow the precautions below when performing wiring.

- Use the following type of compliant cable:
  Cable size: AWG24 to 22 (stranded)
  Cross-section: 0.2 to 0.3 mm^2
  Cable sheath diameter: ϕ1.5 to ϕ1.1
- Cut the end of the cable straight across.



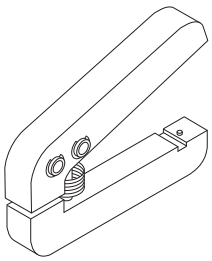
- After performing the wiring, check that the cable is securely held in the clamp and that it is inserted firmly.
- Cut the cable clearly so that no loose threads remain. (The sheath does not need to be removed.)
- Use the thin cable contacts OP-30594 (200 pieces included) for AWG28 to 26. (Use this together with OP-22185 or OP-84456.)
  Cable size: AWG28 to 26
  Cross-section: 0.08 to 0.14 mm^2
  Cable sheath diameter: ϕ1.3 to ϕ1.1

■ **Dedicated crimping tool**

You can use the dedicated crimping tool to easily crimp the ends of the cable.
Use the following dedicated crimping tool for wiring.

Reference If you do not use the dedicated crimping tool, you must solder the connection.

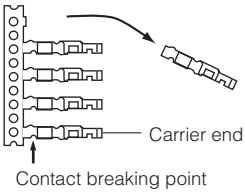
● **Dedicated crimping tool: Model OP-21734**



■ Wiring to the connector

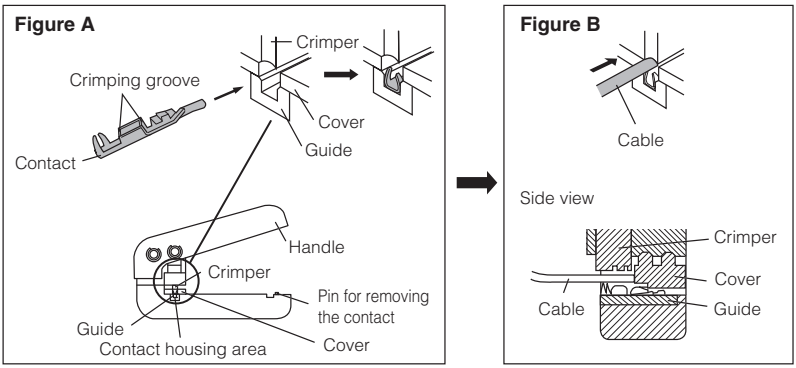
This section explains how to use the dedicated crimping tool to perform wiring. Make sure to have contacts, housing, and the cable beforehand.

1 **To remove the contact, bend at the breaking point.**
For additional contacts use OP-22186 (includes 200 contacts).

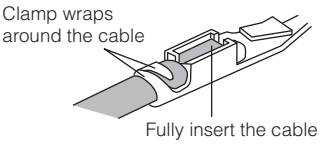


2 **Fully insert the contact straight into the contact housing area of the dedicated crimping tool as in (Figure A) .**

3 **Fully insert the cable straight into the dedicated crimping tool so that it lays in the crimping grove of the contact. (Figure B)**
(The cable sheath does not need to be removed.)

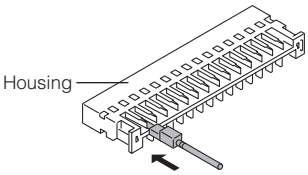


4 **Press down on the handle of the dedicated crimping tool until the clamp wraps completely around the cable.**
Gently tug on the cable to remove the cable with crimped contact from the housing area of the dedicated crimping tool.



5 **Fully insert the cable straight into a groove in the house that does not already contain a contact.**

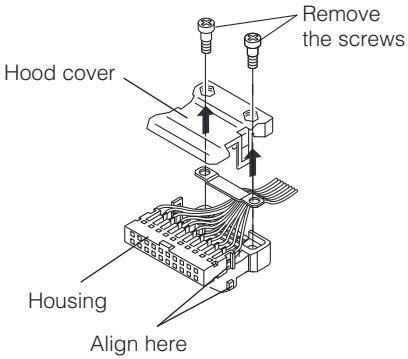
- Gently tug on the cable to check that the contact is securely inserted.
- Completely insert the contact in the housing.



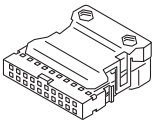
6 **With the contacts inserted into the housing, install the hood covers.**

OP-22185

(1) Attach the screws

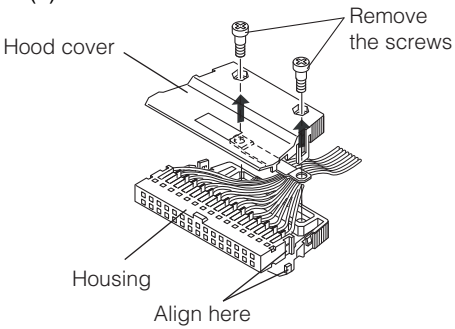


(2) Put the cover

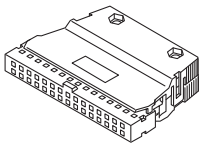


OP-84456

(1) Attach the screws



(2) Put the cover

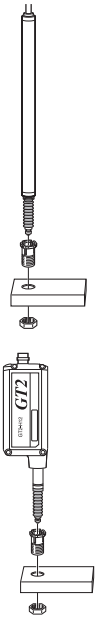


Mounting the Sensor Head

Mounting directly to a jig

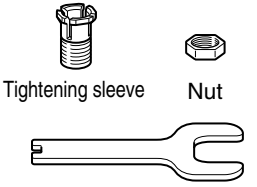
Before mounting the sensor head directory to the jig, create a hole on the jig. Attach the sensor head using the optional mounting bracket sold separately. A mounting bracket is provided with the GT2-P12KF/P12F/H12K(L)F/H12(L)F as standard. Attach it with the supplied nut.

Mounting diagram

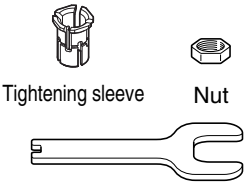


● **1/5/12 mm stroke sensor head other than the flange type**

Package contents of the mounting bracket A (OP-76874)

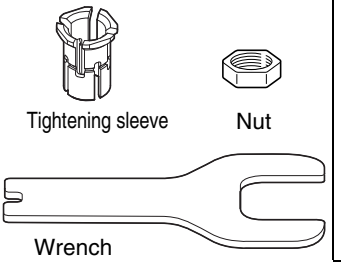


Package contents of the mounting bracket C (OP-84396)



● **GT2-H32(L)/H50/A32/A50**

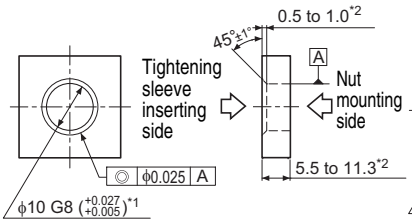
Package contents of the mounting bracket D (OP-84327)



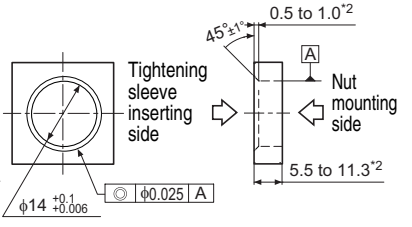
NOTICE	**When mounting the GT2-H32L facing upward, be sure to use the mounting holes on the side of the sensor head. If the sensor head is mounted using mounting bracket D, the spindle may not fully extend.**

1 **Cut the jig to create a sensor head mounting hole referring to the illustration below.**

● **1/5/12 mm stroke sensor head other than the flange type**



● **GT2-H32(L)/H50/A32/A50**

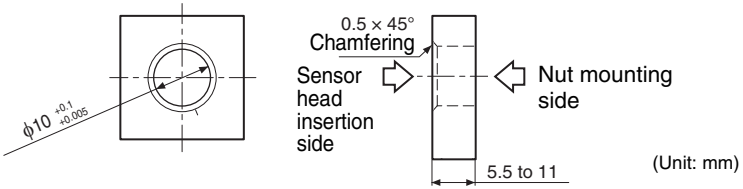


*1 For mounting bracket C
$\phi 10\ ^{+0.1}_{+0.005}$

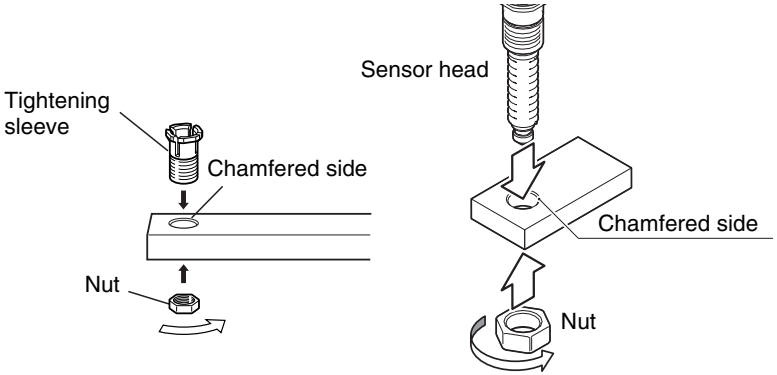
*2 Processing accuracy: ±0.05

(Unit: mm)

● **GT2-P12KF/P12F/H12K(L)F/H12(L)F**

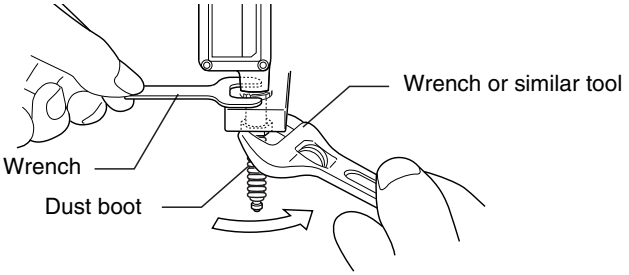


2 **Insert the tightening sleeve into the hole (from the Chamfered side), and loosely tighten with the nut.**



NOTICE	**Strongly tightening the nut without the sensor head inserted may deform the tightening nut.**

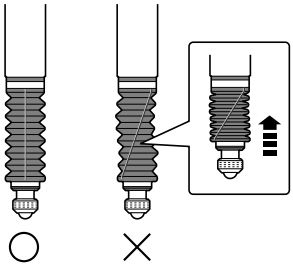
3 **Insert the sensor head into the tightening sleeve. While securing the tightening sleeve with the included wrench, tighten the nut with a separate wrench.**



NOTICE	**Tightening the nut while fixing the sensor head may lead to damage.** **• The tightening torque for mounting bracket A (OP-76874), mounting bracket C (OP-84396), and the nuts supplied with the GT2-H12K(L)F/H12(L)F/P12KF/P12F is between 5 and 7 N•m (the recommended tightening torque is 5 N•m) for all products other than the GT2-S5 and is between 4 and 5 N•m (the recommended tightening torque is 4 N•m) for the GT2-S5. Apply tightening torque between 15 and 18 N•m (20 to 23 N•m when using the GT2-A32/A50) to mounting bracket D (OP-84327). Use the wrench that matches the nut width.** **• Care must be taken not to damage the dust boot when tightening.**

4 **Rotate the dust boot so that the side line is straight.**

Check with the spindle pushed in.

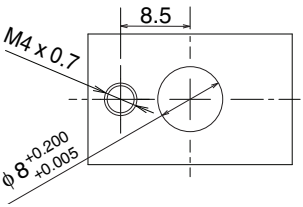


NOTICE	**• If the dust boot is not straight, it becomes easier to damage when the spindle is moved.** **• GT2-H12KL/H12L/H32L/A12KL/A12L has no dust boot.**

Using mounting bracket F

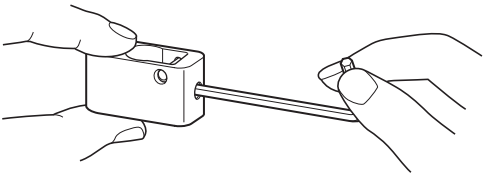
1 **Refer to the illustration below and cut the jig to create a sensor head mounting hole.**

● **GT2-P12K(L)/P12(L)/PA12K/PA12**

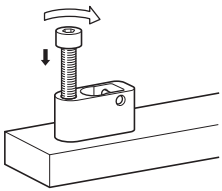


Make sure that the metal plating mounting bracket F attaches to is at least 5 mm thick.

2 **Loosen the screw on the side of mounting bracket F using the supplied hexagonal wrench.**



3 **Align mounting bracket F with the hole made in step 1 and secure it using the supplied hexagonal wrench.**



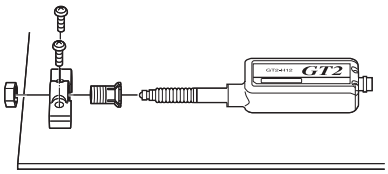
4 **Insert the sensor head, and tighten the screw loosened in step 2 using the supplied hexagonal wrench to secure. The recommended tightening torque is 0.6 to 0.8 N•m. Make sure that the dust boot does not obstruct the metal plating that mounting bracket F is attached to.**

NOTICE	• **Make sure that the dust boot does not become damaged during the procedure.** • **When loosening the screw with the hexagonal wrench, insert the long end of the hexagonal wrench into the hex screw and rotate the small end with your hand.** • **Do not forcibly tighten the hex screw.** • **Cannot be used with GT2-P12KF/P12F/H***/A***.**

Mounting on the side of a surface

To mount a 1/5/12 mm stroke sensor head other than the flange type on the side face of a table or the like, use the included mounting bracket B (OP-76875) or mounting bracket E (OP-87220).

Mounting diagram



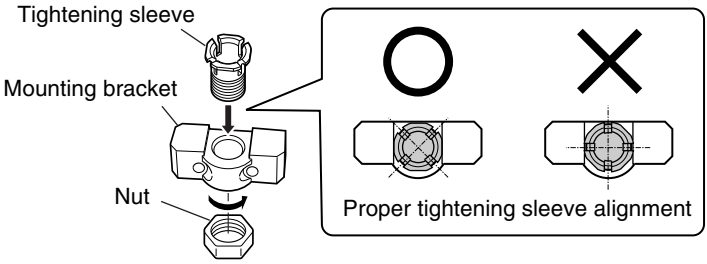
Package contents of the mounting bracket B (OP-76875)

Tightening sleeve Nut Mounting bracket

Package contents of the mounting bracket E (OP-87220)

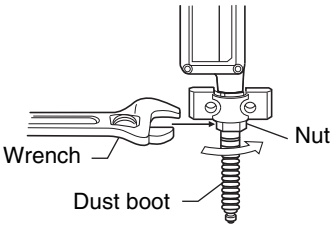
Tightening sleeve Nut Mounting bracket

1 **Insert the tightening sleeve into the mounting bracket from the slotted side, and loosely tighten with the nut.**



NOTICE	• **If the tightening sleeve is inserted from the wrong side, the sensor head cannot be secured.** • **Strongly tightening the nut without the sensor head inserted may deform the tightening sleeve.** • **Mounting bracket C (OP-84396) and mounting bracket D (OP-84327) cannot be used together.**

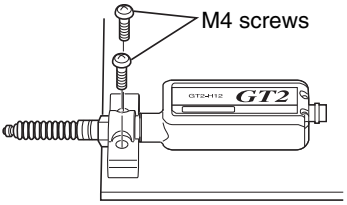
2 **Insert the sensor head into the tightening sleeve, and tighten the nut with a wrench.**



NOTICE	**Tightening the nut while fixing the sensor head may lead to damage.** • **Apply a tightening torque of 5 to 7 N•m (the recommended tightening torque is 5 N•m) for all products other than the GT2-S5 and a tightening torque of 4 to 5 N•m (the recommended tightening torque is 4 N•m) for the GT2-S5. Use the wrench that matches the nut width.** • **Care must be taken not to damage the dust boot when tightening.**

3 **Secure the sensor head with M4 screws.**

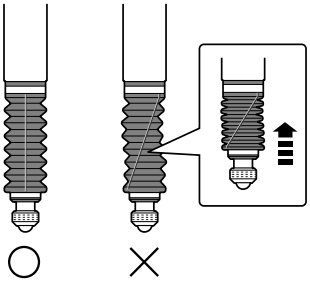
Mount the sensor head with the model label on top. For GT2-P12K(L)/P12(L)/ PA12K /PA12, mount so that the status lamp is on top.



NOTICE	• **Never apply tightening torque over 1.4 N•m.** • **Care must be taken not to damage the dust boot when tightening.** • **Install the sensor head with the model label facing up. The sensor head cannot be installed in another orientation.**

4 **Rotate the dust boot so that the side line is straight. (Models other than GT2-PA12K/PA12)**

Check with the spindle pushed in.

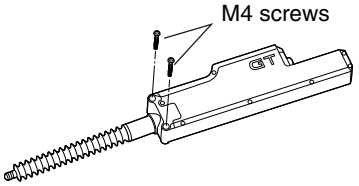


NOTICE	• **If the dust boot is not straight, it becomes easier to damage when the spindle is moved.** • **GT2-H12KL/H12L/A12KL/A12L has no dust boot.**

Mounting with the mounting holes

Mount the GT2-H32(L)/H50/A32/A50 on the side of a table using the mounting holes on the side of the unit body.

Mounting diagram



(Mounting hole dimensions)

NOTICE	• **Roughness of the mounting surface may cause the sensor to tilt, and sufficient accuracy may not be obtained. When performing a high-accuracy measurement, use a jig to mount the sensor head. "Mounting directly to a jig" (page 2-14)** • **Apply tightening torque between 1.2 and 1.5 N•m.**

Installing the Air Tube

■ Available air tubes

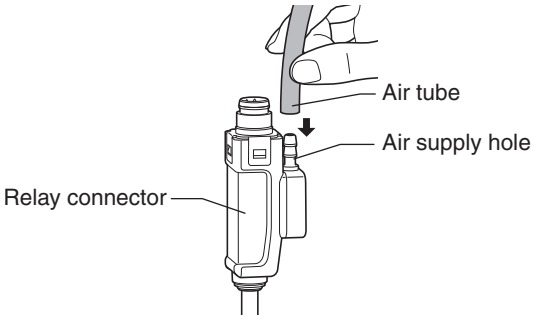
Use a tube with the following specifications.

Item		Description
Recommended tubing material		Nylon, Urethane
Tubing size	Outer diameter	ϕ4 mm
	Inner diameter	ϕ2.5 mm

■ How to Attach/Detach the Air Tube (GT2-PA12K(L)/PA12(L))

● Attaching the air tube

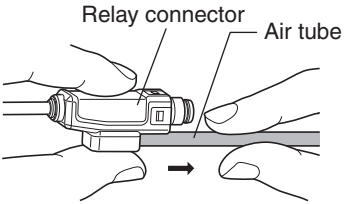
Insert the air tube into the air supply hole on the relay connector.



NOTICE	• **For best results, cut the end of the tube at a right angle, and ensure that the outer perimeter is not damaged, and that it still maintains a circular cross section.** • **If the tube is not properly inserted, air leakage may result.** • **After attaching, pull on the tube to make sure it is secure.**

● **Detaching the air tube**

To detach the air tube, pull the air tube in the direction of the arrow, as indicated in the figure below.

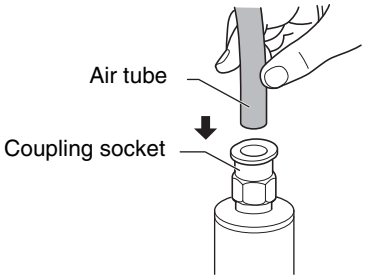


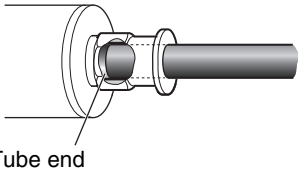
NOTICE	**Before detaching the tube, be sure to stop any air flow.**

■ **How to attach/detach the air tube (GT2-A12K(L)/A12(L)/A32/A50)**

● **Attaching the air tube**

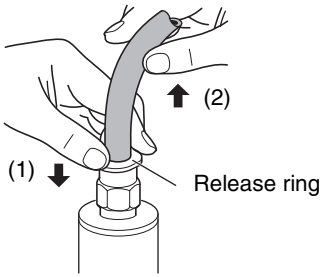
Feed the tubing into the socket until it bottoms out (about 1/2").
The socket will ensure a tight seal around the tubing.



NOTICE	• **For best results, cut the end of the tube at a right angle, ensure that the outer perimeter is not damaged, and that it still maintains a circular cross section.** • **If the tube is not properly inserted, air leakage may result (see figure below).**  Tube end • **After attachment, pull on the tube to make sure it is secure.**

● **Detaching the air tube**

To detach the air tube, (1) press down on the release ring, (2) pull out the tube.

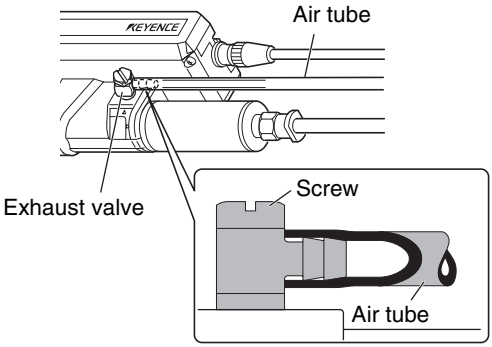


NOTICE	• **Before detaching the tube, be sure to stop any air flow.** • **Press down on the release ring evenly from both sides, and pull the tube out. Uneven pressure may result in damage to the tube or damage to the operation of the air cylinder.**

■ If the IP67 enclosure rating is required (GT2-A12K/A12/A32/A50)

To maintain an IP67 enclosure rating, the following must be satisfied:

- Firmly connect tubing with ϕ2.5 mm inner diameter to the exhaust port until it bottoms out.
  Ensure that the tube end is free of dirt or water.

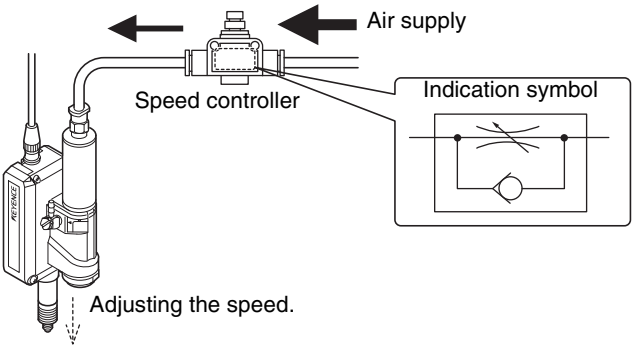


- Tighten the screw of the exhaust valve with a torque of 0.5 to 0.6 N•m. If the screw is loose, the IP67 rating cannot be guaranteed.

Reference By loosening the screw of the exhaust valve, you can change the exhaust port angle.

■ Adjustment of Spindle Movement Speed

To adjust the spindle movement speed, install a speed controller between the cylinder and the air supply. Using OP-87970 (for the GT2-PA12K/PA12/A12K(L)/A12(L)/A32/A50) is recommended.



NOTICE	• **To further decrease spindle movement speed, use a coil-shaped tube (OP-87986) or similar to increase the distance between the air supply hole and the speed controller.** • **The speed controller will not operate if installed in the reverse direction.**

■ **Pneumatic circuit (for GT2-P***/A***)**

Use the information below as reference for the pneumatic circuit.

- Use a regulator to supply stable air pressure to the sensor head.
- Use an air filter, mist separator, etc. to provide dry air.

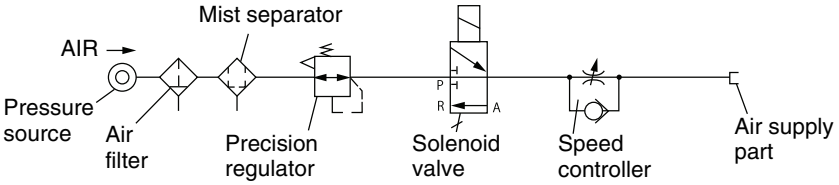
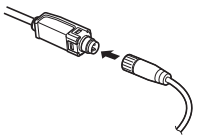


Illustration 1 - Pneumatic circuit

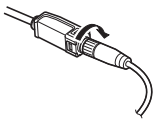
Connecting the sensor head connection cable

● **For GT2-S1/S5/P***/PA*****

1 **Insert the sensor head connection cable into the cable connector on the relay connector cable.**



2 **Secure the connector with the sensor head connecting cable screw.**

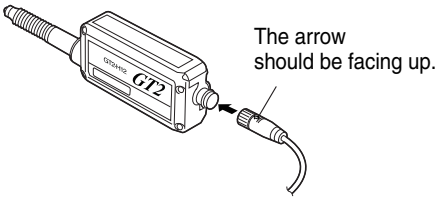


NOTICE	**When connecting the connector, be sure to insert it straight, and tighten it securely. (Recommended tightening torque: 0.4 to 0.5 N•m*) If the connection is not tight enough, the connector may be loosened by vibration or other causes, leading to a connection failure. (* After tightening it firmly by hand, use pliers or other tools to rotate it about 30° for further tightening.)**

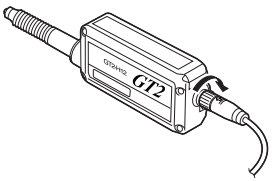
● **For units other than GT2-P***/PA*****

NOTICE	**The M8 L-shaped connector (GT2-CHL*M) cannot be used with the GT2-H32(L)/H50/A32/A50.**

1 **Insert the sensor head connection cable into the cable connector of the sensor head.**



2 **Secure the connector with the screws of the sensor head connection cable.**

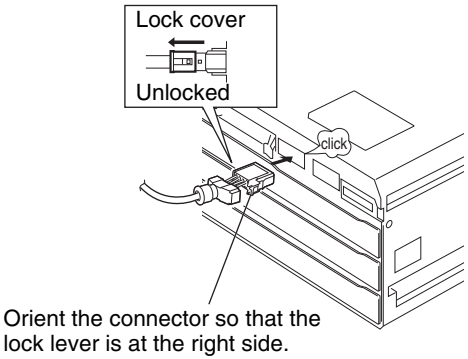


NOTICE	• **When connecting the connector, be sure to insert it without tilt, and tighten it securely. (Recommended tightening torque: 0.4 to 0.5 N•m*)** **If the connection is not tight enough, the connector may be loosened by vibration or other causes, leading to a connection failure.** **(* After tightening it strongly by hand, use pliers or other tools to rotate it about 30° for further tightening.)** • **When the head is attached to a moving part, and the cable will be repeatedly bent, ensure that the cable between the sensor head and relay connector does not bend. Instead, bend the sensor head cable connecting the relay connector and the amplifier.**

- To disconnect the sensor head connection cable, reverse the steps above.

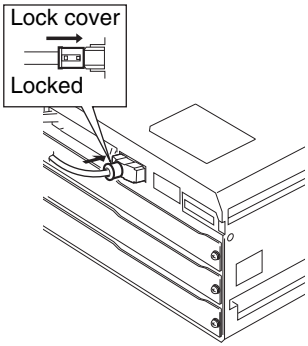
Connecting the Amplifier

1 **Remove the lock cover of the connector of the sensor head connection cable, and insert the sensor head connection cable into the connector on the back of the amplifier until it clicks.**



NOTICE	**To disconnect the sensor head connection cable, press and hold the lock lever on the side of the connecter and disconnect the cable.**

2 **Put the lock cover on the connector, and lock the lock cover.**



Installing the Head Cable Connector (OP-84338)

NOTICE	**When the connector is changed, be sure to connect it to the amplifier, and check that it operates correctly. If it does not operate correctly, crimp the connector again with pliers or a similar tool. The connector cannot be reused if it is crimped once.**

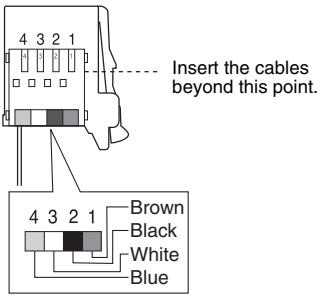
1 **Cut the cables to a necessary length.**

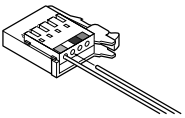
Peel back the cable insulation about 15 mm from the end.

NOTICE	**Do not peel the insulation of the core wires.**

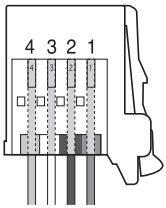
2 **Insert the cables into the connector holes of the matching color.**

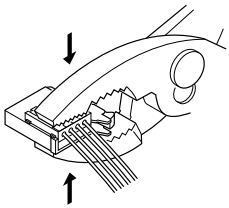
The cables are lightly locked when they reach the end.

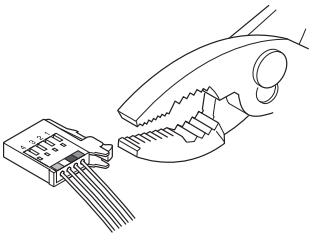




3 **Check that all the cables are inserted to the designated position, and crimp the connector parallel with pliers or a similar tool to secure the cables.**







MEMO

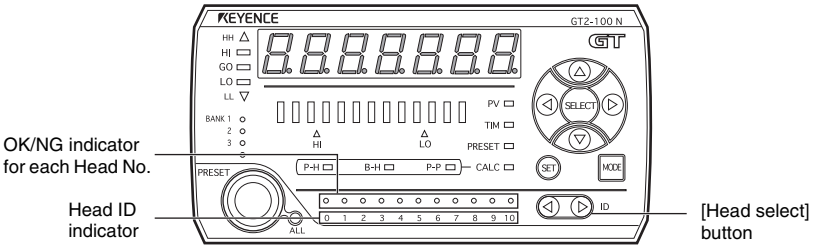
Basic Usage of the GT2-100 Series

3

This chapter describes the basic setting method for the GT2-100 Series.

3-1 Valid ID Setting

On the GT2-100 Series, the expansion unit head ID is pre-assigned. When turning on the power for the first time or changing the number of connected sensor heads, set the valid ID.



■ **Initial values of the valid number of connecting units when shipped from the factory**

The initial value of the valid ID setting varies depending on the number of head expansion boards.

Number of head expansion boards	Initial value	Maximum number of connecting sensor heads
0 boards	id = 1	Main unit: 1 unit, Expansion unit: 1 unit
1 board	id = 4	Main unit: 1 unit, Expansion unit: 4 units
2 boards	id = 7	Main unit: 1 unit, Expansion unit: 7 units
3 boards	id = 10	Main unit: 1 unit, Expansion unit: 10 units

- When using the unit with the initial values, connect the maximum number of sensor heads. When the number of the connected sensor heads is less then the maximum number of connecting units, the ID to which no sensor head is connected becomes "ErH (head connection error)".
- When the number of the connected sensor heads is less than the maximum number of connecting units, change "27. id (Valid ID Setting)" in the additional function setting mode.

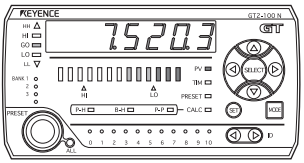
■ **Changing the valid ID**

1 **Turn on the power.**

The main display appears.

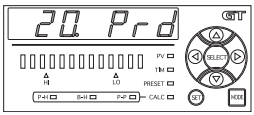
If several IDs are already validated, operate while the "0" in the head ID indicator is blinking in red.

"Selecting the ID" (page 3-13)



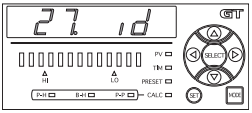
2 **Press the [MODE] button and the left Arrow button at the same time for at least two seconds.**

The GT2-100 Series enters the additional function setting mode.



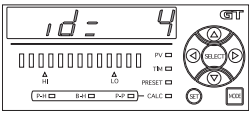
3 **Press the right Arrow button until "27. id" appears.**

The valid ID setting mode is displayed.



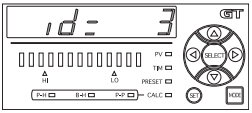
4 **Press the top/bottom Arrow buttons once.**

The current setting value is displayed.



The heads of ID 00 to 04 are available

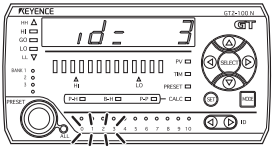
5 **Press the top/bottom Arrow button to select the IDs to be activated.**



When activating the heads of ID 00 to 03

Reference

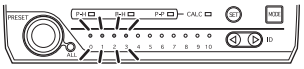
While setting the valid IDs, the head ID indicator of the expansion unit currently set as the available range blinks in green, and the display "id = **" appears on the digital LED display.



When selecting the heads of ID 00 to 03

6 **Press the [MODE] button (or click the right Arrow button) to exit the valid ID setting mode.**

When the setting is completed, press the [MODE] button again to exit the additional function setting mode. The usable head ID indicator and its head OK/NG indicator turn on.



When valid ID = 3 is selected

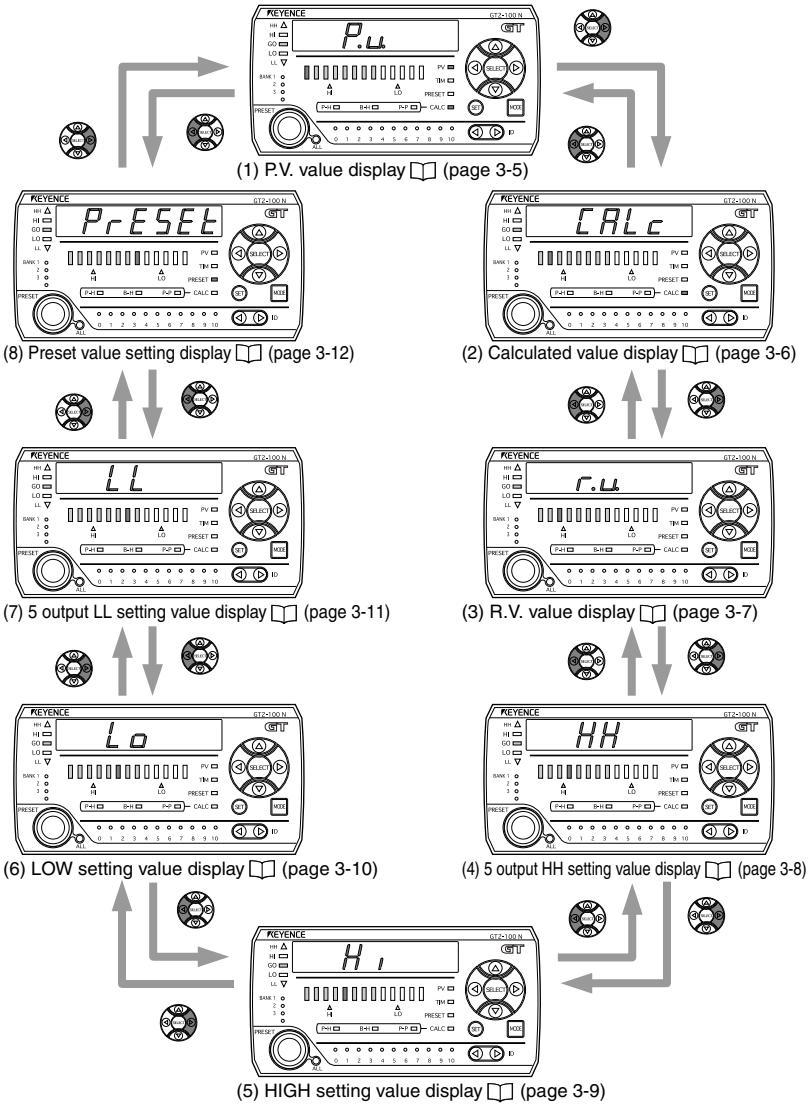
NOTICE	**The ID of the sensor head exceeding the IDs set as the valid ID setting cannot be recognized.** **For the unrecognized ID, its head ID indicator and its head OK/NG indicator are turned off, and the unused ID cannot be selected.**

3-2 Main Screens

The following main screens appear on the main unit and are switched using the [Left]/[Right] arrow buttons as shown below.

Display Patterns of the Main Screens

Some main screens are not displayed depending on the connection pattern and settings. For details on each screen, refer to the pages of the detail description.



(1) P.V. value display (page 3-5)

(8) Preset value setting display (page 3-12)

(2) Calculated value display (page 3-6)

(7) 5 output LL setting value display (page 3-11)

(3) R.V. value display (page 3-7)

(6) LOW setting value display (page 3-10)

(4) 5 output HH setting value display (page 3-8)

(5) HIGH setting value display (page 3-9)

(1) P.V. value display

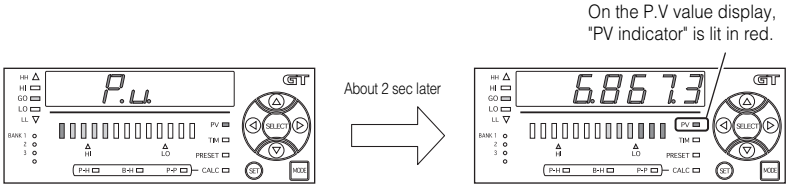
The P.V. (= Present Value) display shows the current measurement of the displaced contact.

When using the hold functions, the held value is displayed and the criterion output is performed based on that value.

Reference

The P.V. value display screen is not displayed in the following case.

- The main screen of an expansion unit when "CALc (calculation mode)" is selected in the function setting "A1. Calculation Mode" and the setting other than "C5. rEF (reference difference)" is selected in the function setting "A2. Calculation Method" of the main unit.



- Approximately two seconds after the title screen appears, it changes to the digital LED display.
- From the "P.V. value setting screen", the tolerance calibration can be set.

  "Tolerance calibration" (page 3-19)
- When the calculation function is used, the status indicator "CALC" lights in red.

  "5-6 Calculation Setting Mode" (page 5-54)
- The preset, measurement direction, multiplier, and calibration function setting are displayed according to the P.V. value.

  "Preset Function (Displaying the Value by Adding or Subtracting a Desired Value)" (page 3-30)

  "10. Measurement Direction" (page 5-17)

  "11. Multiplier" (page 5-18)

  "30. Calibration Function Setting" (page 5-49)

(2) Calculated value display

The calculated value display screen shows a calculated value such as a maximum or minimum value of multiple detection points created when adding one or more expansion units.

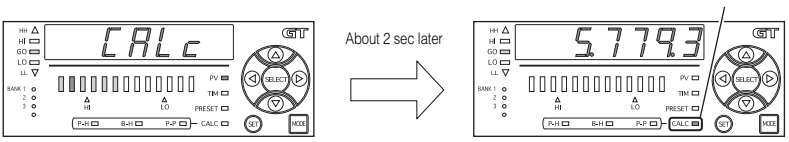
For details on calculation function, refer to 📖 "5-6 Calculation Setting Mode" (page 5-54).

Reference

The calculated value display screen is not displayed in the following cases.

- When no expansion heads are added.
- When "noCALc (not calculation)" is selected in the function setting "A1. Calculation Mode" of the main unit.
- On the main screen of the main unit when "C5. rEF (reference difference)" is selected in the function setting "A2. Calculation Method" of the main unit.
- On the main screen of the expansion unit when the setting other than "C5. rEF (reference difference)" is selected in the function setting "A2. Calculation Method" of the main unit.

When the calculation function is used, the status indicator "CALC" lights in red.



<Calculation title screen> <Calculated value display screen>

- Approximately two seconds after the title screen appears, it changes to the digital LED display.
- In the calculated value display screen, the displayed value is not held even when using the hold function mode.

(3) R.V. value display

The R.V. (= Raw Value) value display shows the actual measured displacement of the target, via the position of the spindle.

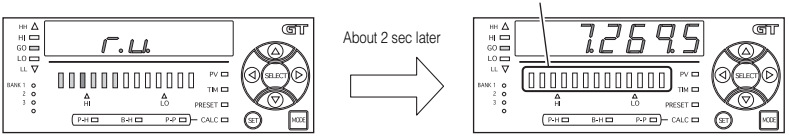
The displayed value is not held even when using the hold function mode, which allows the actual detection value (spindle position) to be checked.

Reference

The R.V. value display screen is not displayed in the following case.

- On the main screen of the main unit when "CAL.noH (calculation dedicated mode) is selected in the function setting "A1. Calculation Mode" of the main unit.

On the R.V. value display screen, all the bar LEDs are turned off.



<R.V. title screen> <R.V. value display screen>

- Approximately two seconds after the title screen appears, it changes to the digital LED display.
- The preset, measurement range multiplier, and calibration function are accessible from the Raw Value screen.

"Preset Function (Displaying the Value by Adding or Subtracting a Desired Value)" (page 3-30)

"10. Measurement Direction" (page 5-17)

"11. Multiplier" (page 5-18)

"30. Calibration Function Setting" (page 5-49)

(4) 5 output HH setting value display

When using the 5 output function, display/set the setting value to be set higher than the HIGH setting value.

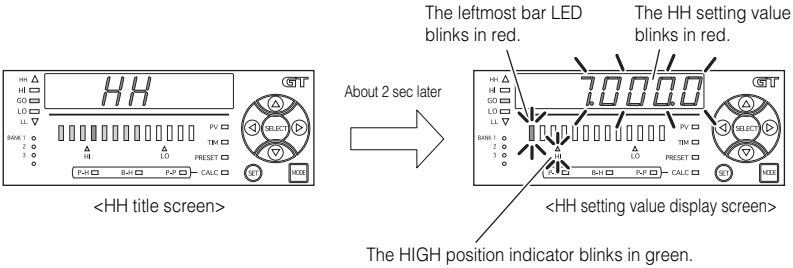
When the P.V. value exceeds the value set here, the HH criterion is output.

For details on the 5 output function, refer to "16. Special Output Setting" (page 5-24).

Reference

5 output HH setting value screen is not displayed in the following cases.

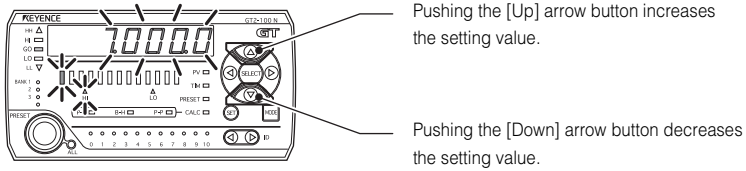
- When the setting other than "5out (5 output)" is selected in the basic setting "16. Special Output Setting" of the main/expansion unit.
- On the main screen of the expansion unit when "CALc (calculation mode)" is selected in the function setting "A1. Calculation Mode" and the setting other than "C5. rEF (reference difference)" is selected in the function setting "A2. Calculation Method" of the main unit.



- Approximately two seconds after the title screen appears, it changes to the digital LED display.

■ Changing the HH setting value

You can change the setting using the [Up] or [Down] arrow button while the HH setting value screen is displayed (while the displayed value, HIGH position indicator and the leftmost bar LED blink).



Item	Setting range	Initial value
HH setting value	-199.9999 to 199.9999	7.0000

Reference

The changed HH setting value can be initialized after simultaneously holding down the [Up] and [Down] arrow buttons for 2 seconds or more while the HH setting value screen is displayed.

(5) HIGH setting value display

Displays the upper limit value of the acceptable measuring range.

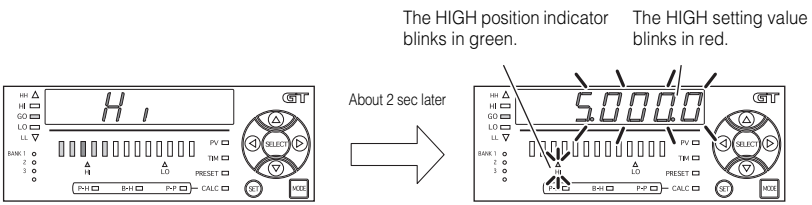
If the P.V. value exceeds this value, the HIGH output activates.

If the P.V. value stays between the HIGH setting value and LOW setting value, the GO output activates.

Reference

The HIGH setting value screen is not displayed in the following case.

- On the main screen of the main unit when "CALc (calculation mode) is selected in the function setting "A1. Calculation Mode" and the setting other than "C5.rEF (reference difference) is selected in the function setting "A2. Calculation Method" of the main unit.

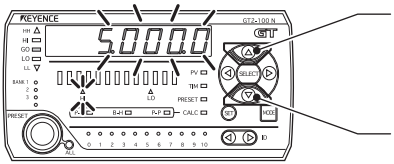


- Approximately two seconds after the title screen appears, it changes to the digital LED display.
- From the " (5) HIGH setting value display" and " (6) LOW setting value display", the two-point calibration can be set.

"Two-point calibration" (page 3-21)

■ Changing the HIGH setting value

You can change the setting using the [Up] or [Down] arrow button while the HIGH setting value screen is displayed.



Item	Setting range	Initial value
HIGH setting value	-199.9999 to 199.9999	5.0000

Reference

The changed HIGH setting value can be initialized after simultaneously holding down the [Up] and [Down] arrow buttons for 2 seconds or more while the HIGH setting value screen is displayed.

(6) LOW setting value display

Displays the lower limit value of the acceptable measuring range.

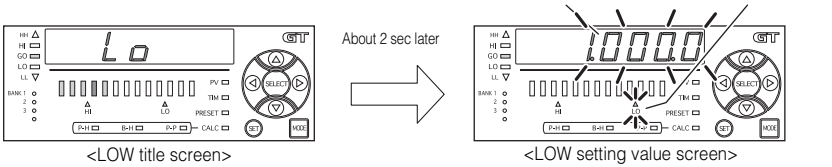
If the P.V. value drops below this value, the LOW output activates.

If the P.V. value stays between the HIGH setting value and LOW setting value, the GO output activates.

Reference

The LOW setting value screen is not displayed in the following case.

- On the main screen of the expansion unit when "CALc (Calculation Mode)" is selected in the function setting "A1. Calculation Mode" and the setting other than "C5. rEF (Reference difference)" is selected in the function setting "A2. Calculation Method" of the main unit.

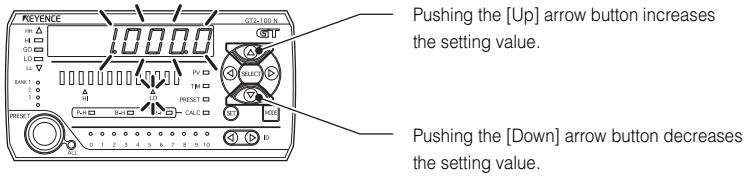


- Approximately two seconds after the title screen appears, it changes to the digital LED display.
- One can perform a two-point calibration from the " (5) HIGH setting value display" and " (6) LOW setting value display".

"Two-point calibration" (page 3-21)

■ Changing the LOW setting value

You can change the setting value using the [Up] or [Down] arrow button while the LOW setting value screen is displayed.



Item	Setting range	Initial value
LOW setting value screen	-199.9999 to 199.9999	1.0000

Reference

The changed LOW setting value can be initialized after simultaneously holding down the [Up] and [Down] arrow buttons for 2 seconds or more while the LOW setting value screen is displayed.

(7) 5 output LL setting value display

When using the 5 output function, display/set the LL setting value lower than the LOW setting value.

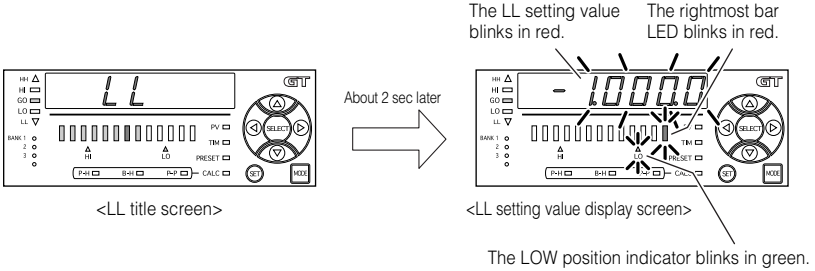
When the P.V. value drops below the value set here, the LL criterion is output.

For details on the 5 output function, refer to "16. Special Output Setting" (page 5-24).

Reference

5 output LL setting value screen is not displayed in the following cases.

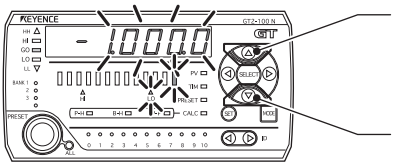
- When the setting other than "5out (5 output)" is selected in the basic setting "16. Special Output Setting" of the main/expansion unit.
- On the main screen of the expansion unit "CALc (Calculation Mode)" is selected in the function setting "A1. Calculation Mode", and the setting other than "C5. rEF (reference difference)" is selected in the function setting "A2. Calculation Method" of the main unit.



- Approximately two seconds after the title screen appears, it changes to the digital LED display.

■ Changing the LL setting value

You can change the setting using the [Up] or [Down] arrow button while the LL setting value screen is displayed (while the displayed value, LOW position indicator and the leftmost bar LED blink).



Item	Setting range	Initial value
LL setting value	-199.9999 to 199.9999	-1.0000

Reference

The changed LL setting value can be initialized after simultaneously holding down the [Up] and [Down] arrow buttons for 2 seconds or more while the LL setting value screen is displayed.

(8) Preset value setting display

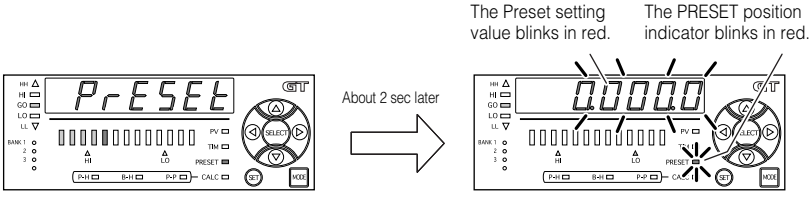
Display/Set the number to be added to or subtracted from the display value.

For details on the preset function, refer to "Preset Function (Displaying the Value by Adding or Subtracting a Desired Value)" (page 3-30).

Reference

The preset value setting screen is not displayed in the following case.

- On the main screen of the main unit when the setting other than "CAL.noH (calculation dedicated mode)" is selected in function setting "A1. Calculation Mode" of the main unit.

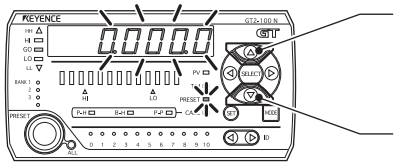


<Preset title screen> <Preset value setting screen>

- Approximately two seconds after the title screen appears, it changes to the digital LED display.

■ Changing the preset setting value

You can change the setting value using the [Up] or [Down] arrow button while the Preset setting value screen is displayed (when the displayed value and the PRESET position indicator blink).



Item	Setting range	Initial value
Preset setting value	-199.9999 to 199.9999	0.0000

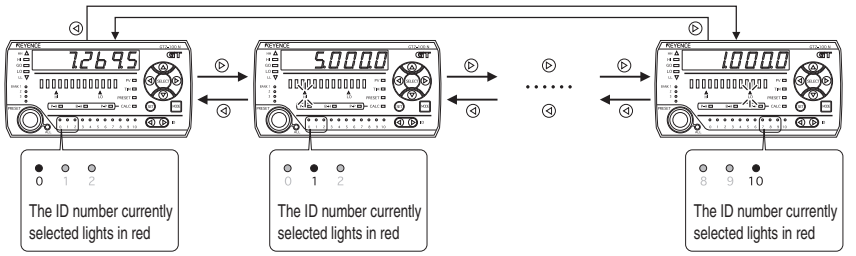
Reference

The changed preset setting value can be initialized after simultaneously holding down the [Up] and [Down] arrow buttons for 2 seconds or more while the preset value setting screen is displayed.

Selecting the ID

On the GT2-100 Series, multiple sensor heads can be connected. To display the measurement value of each ID, the screens need to be switched.

Reference Selecting the ID can only be performed on the main screen.



While the main unit (ID:00) is displayed

While the expansion unit (ID:01) is displayed

While the expansion unit (ID:10) is displayed

- An ID set as invalid in the valid ID setting cannot be selected. (The head ID indicator will be turned off for invalid ID.)
- When the ▷ button is pressed while the maximum ID number is displayed, the screen returns to the main unit (ID:00) display screen.
- When the ◁ button is pressed while the maximum ID number is displayed, the screen returns to the maximum ID number display screen.
- The ID number blinks red ←→ green for 10 seconds after it is changed.

3-3 Origin Alignment

When you use the GT2-100 Series for the first time or when you replace the sensor head, you must reset the origin. The tolerance range will be now based on the new origin.

"3-4 Setting the Tolerances" (page 3-17)

Origin alignment can be performed for all IDs at once.

"26. Batch Setting" (page 5-46)

"15. Batch Input Settings" (page 5-23)

The origin can be adjusted either by the sensor directly or from a remote external input.

Align the origin by the following methods.

- Button operation
- External input

NOTICE	**• You cannot align the origin when the R.V. value display screen is displayed as "------". (Immediately after the power is turned on, or immediately after the reset input.)** **• Aligned origin is written to the internal memory every time, so the changed origin is saved even after the power is turned off. The origin alignment can be performed up to about a million times. When zero-point calibration is frequently used, you can perform setting so that the zero-point calibration will not be written into the memory.** **• If you frequently perform origin alignment through an external input, select "OFF" for " 21. Store Preset Value". If "OFF" is selected, origin alignment can be set, however it is not written to the internal memory. (When the power is turned off, it returns to the previously stored origin.)** **"21. Store Preset Value" (page 5-37)**

Reference We recommend that you should periodically reset the origin for more accurate judgment.

Adjusting the Origin Directly from the Sensor

This section describes the procedures of the origin alignment using the operation buttons of the sensor amplifier.

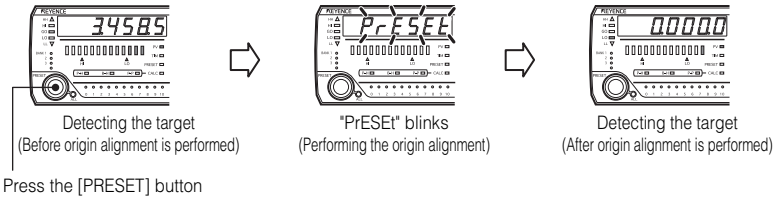
1 **After selecting the ID to use as the target for original alignment, switch one of the sensor amplifier displays to the main screen and detect the detection target (master work) that will become the origin (standard).**

"Selecting the ID" (page 3-13)

Reference The origin can only be set on the main screen.
"3-2 Main Screens" (page 3-4)

2 **Press the [PRESET] button while the master workpiece is in place.**

After "PrESEt" blinks several times on the amplifier display screen, "0.000.0" * is displayed on the P.V. value display, and the origin has been set.



* When using the preset function, the specified preset value is displayed.

Reference To reset the origin to factory default, hold down the preset button. After "PrESEt" is displayed, "rESEt" blinks, indicating that the origin alignment is reset to the factory default setting.

■ Origin alignment combined with the preset function

When you want to display a desired value for the measured value, such as when measuring a master workpiece, the origin can be aligned without changing the mounting position of the sensor head by combining the preset function.

1 **Place the sensor's contact on the desired target to serve as the origin.**

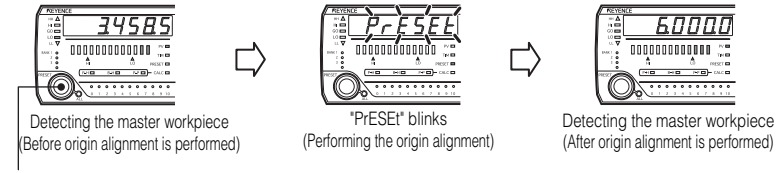
2 **Set a value that you want to display when measuring the master workpiece.**

Example If you want to make the measured value for the master workpiece 6.000.0, set the preset value to 6.000.0.

" (8) Preset value setting display" (page 3-12)

3 **Press the [PRESET] button while the master workpiece is in place.**

After "PrESEt" blinks several times on the amplifier display screen, "6.000.0" is displayed on the P.V. value display screen.



Origin Alignment by External Input

By short-circuiting "Preset input" from the external device, origin alignment is performed within the minimum input time. (The preset indicator blinks for about 0.3 seconds.)

"6-2 I/O Circuit Diagram" (page 6-13)

"Minimum Input Time" (page 6-17)

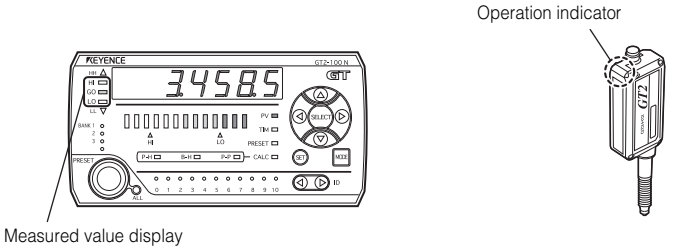
Reference When origin alignment is performed by external input, "PrESEt" is not displayed.

3-4 Setting the Tolerances

The tolerances of the GT series are comprised of upper and lower limits. Any measured value that goes beyond the upper or lower limits will activate the HIGH or LOW outputs respectively. Any measured value that lies between the tolerances will activate a GO output.

These outputs are displayed on both the sensor amplifier as well as the head. A HIGH or LOW output is displayed as a red operation indicator light whereas a GO output is a green light. The operation indicator on the head is easily visible so that a user can simply glance at the sensor and know whether the target is good or defective.

The operation indicator blinks while the sensor head is being set, so even if multiple devices are installed side by side, the sensor head currently being set can be recognized at a glance.



The tolerances can be set either manually or automatically.

Item		Procedure for setting the value
Manual setting		Directly enter the tolerances (HIGH setting value, LOW setting value).
Automatic setting	Tolerance calibration	Measure the master workpiece and set the tolerance.
	Two-point calibration	Detect the good and defective product and set the tolerance.

Reference

When setting the tolerances manually or by two-point calibration, be sure to set them as "HIGH setting value > LOW setting value".

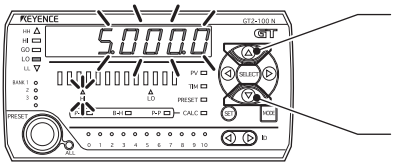
- The criterion output when setting as "HIGH setting value < LOW setting value" is as follows.
  - Regardless of the detected value, the GO criterion is not output.
  - When the value that is over the HIGH setting value and under the LOW setting value is detected, the HIGH criterion and the LOW criterion are output at the same time.
- When "5 out (5 output)" is selected in "16. Special output setting", 5 levels of judgment are possible with two additional setting values. For the HH/LL setting method, refer to "3-5 Setting the HH/LL Criterion Value" (page 3-24).

Setting the Tolerances Manually

This is a method for directly setting the tolerances (HIGH setting value, LOW setting value).

1 **On the main screen of "HIGH setting value", set a value using the [Up]/ [Down] arrow button.**

" (5) HIGH setting value display" (page 3-9)



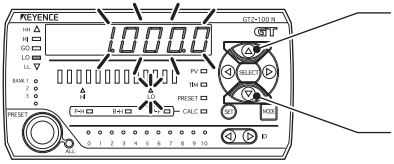
Pushing the [Up] arrow button increases the setting value.

Pushing the [Down] arrow button decreases the setting value.

Item	Setting range	Initial value
HIGH setting value	-199.9999 to 199.9999	5.0000

2 **On the main screen of "LOW setting value", set a value using the [Up]/ [Down] arrow button.**

" (6) LOW setting value display" (page 3-10)



Pushing the [Up] arrow button increases the setting value.

Pushing the [Down] arrow button decreases the setting value.

Item	Setting range	Initial value
LOW setting value	-199.9999 to 199.9999	1.0000

3 **To return to the P.V. value display screen, press the [Right]/[Left] arrow buttons.**

Reference When the HIGH setting value or LOW setting value is set, the new setting values immediately take effect.

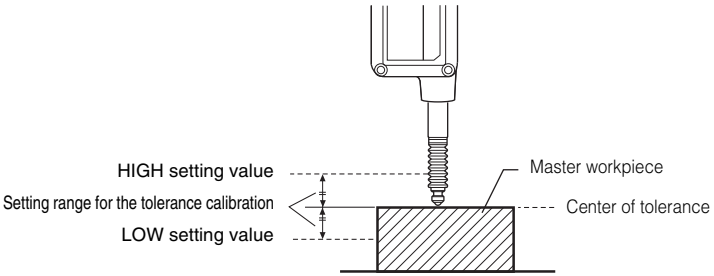
Setting Up the Tolerances Automatically

The upper limit value (HIGH setting value) and lower limit value (LOW setting value) are automatically set.

Tolerances can be set with "Tolerance calibration" when a master workpiece is available and with "Two-point calibration" when actual good and defective targets are available.

Tolerance calibration

This is a method for setting a range based on the detection value of a master workpiece when the master workpiece is available.

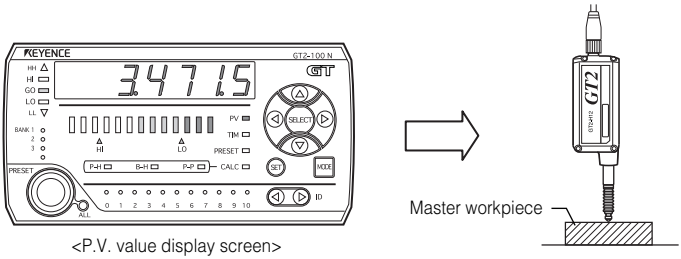


Reference

The tolerance calibration cannot be performed when "------" is displayed.
When "-FFFF" or "FFFF" is displayed, the tolerance cannot be set correctly.

1 While on the "P.V. display screen", position the sensor head to measure the master workpiece and display value you want to use as a reference.

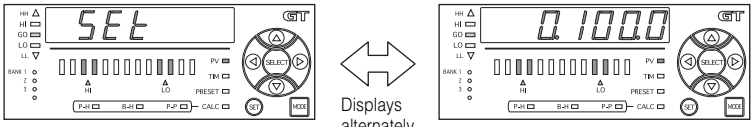
" (1) P.V. value display" (page 3-5)



<P.V. value display screen>

2 Press the [SET] button to capture that value.

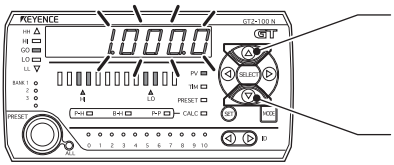
The value captured is the now the center of tolerance.



<Tolerance calibration screen>

<Setting range for tolerance calibration>

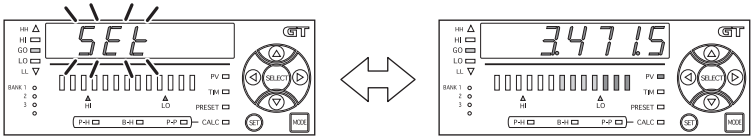
3 Adjust the tolerance calibration range by using the [Up]/[Down] arrow buttons.



Item	Setting range	Initial value
setting range for tolerance calibration	-199.9999 to 199.9999	0.1000

4 Press the [SET] button to complete the tolerance calibration setup.

"SEt" blinks, and the HIGH setting value and LOW setting value are determined. After it blinks for about a second, it returns to the P.V. value display screen.



<Tolerance calibration completion screen>
"SEt" blinks for one second.

<P.V. value display screen>

Reference

The HIGH setting value and LOW setting value can be adjusted after the tolerance calibration is set.

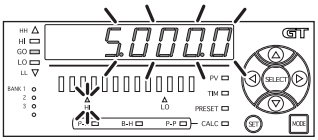
" (5) HIGH setting value display" (page 3-9)
" (6) LOW setting value display" (page 3-10)

Two-point calibration

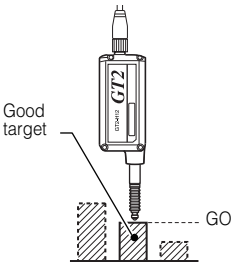
This is a method to set the intermediate value between a good target and a defective target as the tolerance when a good target, a HIGH defective target and a LOW defective target are available.

Reference When the R.V. value display screen is displayed as "------", the two-point calibration cannot be performed. When "-FFFF" or "FFFF" is displayed, the tolerance cannot be set correctly.

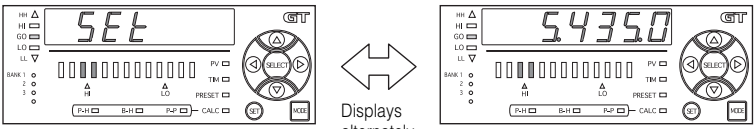
1 **On the main screen of "HIGH setting value display", detect the good target that you want to be judged as a GO output.**



<HIGH setting value screen>



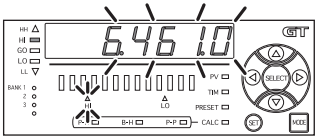
2 **Press the [SET] button while the good target is being detected.**



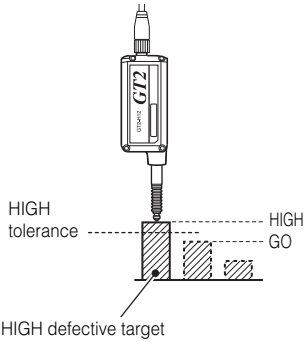
Detected value for the good target

3 **Press the [SET] button while the HIGH defective target is being detected.**

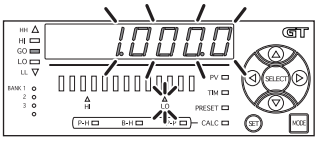
The value for the HIGH defective target is captured.



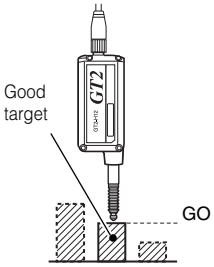
For the HIGH setting value, the intermediate value of the detected values of the good target captured in step 2 and the HIGH defective target captured in step 3 is set.



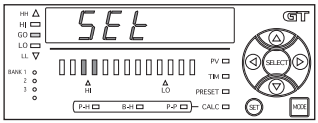
4 **Display the main screen of "LOW setting value screen" and detect a good target that you want to judge as a good workpiece (GO criterion).**



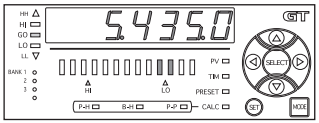
<LOW setting value screen>



5 **Press the [SET] button while the good target is being detected.**



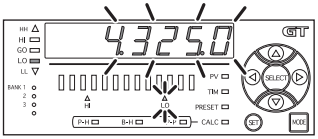
Displays alternately.



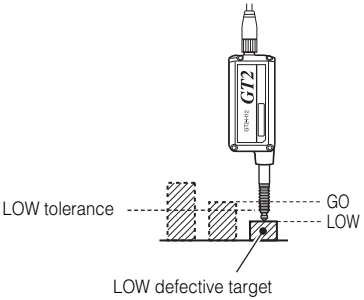
Detected value for the good target

6 **Press the [SET] button while the LOW defective target is being detected.**

The value for the LOW defective target is captured.

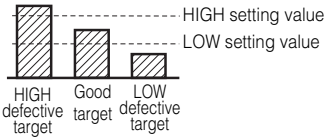


The intermediate value between the detection value of the good target captured in step 5 and the detection value of the LOW defective target captured in step 6 is set as the LOW setting value.



7 **Press the [Right]/[Left] arrow buttons to return to the P.V. value display screen.**

Two-point calibration is complete.



Reference

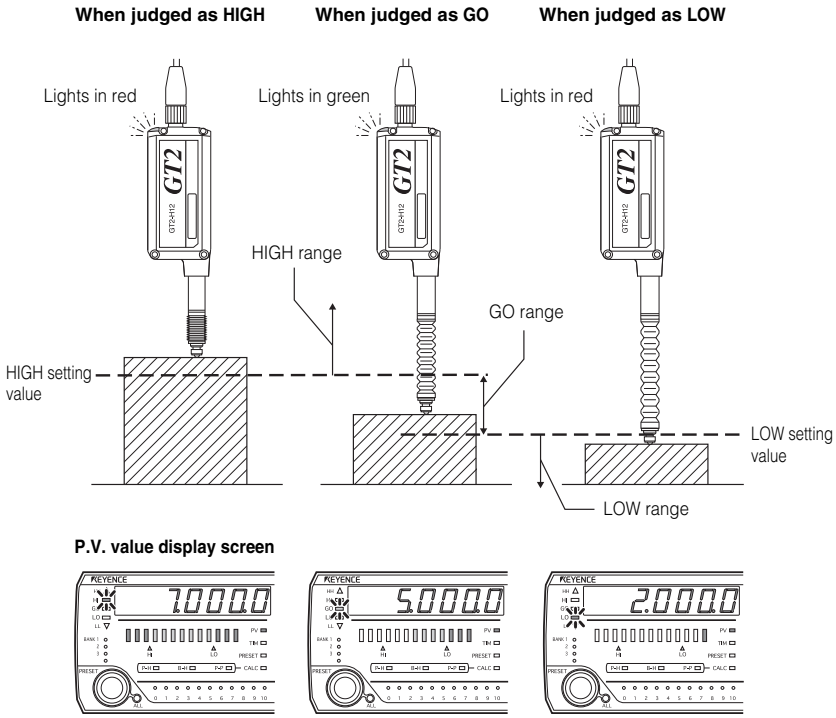
The HIGH setting value and LOW setting value can be adjusted after the two-point calibration is set.

" (5) HIGH setting value display" (page 3-9)
" (6) LOW setting value display" (page 3-10)

Displaying the Detection Result

After the tolerance setup of the GT2-100 Series is completed the following results are displayed on the sensor amplifier and sensor head.

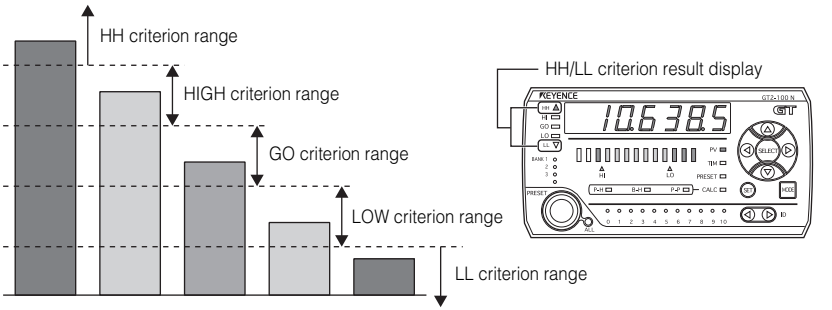
In this example, the tolerances "HIGH setting value = 6.0000" and "LOW setting value = 3.0000" are set.



3-5 Setting the HH/LL Criterion Value

When "5out (5 output)" is selected in "16. Special Output Setting" of the basic setting mode, HH setting value can be set above the upper limit (HIGH setting value) and the LL setting value can be set below the lower limit (LOW setting value).

The criterion is displayed and output in 5 levels by adding HH criterion and LL criterion to HIGH criterion, LOW criterion, and GO criterion.



HH/LL criterion value is set either manually or automatically.

Item		Setting method
Manual setting		Directly input the criterion value (HH setting value, LL setting value).
Automatic setting	Two-point calibration	Detect the good target and HH/LL criterion target, and automatically set the tolerance.

Reference

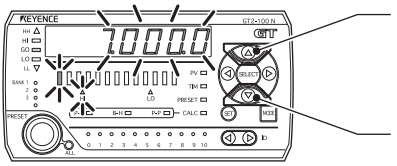
- The HH setting value/LL setting value can be set only when "5out (5 output)" is selected in "16. Special Output Setting" of the basic setting mode.
- When setting the criterion values manually and or with the two-point calibration, make sure to set the values in the following relationship. HH setting value > HIGH setting value > LOW setting value > LL setting value
- When setting the values as "HH setting value < HIGH setting value", the HIGH setting value is not output.
- When setting the values as "LOW setting value < LL setting value", the LOW setting value is not output.
- Criterion outputs when setting the values as "HH setting value < LL setting values" are as follows.
  - Regardless of the detected value, the GO criterion, HIGH criterion, and LOW criterion are not output.
  - When the value that is over the HH setting value and under the LL setting value is detected, the HH criterion and the LL criterion are output at the same time.

Setting HH/LL Criterion Value Manually

Following is a method for directly setting the HH/LL criterion value (HH setting value, LL setting value).

1 **Display the "HH setting value screen" of the basic screen and set a desired value using the [Up] or [Down] arrow button.**

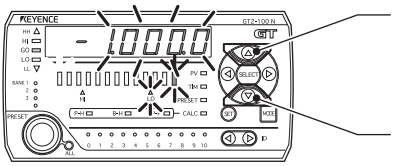
"(4) 5 output HH setting value display" (page 3-8)



Item	Setting range	Initial value
HH setting value	-199.9999 to 199.9999	7.0000

2 **Display the "LL setting value screen" of the basic screen and set a desired value using the [Up] or [Down] arrow button.**

"(7) 5 output LL setting value display" (page 3-11)



Item	Setting range	Initial value
LL setting value	-199.9999 to 199.9999	-1.0000

3 **Return to the P.V. value display screen using the [Right] or [Left] arrow button.**

Reference When the HH setting value/LL setting value is set, the criterion identification and output start at the same time with a new setting value.

Setting HH/LL Criterion Value Automatically

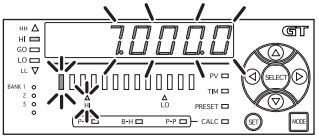
You can set the HH/LL criterion value (HH setting value, LL setting value) automatically (two-point calibration).

The following is a method to set the intermediate value between the detected values of the HIGH defective target, HH defective target, LOW defective target, and LL defective target as the tolerance for each pair when these defective targets are available.

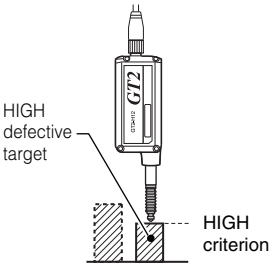
Reference

When the R.V. value display screen is displayed as "------", the two-point calibration cannot be performed. When "-FFFF" or "FFFF" is displayed, the tolerance cannot be set correctly.

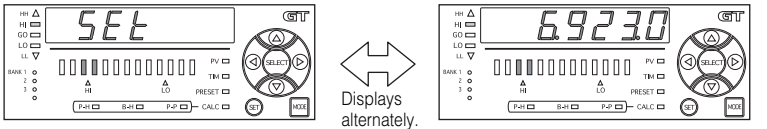
1 **Display "HH setting value screen" of the main screen and detect the HIGH defective target (the detected target that you want to judge as the HIGH criterion).**



<HH setting value screen>



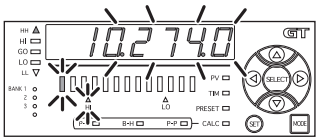
2 **While the HIGH defective target is being detected, press the [SET] button to capture the value.**



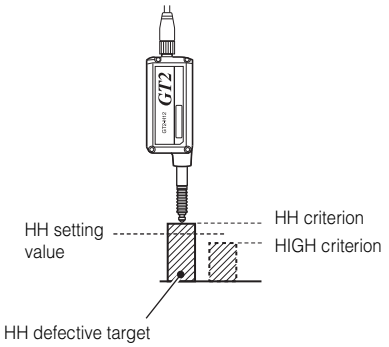
Detected value for the HIGH defective target

3 **When the HH defective target is detected, press the [SET] button to capture the value.**

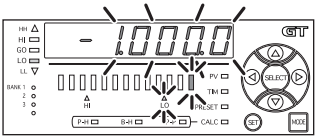
The detected value of the HH defective target is captured, and the HH setting value is determined.



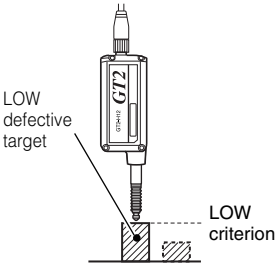
For the HH setting value, the intermediate value of the detected values of the HIGH defective target captured in step 2 and the HH defective target captured in step 3 is set.



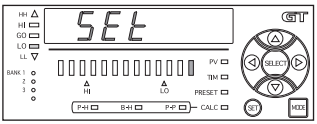
4 **Display "LL setting value screen" of the basic screen and detect the LOW defective target (the detected target that you want to judge as the LOW criterion).**



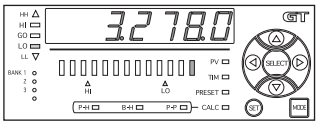
<LL setting value screen>



5 **While the LOW defective target is being detected, press the [SET] button to capture the value.**



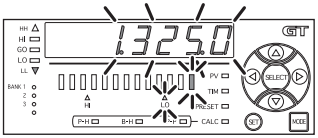
Displays alternately.



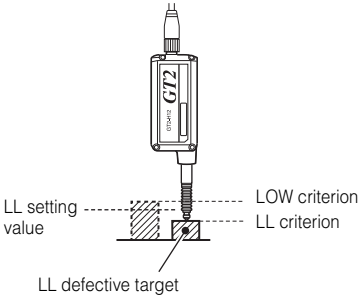
Detected value for the LOW defective target

6 When the LL defective target is detected, press the [SET] button to capture the value.

The detected value of the LL defective target is captured, and the LL setting value is determined.

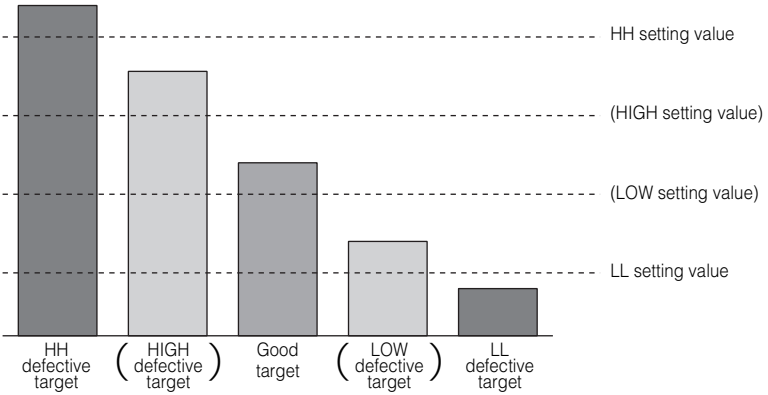


For the LL setting value, the intermediate value of the detected values of the LOW defective target captured in step 5 and the LL defective target captured in step 6 is set.



7 Return to the P.V. value display screen using the [Right] or [Left] arrow button.

The two-point calibration is completed.



Reference

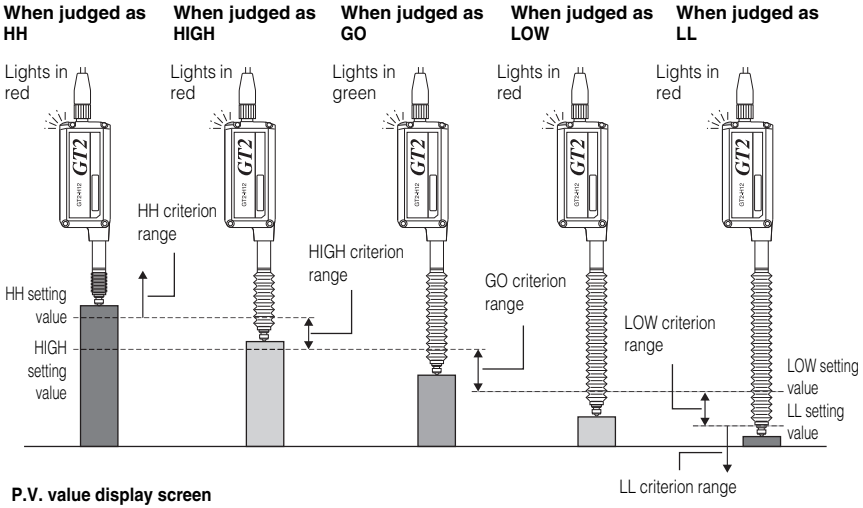
The HH setting value and LL setting value can be adjusted after the two-point calibration is set.

"(4) 5 output HH setting value display" (page 3-8)
"(7) 5 output LL setting value display" (page 3-11)

Displaying the Detection Result

After the HH/LL criterion values are complete and detection is performed, the following results are displayed on the sensor amplifier and sensor head.

In this example, the criterion values are set as "HIGH setting value = 7.0000", "LOW setting value = 3.0000", "5 output HH setting value = 9.000", and "5 output LL setting value = 1.000".



Reference

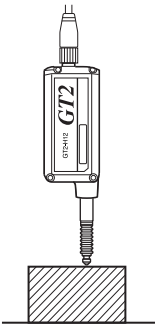
Operations of the HH output/LL output change depending on the items selected in "16. Special Output Setting".

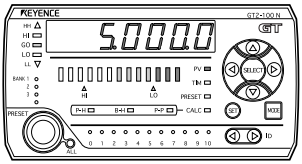
"16. Special Output Setting" (page 5-24)

Preset Function (Displaying the Value by Adding or Subtracting a Desired Value)

When the preset value is set, the displayed value can be changed by adding or subtracting the desired value (preset value).

Example To change the value by adding "10.0000"

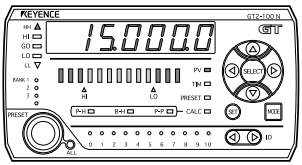




Before adjusting the preset

Display "5.0000" before setting the preset value

Set "10.0000" for the preset value.



After adjusting the preset

Display the value by adding the preset value "10.0000" to "5.0000" after the preset is set.

- Adjust the preset on the main screen of "Preset value setting screen".

  " (8) Preset value setting display" (page 3-12)
- The criterion outputs are judged by setting the value to which the preset value is added as the detected value. After the preset values is set, set the criterion values (5 output HH setting value/HIGH setting value/LOW setting value/LL setting value) again.
- By combining with the origin alignment, a desired value can be displayed as the detected value of the workpiece (master workpiece).

  "3-3 Origin Alignment" (page 3-14)

Bank Function (Registering Multiple Criterion Values and Preset Values)

With GT2-100 Series, you can register up to four pre-registered HI/GO/LO settings.

- HH setting value
- HIGH setting value
- LOW setting value
- LL setting value
- Preset point (origin alignment position)
- Preset value

By using the bank function, registered setting items can be switched easily according to the changes of the type of the detection target.

Reference

The preset point can be set for each bank individually of for all the banks together.

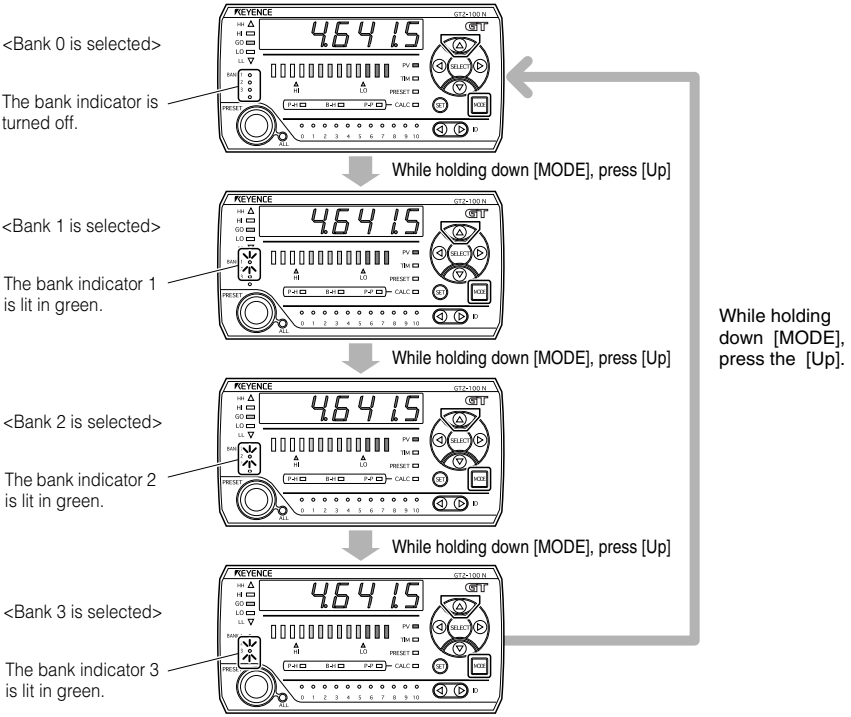
"22. Preset Point" (page 5-38)

How to switch the bank

The bank can be switched either by button operations of the sensor amplifier or by an external input.

■ Switching the bank by button operation

While holding down the [MODE] button, press the [UP] arrow button. Each pressing of the [Up] button allows the bank to switch to another one.



Reference

The bank can be switched by external input only when the key lock is active.
Therefore, when the key lock is activated, the bank switches depending on the status (combination of ON/OFF) of the BANK A input and Bank B input.
"Switching the bank by external input" (page 3-33)

The selected bank is retained even after turning off the power and turning it back on.
All IDs can also be switched at once.
"26. Batch Setting" (page 5-46)

■ Switching the bank by external input

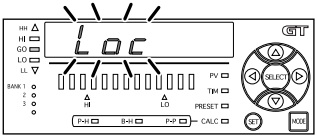
Switching the bank using an external input is performed using Bank A input and Bank B input.

"6-2 I/O Circuit Diagram" (page 6-13)

1 Set the key lock function.

If you switch the bank using an external input, the sensor amplifier must be in a key locked state or full key locked state.

Refer to "Key Lock" (page 3-42).



2 Switch the banks by combining ON/OFF of the BANK A input and Bank B input.

- The bank input should be 20 ms or longer.
  "Minimum Input Time" (page 6-17)
- The combination patterns of BANK A input and BANK B input are as follows.

Bank	Input line 1 *	Input line 2 *
Bank 0	OFF	OFF
Bank 1	ON	OFF
Bank 2	OFF	ON
Bank 3	ON	ON

ON: Short-circuited
OFF: Open

* If "Bank" is not selected in the input line function, it is treated as OFF.

- The display when the bank is switched using the input line function is the same as when the bank is switched using the buttons.
  "Switching the bank by button operation" (page 3-32)
- When key lock is deactivated, the bank selected by the input line is retained.

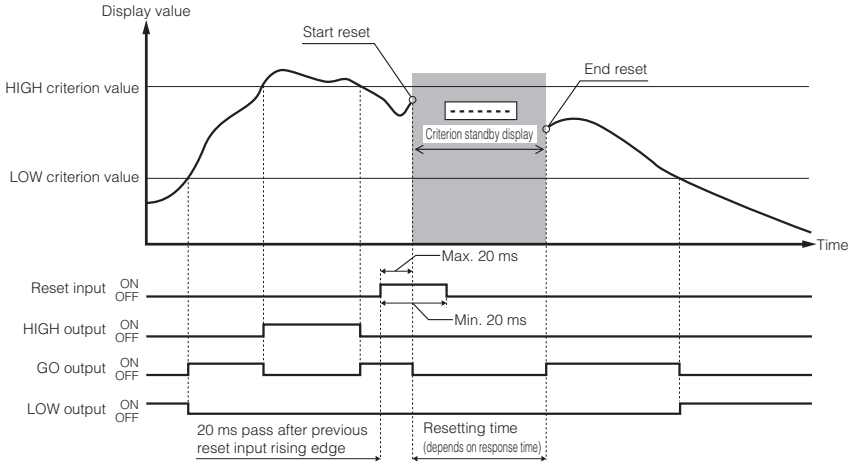
Reference

The banks can be switched for all IDs at once.
"15. Batch Input Settings" (page 5-23)

Reset Input (Resetting Internal Values)

When a reset signal is input from an external input, all of the outputs are turned off (when N.O. is set) and the P.V. and R.V. values become "- - - - - -" during the reset (from 20 ms after the rise of the reset input to the completion of reset).

Reference The resetting time is the same as the response time set in "03. Response Time" (page 5-8).

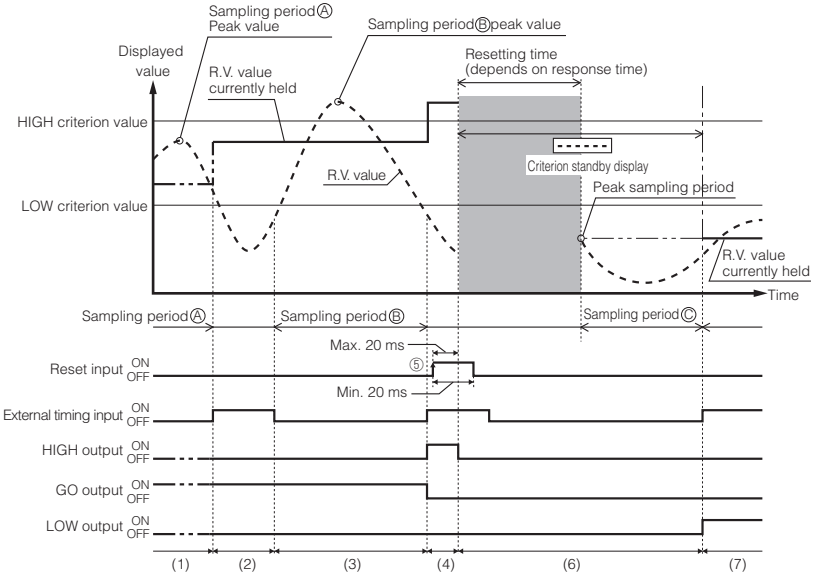


Reference Wait until 20 ms have passed after the previous reset input before entering a new reset input. If fewer than 20 ms pass, the reset input may not be recognized.

■ Reset input when using the hold function

When a reset signal is input from an external input while using the hold function, all of the criterion outputs are turned off (when N.O. is set) and the P.V. and R.V. values becomes "- - - - - -" from the time that resetting starts to the time when the next external timing input turns on.

Reference The resetting time is the same as the response time set in "03. Response Time" (page 5-8).



(1) The peak value is stored while the external timing input is off (sampling period Ⓐ).

(2) At the rise time of the external timing input (end of the sampling period Ⓐ), the peak value stored during the sampling period Ⓐ is displayed. This peak value is taken as a measured value and the GO output turns on.

(3) Peak value is stored while the external timing input is off (sampling period Ⓑ).

(4) At the rise time of the external timing input (end of the sampling period Ⓑ), the peak value stored during the sampling period Ⓑ is displayed. The peak value is taken as the measured value, In this case, The HIGH output turns on.

(5) When a reset signal currently held is activated, all of the criterion outputs are turned off 20 ms after the reset input started at the latest. At this time, "- - - - - -" is displayed on the sensor amplifier.

(6) After the resetting time ends, sampling starts when the external timing input turns off. Sampling continues until the next external timing input turns on and the peak value is saved.

(7) At the rising edge of the external timing input (end of the sampling period Ⓒ), the peak value stored during the sampling period Ⓒ is displayed. This peak value is taken as a measured value and the GO output turns on.

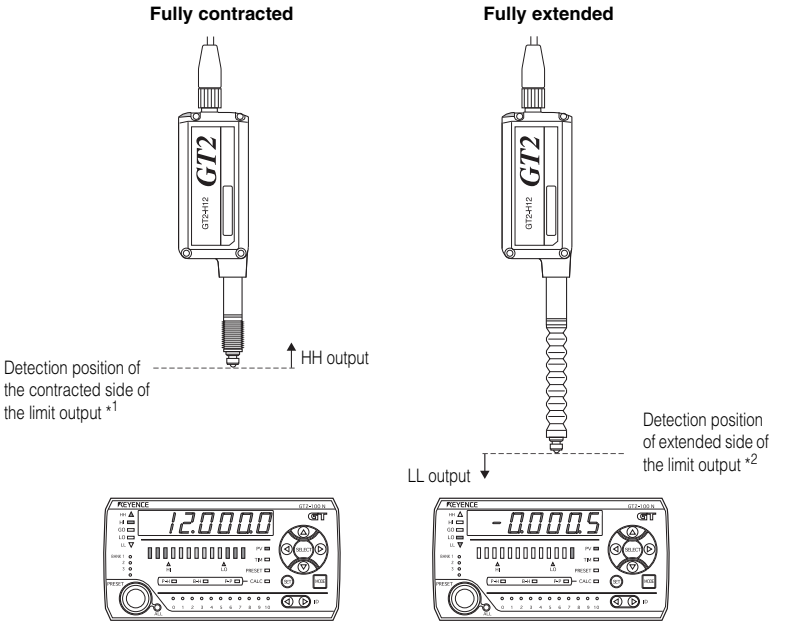
Reference Wait until 20 ms have passed after the previous reset input before entering a new reset input. If fewer than 20 ms pass, the reset input may not be recognized.

Limit Output Function

The GT2-100 Series can detect stroke ends using the limit output function.

The limit output displays/outputs by "HH display indicator/HH output" and "LL display indicator/LL output" regardless of the output of criterion values of HI/GO/LO.

For the setting procedures of the limit output, refer to "16. Special Output Setting" (page 5-24)



*1 The position where the spindle is contracted from the factory default origin position by the detection range.
*2 The factory default origin position.

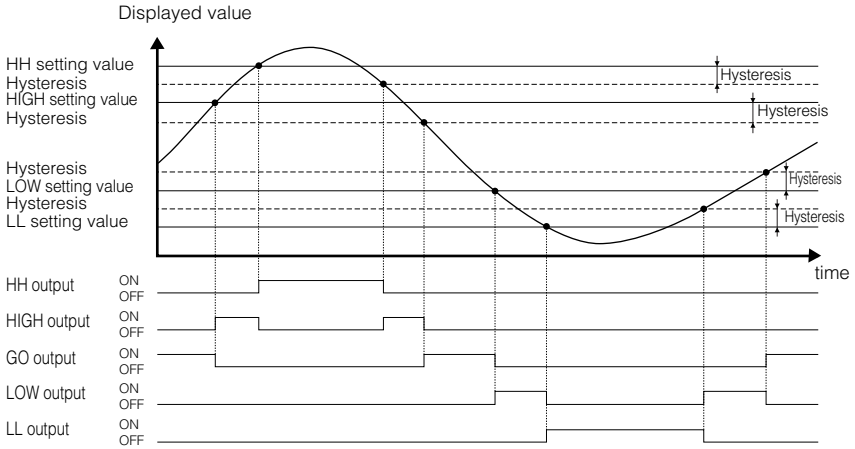
- The limit output displays/outputs according to the mechanical position of the spindle regardless of the P.V. value and R.V. value.
- The limit output displays/outputs HH on the contracted side and LL on the extended side regardless of the settings of "10. Measurement Direction".
  "10. Measurement Direction" (page 5-17)
- When "Lt.USEr (limit output user setting)" is selected in "16. Special Output Setting", the position of the limit output can be set to a desired position.
  "16. Special Output Setting" (page 5-24)

Hysteresis

If the P.V. value is fluctuating around the tolerances, the outputs may repeatedly turn on and off. By increasing the hysteresis value, the delta between the SET and RESET distance widens to reduce output chattering.

You can set the hysteresis in the basic setting mode of "14. Hysteresis".

Refer to 🕮 "14. Hysteresis" (page 5-21) for details on hysteresis.



Reference

- The hysteresis is set to "0.0030" when shipped from the factory.
- The hysteresis is available during HIGH/GO/LOW criterion output, and HH/LL output when "5out (5 output)" is selected in "16. Special Output Setting".
- The hysteresis of HH/LL output cannot be changed when "Lt (limit output)" or "Lt.USEr (limit output user setting)" is selected in "16. Special Output Setting".

Initialization (Initial Reset)

Reset all settings* to the factory default setting.

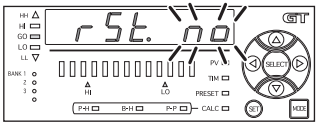
* The span adjustment result set in the calibration setting is not initialized.

"30. Calibration Function Setting" (page 5-49)

1 **On the main screen, while holding down the [MODE] button, press the [SET] button five times.**

The initialization screen appears.

"no" is blinking.



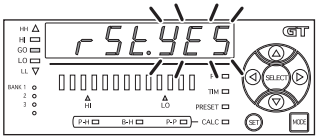
<Initialization screen>

Reference

When you press either [PRESET], [SET], [LEFT], or [RIGHT], the initialization is canceled and the screen returns to the main screen.

2 **Select "rSt.YES" by using the [Up]/[Down] arrow buttons.**

"YES" is blinking.



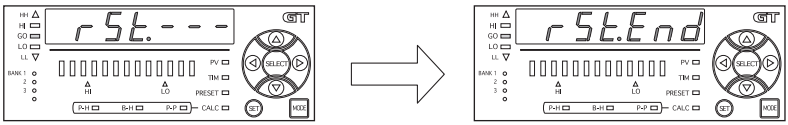
Reference

- When you press either [PRESET], [SET], [LEFT], or [RIGHT], the initialization is canceled and the screen returns to the main screen.
- When pressing and holding the top/bottom arrow buttons for more than 2 seconds in step 2, "ALL.no" appears. When pressing either of the top/bottom arrow button to select "ALL.yES" and pressing the [MODE] button at this point, all ID settings are initialized.

3 **Press the [MODE] button to start initialization.**

Initialization is completed when "rSt.End" is displayed.

After the initialization is completed, the screen automatically returns to the main screen.

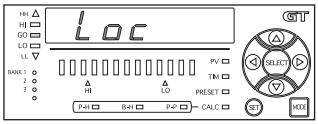


<Resetting screen>

<Reset completion screen>

Reference

When you attempt to initialize the equipment while the key lock function is set, the screen shown on the right appears and the initialization fails.
You must first cancel the key lock setting before attempting to initialize the unit.
"Key Lock" (page 3-42)



• Initial value list

The setting items and the initial values to be initialized by the initial reset are as follows.

Initial values of function settings

Setting item		Initial value
01.	Detection mode	Std
02.	Hold update method	tim
03.	Response time	100 (400)*
04.	Timing type	t-in
05.	Self-timing level	0.5000
06.	Self timing delay type	Stb.d
07.	User specified delay time	t=1000
08.	Static hold delay stability criterion	dEFALt
09.	Static hold delay stability width	0.0100
A1.	Calculation mode setting	noCALc
A2.	Calculation method	C1.mAX

* When using GT2-P12K(L)(F)/P12(L)(F)/PA12K/PA12.

Initial values of basic settings

Setting item		Initial value
10.	Measurement direction change	nor
11.	Multiplier	1.0
12.	Output mode	no
13.	Displayed number of digits	0.0001
14.	Hysteresis	0.0030
15.	Batch input setting	onE
16.	Special output setting	noUSE
17.	Limit output HH side criterion position setting	0.5000
18.	Limit output LL side criterion position setting	0.5000

Initial values of added function settings

Setting item		Initial value
20.	Select preset data	r.v.
21.	Preset memory	yES
22.	Preset point setting	onE
23.	Power-saving function (ECO)	oFF
24.	Jam detection function	oFF
25.	Jam detection position	0.5000
26.	Batch setting	onE
27.	Valid ID Setting	(Not initialized)

Initial values of calibration function settings

Setting item		Initial value
30.	Calibration function setting	(Not initialized)
31.	2nd point target value	5.0000

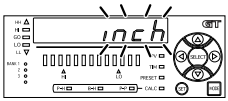
Switching the Display Unit (mm/inch)

The display unit can be switched from the initial reset screen.
This section explains how to switch from "mm" display to "inch" display.

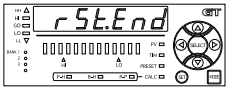
1 **Display "rSt.YES" from the initial reset screen.**
Refer to "Initial reset" for more details on how to display "rSt.YES".

2 **Pressing the [MODE] button, press the [SET] button for 2 seconds or more.**

3 **Use the up and down Arrow button to select "inch".**



4 **Press the [MODE] button.**
"rSt.End" will appear.
Switching the display unit is completed.



Key Lock

The key lock function prevents unwanted button pushing.

Use either of the following key lock functions according to the purpose.

Key lock: Disables all operations other than the display switching, [head selection] button and the operation of the [PRESET] button.

Full key lock: Disables the operations other than the display switching and [head selection] button.

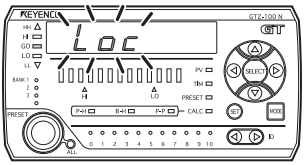
If you switch the bank by an external input, the key lock function (or full key lock) must be set.

"Bank Function (Registering Multiple Criterion Values and Preset Values)" (page 3-31)

Setting the key lock

On the main screen, while holding down the [MODE] button, press the [Up] arrow button for two seconds or more.

The key lock screen appears and then changes to the main screen.



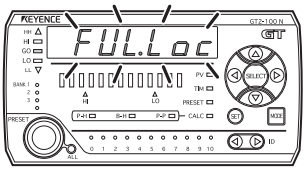
Key lock screen

Reference During key lock, only the switching of the main screen display and the operation of the [PRESET] button are accepted.

Full key lock

Display the main screen, and while pressing the [MODE] button, press the [Down] arrow button for two seconds or more.

The full key lock screen appears, and then changes to the main screen.

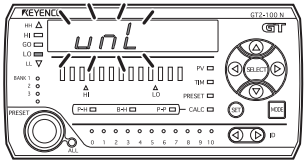


Reference While the full key lock function is set, only the switching of the main screen display is accepted.

Canceling the key lock

Under the key locked state, while holding down the [MODE] button, press the [Up] or [Down] arrow button for two seconds or more.

The key lock cancel screen appears and then changes to the main screen.



Key lock cancel screen

Copy Function

This copies the settings of the main unit (ID: 00) to the expansion unit (ID: 01 to 10).

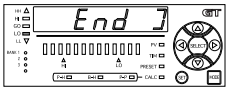
The copy function is available for "function setting", "basic setting", and "additional function setting" respectively.

"List of Setting Modes" (page 5-2)

Reference The "calibration setting" cannot be copied.

1 **Configure the settings of the main unit for each setting mode, and display the "End]" screen.**

The "End]" screen appears in the end when the [Right] arrow button is kept pressed in each setting mode.



<Main unit screen>

Press and hold + for at least 2 sec

2 **Press and hold the [Up] and [Down] arrow buttons at the same time while the "End]" screen is displayed (for at least two seconds).**

The copy screen appears.

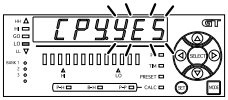
"no" is blinking

<Main unit screen>

/

3 **Select "CPY.YES" with the [Up]/[Down] arrow buttons.**

"YES" is blinking



<Main unit screen>

Press MODE or

4 **Press the [MODE] button or the [Right] arrow button to copy the settings to the connected expansion unit.**

<Expansion unit screen>

Reference

The following settings will not be copied.

- 16. Special Output Setting (only when "ALL.Go" or "ALL.Lt" is selected)
- Limit output teaching position, jam detection checkpoint setting (only when "Lt.USEr (limit output user setting)" is selected in "16. Special Output Setting")
- Jam detection teaching position, jam detection checkpoint setting (only when "USEr (user)" is selected in "24. Jam detection function")
- The following items when "CAL.noH (calculation dedicated mode)" is selected in "A1. Calculation mode setting"
  - "10. Measurement Direction"
  - "11. Multiplier"
  - Additional function settings (except for "23. Power save function")

Using Detection Modes

4

This chapter describes the detection mode and the setting method of the GT2-100 Series.

4-1 Judging with the Current Value

The standard detection mode is used to perform judgment with the current value.

In the standard detection the displayed value (P.V. value) and criterion output are always updated.

In addition, the displayed value (P.V. value) and criterion output can be held via timing input.

Holding the Desired Value

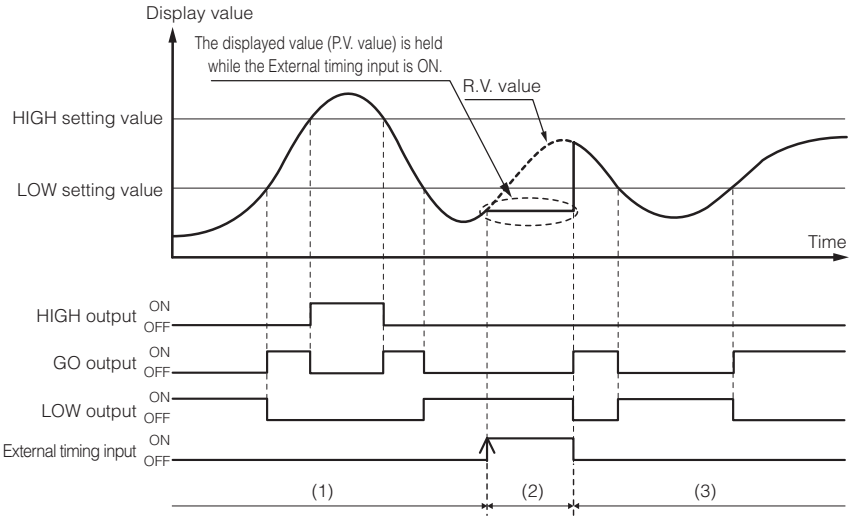
When the external timing is input during the standard detection mode, desired timing data (displayed value, criterion output) currently detected can be held.

■ Timing chart

This section describes changes in the displayed value (P.V. value) and criterion output by the external timing input.

In the following example, "N.O" is set for "12. Output mode".

"12. Output Mode" (page 5-19)



(1) While the external timing input is off, the displayed value (P.V. value) and criterion output are updated according to the changes of the detection value (R.V. value) from the sensor head.

(2) The displayed value (P.V. value) and criterion output are held when the external timing is turned on (at the rising edge).

The displayed value (P.V. value) and criterion output do not change regardless of the changes of the detection value (R.V. value) of the sensor head while they are currently held.

(3) When the external timing input is off, the hold state of the displayed value (P.V. value) and criterion output is cancelled to start the update of the value again.

Reference For the connection procedure of the external timing input, refer to "6-2 I/O Circuit Diagram" (page 6-13).

■ Setting procedure

In the function setting mode (press and hold the MODE button for 2 seconds or more in the main screen), set the following items.

Setting item	Setting
01. Fnc → Std	Select "Std (Standard detection)" and press the ▲/MODE button. "01. Detection Mode" (page 5-6)
03. SPd → 100	Select a desired response time and press the ▲/MODE button. "400" is displayed when using GT2-P***/PA***. "03. Response Time" (page 5-8)
04. t in → t-in	Select "t-in (external timing input)" and press the ▲/MODE button. "04. Timing Type" (page 5-10)
End → End	End the setting and return to the main screen.

4-2 Judging after the Detection Value is Stabilized

When you want to perform judgment only after starting judgment for a workpiece and waiting for fluctuation of the value to end (in other words, when the value is stabilized), set self-timing in the standard detection mode.
There are two methods to perform judgment after fluctuations end.

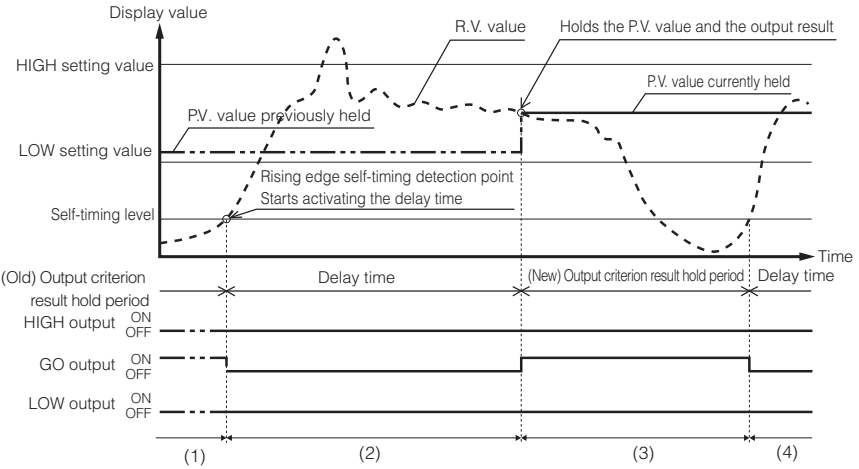
(1) Judging after a Certain Period of Time Has Passed (Delay Timer)

When the delay timer is selected for internal (self-) timing setting during the standard detection the data (displayed value and criterion output) can be held automatically when the specified time (user-specified delay time) is elapsed after the detection value exceeds (drops below) the arbitrary set level.

■ Timing chart

This section describes changes in the displayed value (P.V. value) and criterion output according to the internal (self-) timing.
In the following example, "N.O." is set for "12. Output mode".

"12. Output Mode" (page 5-19)



(1) The last output result is held. The displayed value (P.V. value) is also the value that is previously held.

(2) When the detection value (R.V. value) exceeds the self-timing level, all outputs are turned off and the delay timer starts. At this point, the displayed value (P.V. value) remains unchanged and keeps the value that is previously held.

(3) The criterion result is output based on the detection value (R.V. value) when the set delay time is elapsed. At this point, the criterion value is held and the displayed value (P.V. value) is updated to the newly held value.

(4) When the detection value (R.V. value) drops below the self-timing level and exceeds it again, all

outputs are turned off and the delay timer starts. The displayed value (P.V. value) remains unchanged and keeps the value that has been held in step (3) until the delay time is elapsed.

Reference

If the detection value (R.V. value) drops below the self-timing level before the delay time has elapsed, the data cannot be held and the error shown to the right appears.

"A2 Error Messages" (page A-5)

In this case, the HIGH and LOW outputs will be on while the GO output is off.
Press the SET button or perform reset input to release the error state. Also when the detection value (R.V. value) exceeds the timing level again, the error is canceled.
When the power is turned on or the error display is reset, the criterion standby display shown to the right is displayed until the first P.V. value is fixed (when the P.V. value display is set) and all outputs are turned off.

Criterion standby display

The setting of hysteresis is reflected on the self-timing level.

"14. Hysteresis" (page 5-21)

■ Setting procedure

In the function setting mode (press and hold the MODE button for 2 seconds or more in the main screen), set the following items.

Setting item	Setting
01 Fnc → Std	Select "Std (Standard detection)" and press the ▲/MODE button. "01. Detection Mode" (page 5-6)
03 SPd → 100	Select a desired response time and press the ▲/MODE button. "400" is displayed when using GT2-P***/PA***. "03. Response Time" (page 5-8)
04 t in → SELF._r	Select "SELF._r (rising edge)" or "SELF._L (falling edge)" and press the ▲/MODE button. "04. Timing Type" (page 5-10)
05 LEv → 0500.0	Set the self-timing level to a desired value and press the ▲/MODE button. "05. Self-timing Level" (page 5-11)

Setting item	Setting
06. dLY	t.d — Select "t.d (Delay timer)" and press the SELECT/MODE button. "06. Self Timing Delay Types" (page 5-12)
07. d-t	t = 1000 — Set the delay timer to a desired value and press the SELECT/MODE button. "07. User-specified Delay Time" (page 5-13)
End]	End — End the setting and return to the main screen.

(2) Automatically Detecting the End of the Fluctuation

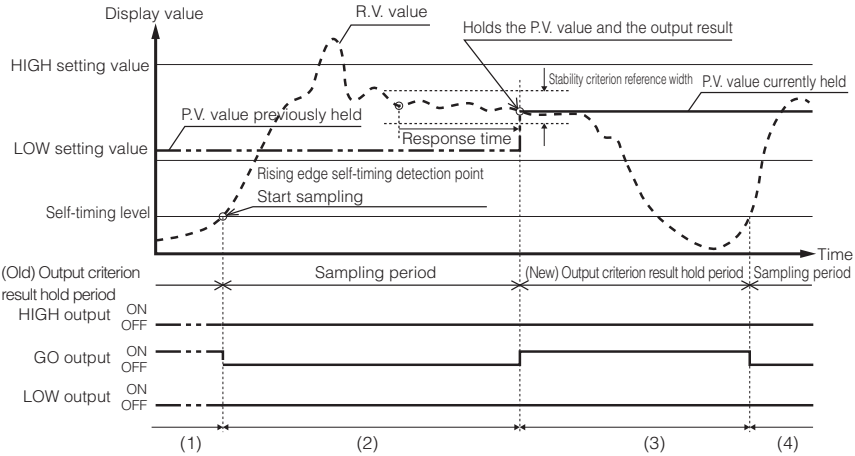
When the static hold is selected for internal (self-) timing setting during the standard detection the data (displayed value and criterion output) is automatically held when the detection value is stable within the stability width after the detected value exceeds the arbitrary set level (self-timing level).

■ Timing chart

This section describes changes in the displayed value (P.V. value) and criterion output according to the internal (self-) timing (static hold).

In the following example, "N.O." is set for "12. Output mode".

"12. Output Mode" (page 5-19)



(1) The last output result is held. The displayed value (P.V. value) is also the value that is previously held.

(2) When the detection value (R.V. value) exceeds the self-timing level, all outputs are turned off and the sampling starts. At this point, the displayed value (P.V. value) remains unchanged and keeps the value that is previously held.

(3) The criterion result is output based on the detection value (R.V. value) when the response time* elapses after the detection value (R.V. value) is stable within the stability criterion reference width during the sampling period. At this point, the criterion value is held and the displayed value (P.V. value) is updated to the newly held value.

(4) When the detection value (R.V. value) drops below the self-timing level and exceeds it again, all outputs are turned off and the sampling starts. The displayed value (P.V. value) remains unchanged and keeps the value that has been held in step (3) until the value is updated again.

* For details on the response time, refer to "03. Response Time" (page 5-8).

Reference

If the detection value (R.V. value) drops below the self-timing level before the detection value is stabilized, the error shown to the right appears.

"A2 Error Messages" (page A-5)

In this case, the HIGH and LOW outputs will be on while the GO output is off.

Press the SET button or perform reset input to release the error state. Also when the detection value (R.V. value) exceeds the timing level again, the error is canceled.

When the power is turned on or the error display is reset, the criterion standby display shown to the right is displayed until the first P.V. value is fixed (when the P.V. value display is set) and all outputs are turned off.

Criterion standby display

- When the value of the stability criterion reference width is small, the sampling continues until the detection value is stabilized. When the displayed value is not held (cannot obtain the displayed value) even after a long time, increase the stability criterion reference width or extend the response time.
  "03. Response Time" (page 5-8)
- The setting of hysteresis is reflected on the self-timing level.
  "14. Hysteresis" (page 5-21)

■ Setting procedure

In the function setting mode (press and hold the MODE button for 2 seconds or more in the main screen), set the following items.

Setting item	Setting
01 Fnc → Std	Select "Std (Standard detection)" and press the ▲/MODE button. "01. Detection Mode" (page 5-6)
03 SPd → 100	Select a desired response time and press the ▲/MODE button. "400" is displayed when using GT2-P***/PA***. "03. Response Time" (page 5-8)
04 tin → SELF_r	Select "SELF_r (rising edge)" or "SELF_F (falling edge)" and press the ▲/MODE button. "04. Timing Type" (page 5-10)
05 LEv → 00500	Select the self-timing level to a desired value and press the ▲/MODE button. "05. Self-timing Level" (page 5-11)

Setting item	Setting	
06. dLY	Stbd	Select "Stbd (static hold)" and press the / button.
		"06. Self Timing Delay Types" (page 5-12)

A. When setting with the specified stability width

Setting item	Setting	
08. Stb	dEFALt	Select "dEFALt (default)" and press the / button.
		"08. Static Hold Delay Stability" (page 5-14)
End]	End	End the setting and return to the main screen.

B. When setting the stability width manually

Setting item	Setting	
08. Stb	USEr	Select "USEr (User)" and press the / button.
		"08. Static Hold Delay Stability" (page 5-14)
09. Stu	0.0 10.0	Set the stability width to a desired value and press the / button.
		"09. Static Hold Delay Stability Width" (page 5-15)
End]	End	End the setting and return to the main screen.

4-3 Judging by the Maximum Value (Peak Hold)

When the peak hold detection mode is used, the peak value in the period specified with the external input or internal input can be taken as the criterion value.

The following setting methods are available in the peak hold detection mode.

Method to specify the sampling period	Timing to update the hold value	Reference page
(1) Specifying the Sampling Period from External Input	At the end of the sampling period	4-10
	Regularly during the sampling period	4-13
(2) Using without the Timing Input	At the end of the sampling period	4-15
	Regularly during the sampling period	4-17

Reference

When the power is turned on or the error display is reset*, the criterion standby display occurs until the first P.V. value is fixed and all outputs are turned off.

Criterion standby display

* You can reset the error display by using any of the following methods.
- Enter RESET from the external device.
- Press the [SET] button (when the error is displayed).

(1) Specifying the Sampling Period from External Input

When the external input is entered during the peak hold detection mode, data (displayed value, criterion output) of a desired sampling period currently detected can be held.

The update timing of the displayed value (P.V value) to be held and that of the criterion output vary depending on the setting of the hold update method.

Updating the peak value (P.V. value) and criterion output at the end of the sampling period

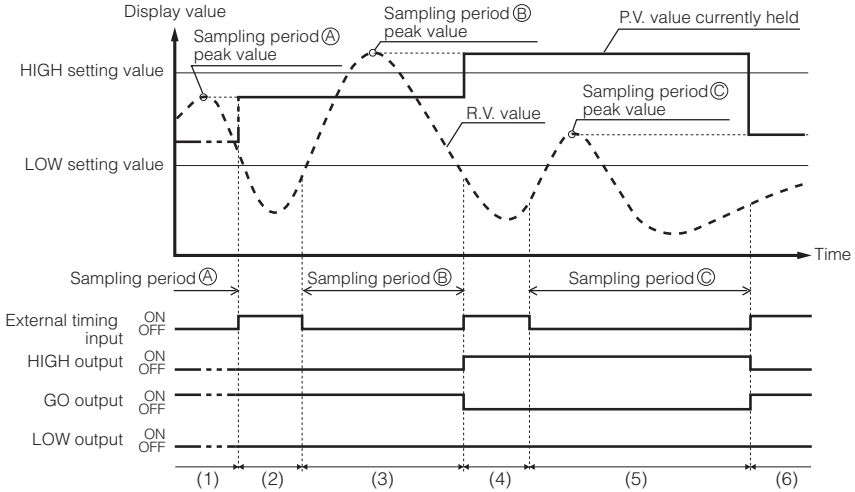
When the hold update method is set to "tim (timing input)", the display and the criterion output of the peak value (P.V. value) to be held are updated by the external timing input.

■ **Timing chart**

This section describes the changes in the display value (P.V. value) and criterion output by the external input when the detection mode is set to "P-H (peak hold)" and the hold update method is set to "tim (timing input)".

In the following example, "N.O" is set for "12. Output mode".

"12. Output Mode" (page 5-19)



(1) The maximum value (peak value) of the detection value (R.V. value) is held while the external timing input is off (sampling period Ⓐ).

(2) At the rising edge of the external timing input (end of the sampling period Ⓐ), the peak value held during the sampling period is displayed as the P.V. value. The resulting output (in this case, GO criterion output) will turn on based on the peak value.

(3) The maximum value (peak value) of the detection value (R.V. value) is held while the external timing input is off (sampling period Ⓑ).

(4) At the rising edge of the external timing input (end of the sampling period Ⓑ), the peak value held during the sampling period is displayed as the P.V. value. The resulting output (in this case, HIGH criterion output) will turn on based on the peak value.

(5) The maximum value (peak value) of the detection value (R.V. value) is held while the external timing input is off (sampling period Ⓒ).

(6) At the rising edge of the external timing input (end of the sampling period Ⓒ), the peak value held during the sampling period is displayed as the P.V. value. The resulting output (in this case, GO criterion output) will turn on based on the peak value.

■ Setting procedure

In the function setting mode (press and hold the MODE button for 2 seconds or more in the main screen), set the following items.

Setting item	Setting
01 Fnc → P-H	Select "P-H (peak hold)" and press the ▲/MODE button. "01. Detection Mode" (page 5-6)
02. HLd → t in	Select "t in (timing input)" and press the ▲/MODE button. "02. Hold Update Method" (page 5-7)
03 SPd → 100	Select a desired response time and press the ▲/MODE button. "400" is displayed when using GT2-P***/PA***. "03. Response Time" (page 5-8)
04 t in → t-in	Select "t-in (external timing input)" and press the ▲/MODE button. "04. Timing Type" (page 5-10)
End → End	End the setting and return to the main screen.

Updating the peak value (P.V. value) regularly during the sampling period

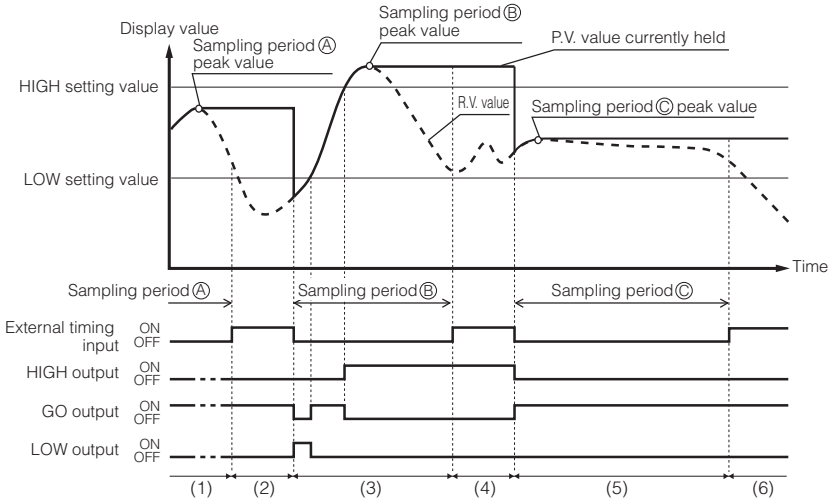
When the hold update method is set to "rEAL (regular update)", the display of the peak value (P.V. value) and criterion output are updated regularly.

■ Timing chart

This section describes the changes in the display value (P.V. value) when the detection mode is set to "P-H (peak hold)" and the hold update method is set to "rEAL (regular update)".

In the following example, "N.O." is set for "12. Output mode".

"12. Output Mode" (page 5-19)



(1) The maximum value (peak value) of the detection value (R.V. value) when the external timing input is off (sampling period Ⓐ) is always updated and displayed as the P.V. value.
The resulting output (in this case, GO criterion output) will turn on based on the peak value that is always updated.

(2) At the rising edge of the external timing input (end of the sampling period Ⓐ), the peak value and criterion output detected during the sampling period Ⓐ are held.

(3) At the falling edge of the external timing input, the peak value is reset. The maximum value (peak value) of the detection value (R.V. value) when the external timing input is off (sampling period Ⓑ) is always updated and displayed as the P.V. value.
The resulting output (in this case, GO criterion output) will turn on based on the peak value that is always updated.

(4) At the rising edge of the external timing input (end of the sampling period Ⓑ), the peak value and criterion output detected during the sampling period Ⓑ are held.

(5) At the falling edge of the external timing input, the peak value is reset. The maximum value (peak value) of the detection value (R.V. value) when the external timing input is off (sampling period Ⓒ) is always updated and displayed as the P.V. value.
The resulting output (in this case, GO criterion output) will turn on based on the peak value that is always updated.

(6) At the rising edge of the external timing input (end of the sampling period Ⓒ), the peak value and criterion output detected during the sampling period Ⓒ are held.

■ Setting procedure

In the function setting mode (press and hold the MODE button for 2 seconds or more in the main screen), set the following items.

Setting item	Setting
01 Fnc → P-H	Select "P-H (peak hold)" and press the ▲/▼/MODE button. "01. Detection Mode" (page 5-6)
02. HLd → rEAL	Select "rEAL (regular update)" and press the ▲/▼/MODE button. "02. Hold Update Method" (page 5-7)
03 SPd → 100	Select a desired response time and press the ▲/▼/MODE button. "400" is displayed when using GT2-P***/PA***. "03. Response Time" (page 5-8)
04 t in → t-in	Select "t-in (external timing input)" and press the ▲/▼/MODE button. "04. Timing Type" (page 5-10)
End → End	End the setting and return to the main screen.

(2) Using without the Timing Input

When internal (self) timing is selected during the peak hold detection mode, the sampling period is set automatically based on the desired self-timing level and the data (displayed value and criterion output) can be held.

The update timing of the displayed value (P.V. value) to be held and that of the criterion output vary depending on the setting of the hold update method.

Updating the peak value (P.V. value) and criterion output at the end of the sampling period

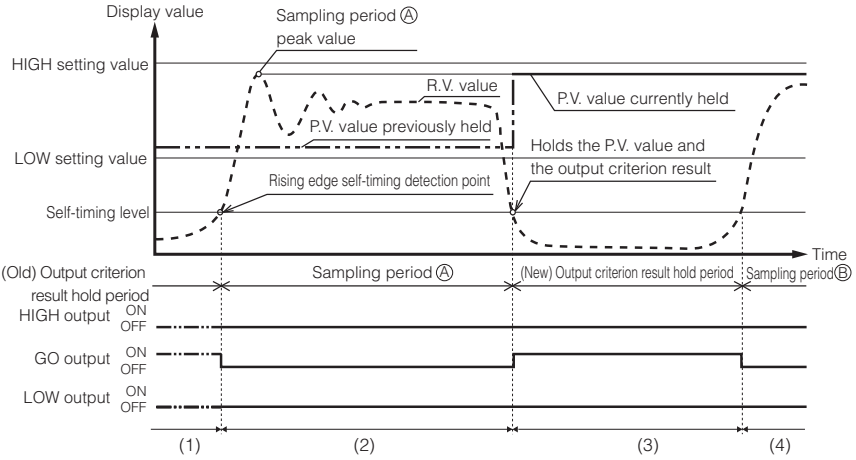
When the hold update method is set to "tim (timing input)", the display and the criterion output of the peak value (P.V. value) to be held are updated based on the self-timing level.

■ Timing chart

This section describes the changes in the displayed value (P.V. value) and criterion output by the internal (self) timing input when the detection mode is set to "P-H (peak hold)" and the hold update method is set to "tim (timing input)".

In the following example, "N.O." is set for "12. Output mode".

"12. Output Mode" (page 5-19)



(1) The last output result is held. The displayed value (P.V. value) is also the value that is previously held.

(2) When the detection value (R.V. value) exceeds the self-timing level, all outputs are turned off and the maximum detected value (peak value) of the sampling period is held. The displayed value remains unchanged at this point and keeps the value that is previously held.

(3) If the measured value drops below the self-timing level, the resulting output will turn on based on the peak value in the sampling period (In this case the GO criterion output will turn on). At this point, the

criterion output is held and the displayed value (P.V. value) is updated to the value (peak value of the sampling period Ⓐ) that is newly held.

(4) Once the measured value drops below the self-timing level and rises above the self-timing level again, all outputs turn off and the new peak value will be detected during the sampling period Ⓑ. The displayed value (P.V. value) remains unchanged and keeps the value that has been held in step (3) until the detection value (R.V. value) drops below the self-timing level again.

■ Setting procedure

In the function setting mode (press and hold the MODE button for 2 seconds or more in the main screen), set the following items.

Setting item	Setting
01 Fnc → P-H	Select "P-H (peak hold)" and press the ▲/MODE button. 📖 "01. Detection Mode" (page 5-6)
02. HLd → t in	Select "t in (timing input)" and press the ▲/MODE button. 📖 "02. Hold Update Method" (page 5-7)
03 SPd → 100	Select a desired response time and press the ▲/MODE button. "400" is displayed when using GT2-P***/PA***. 📖 "03. Response Time" (page 5-8)
04 t in → SELF._r	Select "SELF._r (rising edge)" and press the ▲/MODE button. 📖 "04. Timing Type" (page 5-10)
05 LEu → 05000	Set the self-timing level to a desired level and press the ▲/MODE button. 📖 "05. Self-timing Level" (page 5-11)
End → End	End the setting and return to the main screen.

Updating the peak value (P.V. value) regularly during the sampling period

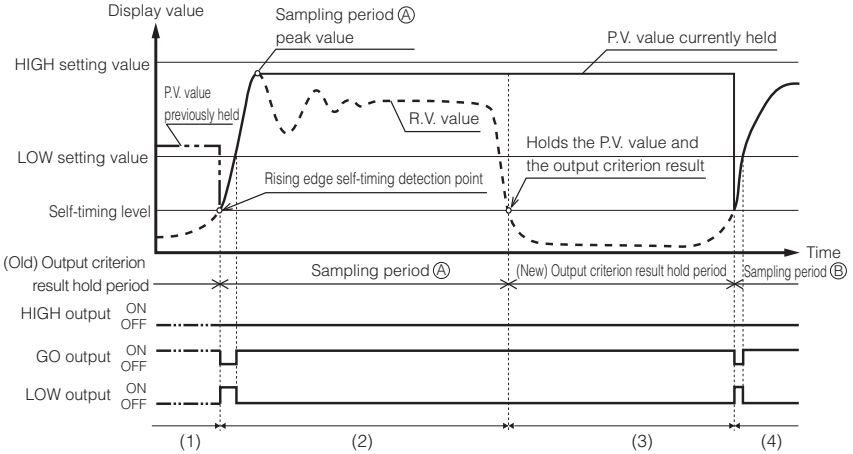
When the hold update method is set to "rEAL (regular update)", the display of the peak value (P.V. value) and criterion output are updated regularly.

■ Timing chart

This section describes the changes in the display value (P.V. value) when the detection mode is set to "P-H (peak hold)" and the hold update method is set to "rEAL (regular update)".

In the following example, "N.O." is set for "12. Output mode".

"12. Output Mode" (page 5-19)



(1) The last output result is held. The displayed value (P.V. value) is also the value previously held.

(2) When the detection value (R.V. value) exceeds the self-timing level, the P.V. values that are held are cleared and the maximum detected value (peak value) of the sampling period is always updated and displayed. The resulting output will turn on based on the updated P.V. value.

(3) When the detection value (R.V. value) drops below the self-timing level, the resulting output will turn on based on the peak value in the sampling period Ⓐ, and the peak value and the displayed value (P.V. value) are held.

(4) Once the detection value (R.V. value) drops below the self-timing level and rises above the self-timing level again, the P.V. values that are held are cleared and the maximum detected value (peak value) of the sampling period Ⓑ is always updated and displayed. The resulting output will turn on based on the updated P.V. value.

■ Setting procedure

In the function setting mode (press and hold the MODE button for 2 seconds or more in the main screen), set the following items.

Setting item	Setting
01 Fnc → P-H	Select "P-H (peak hold)" and press the ▲/MODE button. "01. Detection Mode" (page 5-6)
02. HLd → rEAL	Select "rEAL (regular update)" and press the ▲/MODE button. "02. Hold Update Method" (page 5-7)
03. SPd → 100	Select a desired response time and press the ▲/MODE button. "400" is displayed when using GT2-P***/PA***. "03. Response Time" (page 5-8)
04. tin → SELF_r	Select "SELF_r (rising edge)" and press the ▲/MODE button. "04. Timing Type" (page 5-10)
05. LEu → 05000	Set the self-timing level to a desired level and press the ▲/MODE button. "05. Self-timing Level" (page 5-11)
End → End	End the setting and return to the main screen.

4-4 Judging by the Minimum Value (Bottom Hold)

When the bottom hold detection mode is used, the bottom value in the period specified with the external input or internal input can be taken as the criterion value.

The following setting methods are available in the bottom hold detection mode.

Method to specify the sampling period	Timing to update the hold value	Reference page
(1) Specifying the Sampling Period from External Input	At the end of the sampling period	4-19
	Regularly during the sampling period	4-22
(2) Using without the Timing Input	At the end of the sampling period	4-24
	Regularly during the sampling period	4-26

Reference

When the power is turned on or the reset operation is performed*, the criterion standby display appears until the first P.V. value is fixed, and all the outputs are turned off.

Criterion standby display

* You can perform reset by using any of the following methods.
- Enter RESET from an external device.
- Press the [SET] button (when an error is displayed).

(1) Specifying the Sampling Period from External Input

When the external input is entered during the bottom hold detection mode, the data (displayed value, criterion output) of a desired sampling period currently detected can be held.

The update timing of the displayed value (P.V. value) to be held and that of the criterion output vary depending on the setting of the hold update method.

Updating the bottom value (P.V. value) and criterion output at the end of the sampling period

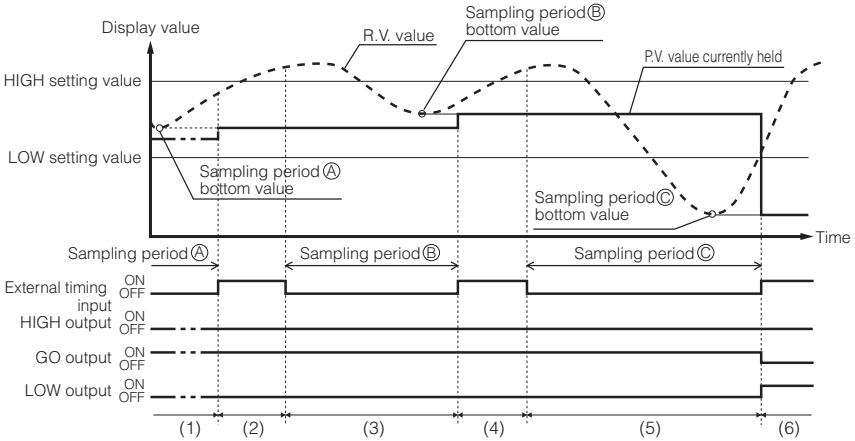
When the hold update method is set to "tim (timing input)", the display timing and the criterion output of the bottom value (P.V. value) to be held are updated by the external timing input.

■ Timing chart

This section describes the changes in the displayed value (P.V. value) and criterion output by the external timing input when the detection mode is set to "b-H (bottom hold)" and the hold update method is set to "tim (timing input)".

In the following example, "N.O" is set for "12. Output mode".

"12. Output Mode" (page 5-19)



(1) The minimum value (bottom value) of the detection value (R.V. value) is held while the external timing input is off (sampling period Ⓐ).

(2) At the rising edge of the external timing input (end of the sampling period Ⓐ), the bottom value held during the sampling period is displayed as the P.V. value. The resulting output (in this case, GO criterion output) will turn on based on the bottom value.

(3) The minimum value (bottom value) of the detection value (R.V. value) is held while the external timing input is off (sampling period Ⓑ).

(4) At the rising edge of the external timing input (end of the sampling period Ⓑ), the bottom value held during the sampling period is displayed as the P.V. value. The resulting output (in this case, GO criterion output) will turn on based on the bottom value.

(5) The minimum value (bottom value) of the detection value (R.V. value) is held while the external timing input is off (sampling period Ⓒ).

(6) At the rising edge of the external timing input (end of the sampling period Ⓒ), the bottom value held during the sampling period is displayed as the P.V. value. The resulting output (in this case, LOW criterion output) will turn on based on the bottom value.

■ Setting procedure

In the function setting mode (press and hold the MODE button for 2 seconds or more in the main screen), set the following items.

Setting item	Setting
01. Fnc → b-H	Select "b-H (bottom hold)" and press the OK/MODE button. "01. Detection Mode" (page 5-6)
02. HLd → t in	Select "t in (regular update)" and press the OK/MODE button. "02. Hold Update Method" (page 5-7)
03. SPd → 100	Select a desired response time and press the OK/MODE button. "400" is displayed when using GT2-P***/PA***. "03. Response Time" (page 5-8)
04. t in → t-in	Select "t-in (external timing input)" and press the OK/MODE button. "04. Timing Type" (page 5-10)
End] → End	End the setting and return to the main screen.

Updating the bottom value (P.V. value) regularly during the sampling period

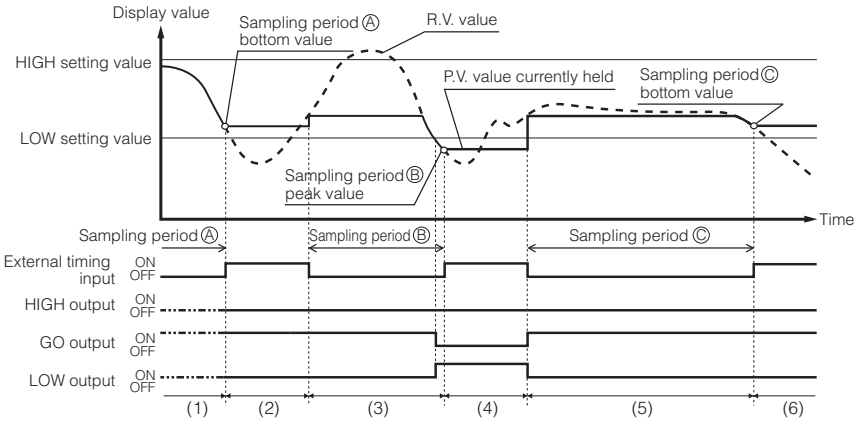
When the hold update method is set to "rEAL (regular update)", the display of the bottom value (P.V. value) and criterion output are updated regularly.

■ Timing chart

This section describes the changes in the display value (P.V. value) when the detection mode is set to "b-H (bottom hold)" and the hold update method is set to "rEAL (regular update)".

In the following example, "N.O." is set for "12. Output mode".

"12. Output Mode" (page 5-19)



(1) The minimum value (bottom value) of the detection value (R.V. value) when the external timing input is off (sampling period Ⓐ) is always updated and displayed as the P.V. value.
The resulting output (in this case, GO criterion output) will turn on based on the bottom value that is always updated.

(2) At the rising edge of the external timing input (end of the sampling period Ⓐ), the bottom value and criterion output detected during the sampling period Ⓐ are held.

(3) At the falling edge of the external timing input, the bottom value is reset. The minimum value (bottom value) of the detection value (R.V. value) when the external timing input is off (sampling period Ⓑ) is always updated and displayed as the P.V. value.
The resulting output (in this case, GO criterion output, then Low criterion output) will turn on based on the bottom value that is always updated.

(4) At the rising edge of the external timing input (end of the sampling period Ⓑ), the criterion output value and criterion output detected during the sampling period Ⓑ are held.

(5) The minimum value (bottom value) of the detection value (R.V. value) when the external timing input is off (sampling period Ⓒ) is always updated and displayed as the P.V. value.
The resulting output (in this case, GO criterion output) will turn on based on the bottom value that is always updated.

(6) At the rising edge of the external timing input (end of the sampling period Ⓒ), the bottom value and criterion output detected during the sampling period Ⓒ are held.

■ Setting procedure

In the function setting mode (press and hold the MODE button for 2 seconds or more in the main screen), set the following items.

Setting item	Setting
01. Fnc → b-H	Select "b-H (bottom hold)" and press the OK/MODE button. "01. Detection Mode" (page 5-6)
02. HLd → rEAL	Select "rEAL (regular update)" and press the OK/MODE button. "02. Hold Update Method" (page 5-7)
03. SPd → 100	Select a desired response time and press the OK/MODE button. "400" is displayed when using GT2-P***/PA***. "03. Response Time" (page 5-8)
04. t in → t-in	Select "t-in (external timing input)" and press the OK/MODE button. "04. Timing Type" (page 5-10)
End → End	End the setting and return to the main screen.

(2) Using without the Timing Input

When internal (self) timing is selected during the bottom hold detection mode, the sampling period is set automatically based on the desired self-timing level and the data (displayed value and criterion output) can be held.

The update timing of the displayed value (P.V value) to be held and that of the criterion output vary depending on the setting of the hold update method.

Updating the bottom value (P.V. value) and criterion output at the end of the sampling period

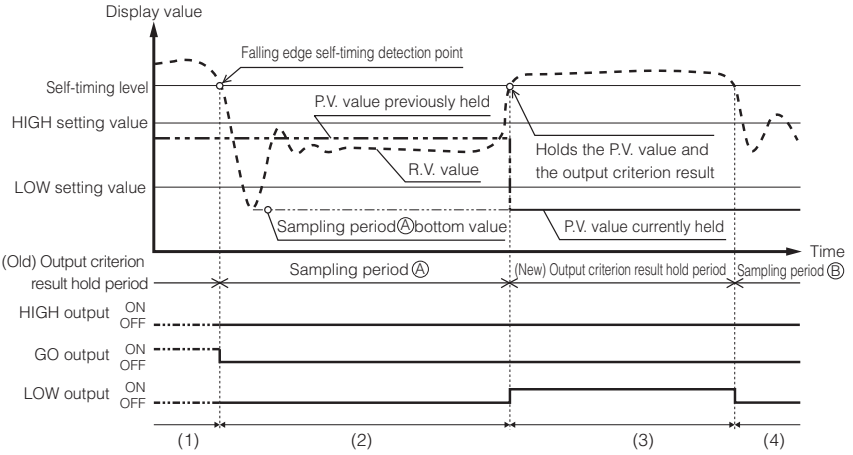
When the hold update method is set to "tim (timing input)", the display and the criterion output of the bottom value (P.V. value) to be held are updated based on the self-timing level.

■ **Timing chart**

This section describes the changes in the displayed value (P.V. value) and criterion output by the internal (self) timing input when the detection mode is set to "b-H (bottom hold)" and the hold update method is set to "tim (timing input)".

In the following example, "N.O." is set for "12. Output mode".

"12. Output Mode" (page 5-19)



(1) The last output result is held. The displayed value (P.V. value) is also the value that is previously held.

(2) When the detected value (R.V. value) drops below the self-timing level, all outputs are turned off and the minimum detected value (bottom value) of the sampling period is held. The displayed value (P.V. value) remains unchanged at this point and keeps the value that is previously held.

(3) If the measured value exceeds the self-timing level, the resulting output will turn on based on the bottom value in the sampling period (In this case the LOW criterion output will turn on). At this point,

the criterion output is held and the displayed value (P.V. value) is updated to the value (bottom value of the sampling period Ⓐ) that is newly held.

(4) Once the measured value rises above the self-timing level and drops below the self-timing level again, all outputs turn off and the new bottom value will be detected during the sampling period Ⓑ. The displayed value (P.V. value) remains unchanged and keeps the value that has been held in step (3) until the detected value (R.V. value) rises above the self-timing level again.

■ Setting procedure

In the function setting mode (press and hold the MODE button for 2 seconds or more in the main screen), set the following items.

Setting item	Setting
01 Fnc → b-H	Select "b-H (bottom hold)" and press the ▲/MODE button. 📖 "01. Detection Mode" (page 5-6)
02 HLd → t in	Select "t in (timing input)" and press the ▲/MODE button. 📖 "02. Hold Update Method" (page 5-7)
03 SPd → 100	Select a desired response time and press the ▲/MODE button. "400" is displayed when using GT2-P***/PA***. 📖 "03. Response Time" (page 5-8)
04 t in → SELF.-L	Select "SELF.-L (falling edge)" and press the ▲/MODE button. 📖 "04. Timing Type" (page 5-10)
05 LEv → 0.500.0	Set the self-timing level to a desired level and press the ▲/MODE button. 📖 "05. Self-timing Level" (page 5-11)
End → End	End the setting and return to the main screen.

Updating the bottom value (P.V. value) regularly during the sampling period

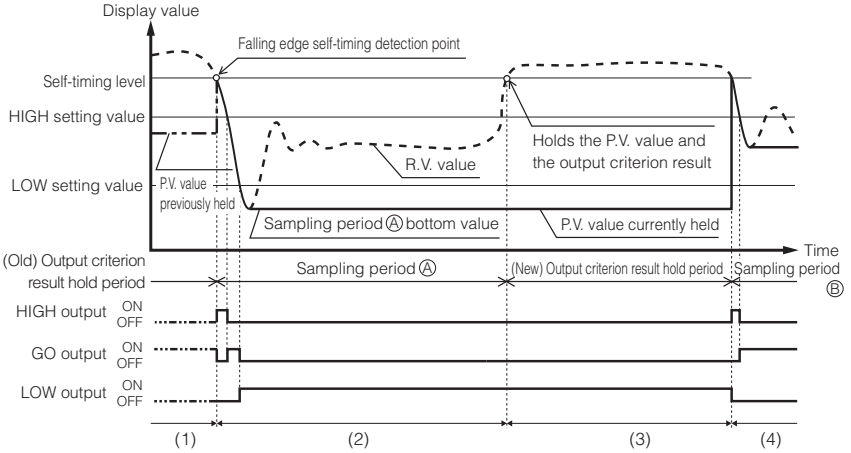
When the hold update method is set to "rEAL (regular update)", the display of the bottom value (P.V. value) and criterion output are updated regularly.

■ Timing chart

This section describes the changes in the display value (P.V. value) when the detection mode is set to "b-H (bottom hold)" and the hold update method is set to "rEAL (regular update)".

In the following example, "N.O." is set for "12. Output mode".

"12. Output Mode" (page 5-19)



(1) The last output result is held. The displayed value (P.V. value) is also the value previously held.

(2) When the detected value (R.V. value) exceeds the self-timing level, the P.V. values that are held are cleared and the minimum detected value (bottom value) of the sampling period Ⓐ is always updated and displayed. The resulting output will turn on based on the updated P.V. value.

(3) If the measured value exceeds the self-timing level, the resulting output will turn on based on the bottom value in the sampling period Ⓐ and the displayed value (P.V. value) is held.

(4) Once the measured value rises above the self-timing level and drops below the self-timing level again, the P.V. values that are held are cleared and the minimum detected value (bottom value) of the sampling period Ⓑ is always updated and displayed. The resulting output will turn on based on the updated P.V. value.

■ Setting procedure

In the function setting mode (press and hold the MODE button for 2 seconds or more in the main screen), set the following items.

Setting item	Setting
01. Fnc → b-H	Select "b-H (bottom hold)" and press the ▲/MODE button. "01. Detection Mode" (page 5-6)
02. HLd → rEAL	Select "rEAL (regular update)" and press the ▲/MODE button. "02. Hold Update Method" (page 5-7)
03. SPd → 100	Select a desired response time and press the ▲/MODE button. "400" is displayed when using GT2-P***/PA***. "03. Response Time" (page 5-8)
04. t in → SELF.-L	Select "SELF.-L (falling edge)" and press the ▲/MODE button. "04. Timing Type" (page 5-10)
05. LEv → 05000	Set the self-timing level to a desired level and press the ▲/MODE button. "05. Self-timing Level" (page 5-11)
End → End	End the setting and return to the main screen.

When the Peak-to-Peak hold detection mode is used, the difference between the peak value and the bottom value specified with the external timing input can be taken as the criterion value.

The following setting methods are available in the peak-to-peak hold detection mode.

Method to specify the sampling period	Timing to update the hold value	Reference page
Specifying the Sampling Period from External Input	At the end of the sampling period	4-28
	Regularly during the sampling period	4-30

* The internal (self) timing function cannot be set during the peak-to-peak detection mode.

Reference

When the power is turned on or the reset operation is performed*, the criterion standby display appears until the first P.V. value is fixed and all the outputs are turned off.

Criterion standby display

* You can perform reset by using any of the following methods.
- Enter RESET from an external device
- Press the [SET] button (when an error is displayed)

Specifying the Sampling Period from External Input

When the external input is entered during the bottom hold detection mode, data (displayed value, criterion output) of a desired timing currently detected can be held.

The update timing of the displayed value (P.V value) to be held and that of the criterion output vary depending on the setting of the hold update method.

Updating the peak-to-peak value (P.V. value) and criterion output at the end of the sampling period

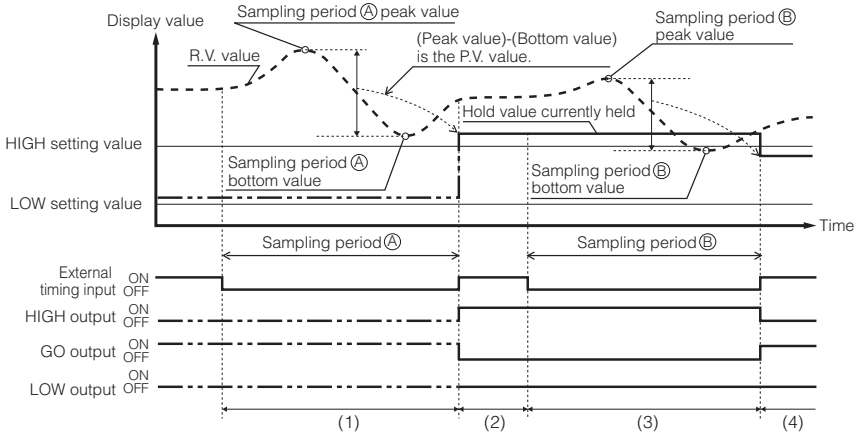
When the hold update method is set to "tim (timing input)", the display of the display and the criterion output of the peak-to-peak value (P.V. value) to be held are updated by the external timing input.

■ Timing chart

This section describes the changes in the displayed value (P.V. value) and criterion output by the external input when the detection mode is set to "P-P (peak-to-peak)" and the hold update method is set to "tim (timing input)".

In the following example, "N.O." is set for "12. Output mode".

"12. Output Mode" (page 5-19)



(1) The maximum value (peak value) and the minimum value (bottom value) of the detection value (R.V. value) are held while the external timing input is off (sampling period Ⓐ).

(2) At the rising edge of the external timing input (end of the sampling period), the difference between the peak value and the bottom value held during the sampling period Ⓐ is calculated and displayed as the P.V. value. The resulting output (in this case, HIGH criterion output) will turn on based on the value of (peak value - bottom value).

(3) The maximum value (peak value) and the minimum value (bottom value) of the detection value (R.V. value) are held while the external timing input is off (sampling period Ⓑ).

(4) At the rising edge of the external timing input (end of the sampling period), the difference between the peak value and the bottom value held during the sampling period Ⓑ is calculated and displayed as the P.V. value. The resulting output (in this case, GO criterion output) will turn on based on the value of (peak value - bottom value).

■ Setting procedure

In the function setting mode (press and hold the MODE button for 2 seconds or more in the main screen), set the following items.

Setting item	Setting
01. Fnc → P-P	Select "P-P (peak-to-peak)" and press the SET/MODE button. "01. Detection Mode" (page 5-6)
02. HLd → t in	Select "t in (timing input)" and press the SET/MODE button. "02. Hold Update Method" (page 5-7)

Setting item	Setting
03 SPd → 100	Select a desired response time and press the ▲/▼/MODE button. "400" is displayed when using GT2-P***/PA***. "03. Response Time" (page 5-8)
End → End	End the setting and return to the main screen.

Updating peak-to-peak value (P.V. value) regularly during the sampling period

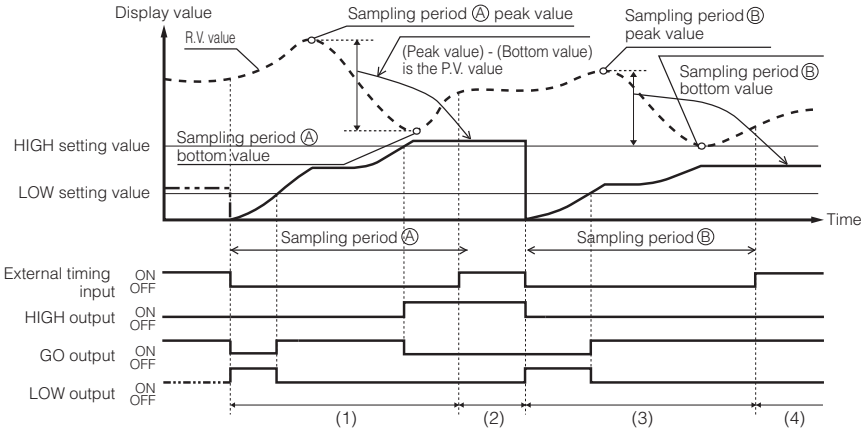
When the hold update method is set to "rEAL (regular update)", the display of the peak-to-peak value (P.V. value) and criterion output are updated regularly.

■ Timing chart

This section describes the changes in the display value (P.V value) when the detection mode is set to "P-P (peak-to-peak)" and the hold update method is set to "rEAL (regular update)".

In the following example, "N.O." is set for "12. Output mode".

"12. Output Mode" (page 5-19)



(1) The P.V. value is cleared when the external timing input is turned off. The difference between the maximum detected value (peak value) and the minimum detected value (bottom value) in the sampling period Ⓐ is always calculated and the display is updated as the P.V. value. The criterion value is output based on the updated P.V. value.

(2) At the rising edge of the external timing input (end of the sampling period), the maximum value of the difference between the peak value and the bottom value in the sampling period Ⓐ is held and displayed , and the criterion result is also held (in this case, HIGH criterion output).

(3) The P.V. value is cleared when the external timing input is turned off. The difference between the maximum detected value (peak value) and the minimum detected value (bottom value) in the sampling period Ⓑ is always calculated and the display is updated as the P.V. value. The criterion value is output based on the updated P.V. value.

(4) At the rising edge of the external timing input (end of the sampling period), the maximum value of the difference between the peak value and the bottom value in the sampling period is held and displayed as it is, and the criterion result (GO criterion output in this case) is also held.

■ Setting procedure

In the function setting mode (press and hold the MODE button for 2 seconds or more in the main screen), set the following items.

Setting item	Setting
01. Fnc → P-P	Select "P-P (peak-to-peak)" and press the ▲/MODE button. "01. Detection Mode" (page 5-6)
02. HLd → rEAL	Select "rEAL (regular update)" and press the ▲/MODE button. "02. Hold Update Method" (page 5-7)
03. SPd → 100	Select a desired response time and press the ▲/MODE button. "400" is displayed when using GT2-P***/PA***. "03. Response Time" (page 5-8)
End → End	End the setting and return to the main screen.

4-6 Holding HIGH/LOW Output

When the NG hold detection mode is used, the output can be held if the HIGH or LOW output turns on during the period specified by the external timing (while the external timing input is off).

With this function, it can be judged whether the HIGH or LOW output turns on during the continuous detection by watching the subsequent criterion outputs with the timing input turned off at the start of the detection and turned on at the end of the detection.

Timing Chart in the NG Hold Detection Mode

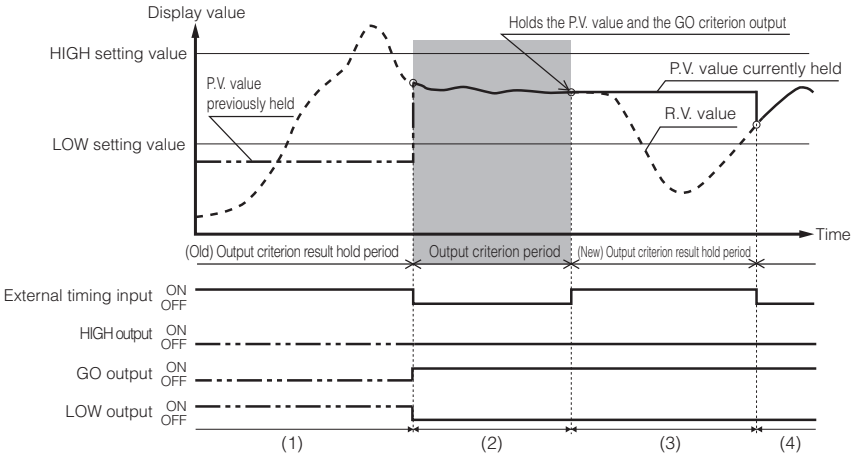
When the external timing is input during the NG hold detection mode, the desired timing data (displayed value, criterion output) currently detected can be held.

■ When the HIGH/LOW output does not turn on during the output criterion period

This section describes the changes in the display value and criterion output when the GO criterion is held.

In the following example, "N.O." is set for "12. Output mode".

"12. Output Mode" (page 5-19)



(1) The last output result is held while the external input is on the displayed value (P.V. value) is also the value that is previously held.

(2) The HIGH/LOW criterion outputs are monitored while the external timing input is off. The hold state of the displayed value (P.V. value) is canceled and displayed according to the detection value (R.V. value) of the sensor head.

(3) When neither the HIGH nor LOW outputs are on during the output criterion period (when the external timing input is off), the GO criterion output is held. The value when the external timing input starts is held for the displayed value (P.V. value).

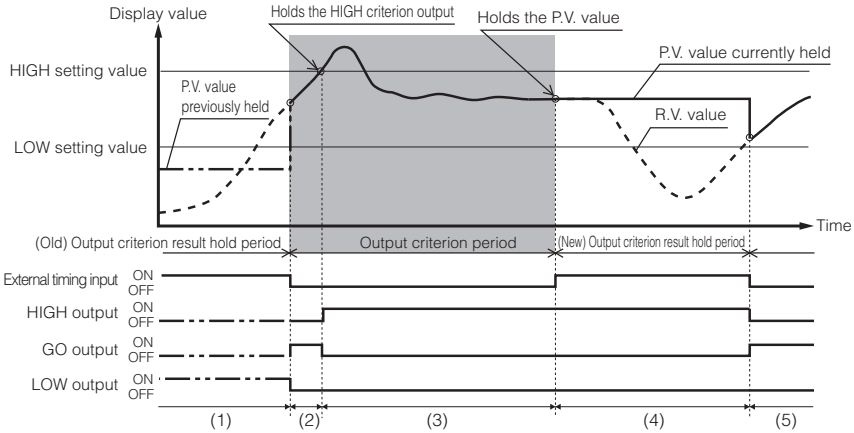
(4) The hold status of the criterion output and displayed value (P.V. value) is canceled when the next external timing input turns off.

■ When the HIGH output turns on during the output criterion period

This section describes the changes in the displayed value and criterion output when the HIGH criterion is held.

In the following example, "N.O." is set for "12. Output mode".

"12. Output Mode" (page 5-19)



(1) The last output result is held while the external input is on the displayed value (P.V. value) is also the value that is previously held.

(2) The HIGH/LOW criterion outputs are monitored while the external timing input is off. The hold state of the displayed value (P.V. value) is canceled and the detection value (R.V. value) is displayed.

(3) When the HIGH criterion is detected during the output criterion period (when the external timing input is off), the HIGH criterion output is held. Once the criterion output is held, the criterion output no longer changes along with the changes of the detection value (R.V. value) even during the output criterion period.

(4) The HIGH criterion is detected during the output criterion period (when the output timing input is off), so the HIGH criterion output is held even after the output criterion period is finished. The value when the external timing input starts is held for the displayed value (P.V. value). The displayed value (P.V. value) is kept held (in this example, value within the GO range) until the external input turns off next time and the HIGH criterion output is held.

(5) The hold status of the criterion output and displayed value (P.V. value) is canceled when the next external timing input turns off.

Reference The hold status of the HIGH criterion output is canceled with the reset input.

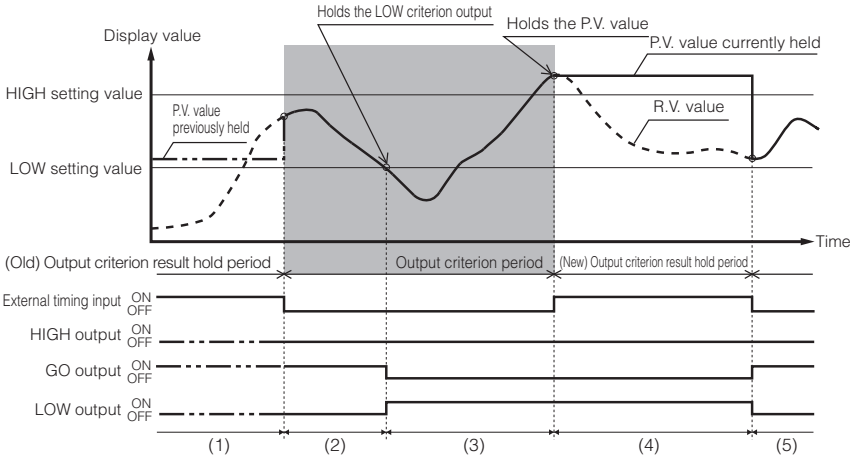
"Reset Input (Resetting Internal Values)" (page 3-34)

■ When the LOW output turns on during the output criterion period

This section describes the changes in the displayed value and criterion output when the LOW criterion is held.

In the following example, "N.O." is set for "12. Output mode".

"12. Output Mode" (page 5-19)



(1) The last output result is held while the external input is on the displayed value (P.V. value) is also the value that is previously held.

(2) The HIGH/LOW criterion outputs are monitored while the external timing input is off. The hold state of the displayed value (P.V. value) is canceled and displayed according to the detection value (R.V. value) of the sensor head.

(3) When the LOW criterion is detected during the output criterion period (when the external timing input is off), the LOW criterion output is held. Once the criterion output is held, the criterion output does not change according to the changes of the detection value (R.V. value) even if it is during the output criterion period.

(4) The LOW criterion is detected during the output criterion period (when the output timing input is off), so the LOW criterion output is held even after the output criterion period is finished. The value when the external timing input starts is held for the displayed value (P.V. value).

(5) The hold status of the criterion output and displayed value (P.V. value) is canceled when the next external timing input turns off.

Reference

The hold status of the LOW criterion output is canceled with the reset input.

"Reset Input (Resetting Internal Values)" (page 3-34)

■ Setting procedure

In the function setting mode (press and hold the MODE button for 2 seconds or more in the main screen), set the following items.

Setting item	Setting
01. Fnc → nG-H	Select "nG-H (NG hold detection)" and press the ▲/MODE button. "01. Detection Mode" (page 5-6)
03. SPd → 100	Select a desired response time and press the ▲/MODE button. "400" is displayed when using GT2-P***/PA***. "03. Response Time" (page 5-8)
End] → End	End the setting and return to the main screen.

MEMO

Setting Various Functions

5

This chapter describes various detection functions of the GT2-100 Series.

5-1 Setting List

List of Setting Modes

With the GT2-100 Series, you can set various functions to support many kinds of detection methods.

Mode	Description	Entering the mode
Function setting mode	Sets up functions related to detection and timing. "5-2 Function Setting Mode" (page 5-5)	Press and hold the [MODE] button for at least two seconds.
Basic setting mode	Sets basic output functions and desired number of digits to be displayed. "5-3 Basic Setting Mode" (page 5-16)	Press and hold the [MODE] and [SET] buttons at the same time for at least two seconds.
Additional function setting mode	Power save and core alarm control. "5-4 Additional Function Setting Mode" (page 5-35)	Press and hold the [MODE] button and the left arrow key at the same time for at least two seconds.
Calibration setting mode	Sets the calibration function. "5-5 Calibration Setting Mode" (page 5-48)	Press and hold the [MODE] button and the right arrow key at the same time for at least two seconds.
Calculation setting mode	Calculation based on the multiple detected targets to check the degree of flatness, twist, or warpage. "5-6 Calculation Setting Mode" (page 5-54)	Press and hold the [MODE] button for at least two seconds. (This mode can be set only when the expansion unit is added.)

Reference Each setting mode can be entered only from the main screen.
"3-2 Main Screens" (page 3-4)

Parameter Setting List

■ Function setting mode

"5-2 Function Setting Mode" (page 5-5)

- **Entering function setting mode: Press and hold the [MODE] button for at least two seconds.**

No.	Item	Description	Reference page
01	Detection mode	Select the detection mode.	5-6
02	Hold update method	When "P-H", "b-H", or "P-P" is selected in 01, select "Timing input" or "Regular update" for the update timing of the hold value.	5-7
03	Response time	Longer response time makes the average data time longer, which stabilizes the value.	5-8
04	Timing type	For the timing input, select "External timing" or "Self timing (internal timing)".	5-10
05	Self-timing level	When self timing is selected in 04, set the threshold of the timing input.	5-11

No.	Item	Description	Reference page
06.	Self timing delay type	When "Std" is selected in 01, select the timing to fix the criterion value after the value rises above (or falls below) the self-timing level: "When the setting time is elapsed (delay timer)" or "After the display value is stabilized (static hold)".	5-12
07.	User specified delay time	Set the delay time when "When the setting time is elapsed (delay timer)" is selected in 06.	5-13
08.	Static hold delay stability criterion	Set the reference of stability criterion when "After the display value is stabilized (static hold)" is selected in 06.	5-14
09.	Static hold delay stability width	Enter a desired number when USEr (user specification) is selected in 08.	5-15

■ Basic setting mode

"5-3 Basic Setting Mode" (page 5-16)

- **Entering basic setting mode: Press and hold the [MODE] and [SET] buttons at the same time for at least two seconds.**

No.	Item	Description	Reference page
10.	Measurement direction change	Set the "Normal" or "Reverse" to set the measurement value to increase or decrease based on position.	5-17
11.	Multiplier	Set the ratio of the detected value.	5-18
12.	Output mode	Set "ON (N.O.)" or "OFF (N.C.)" for output judgment.	5-19
13.	Displayed number of digits	Set the number of display digits.	5-20
14.	Hysteresis	Set the hysteresis value.	5-21
15.	Batch input setting	Set to make input to all added expansion units when an input is made to the input line of the main unit.	5-23
16.	Special output setting	Select the function of the special output lines.	5-24
-	Limit output HH side teaching	Set the reference position where the limit output turns on toward the spindle contraction side when the "Lt.USEr" is selected in 16.	5-31
17.	Limit output HH side criterion position setting	With the reference position being 0, set the position where the limit output of the contraction side turns on.	5-32
-	Limit output LL side teaching	Set the reference position where the limit output turns on toward the spindle extension side when the "Lt.USEr" is selected in 16.	5-33
18.	Limit output LL side criterion position setting	With the reference position being 0, set the position where the limit output extension side turns on.	5-34

■ Additional function setting mode

"5-4 Additional Function Setting Mode" (page 5-35)

- **Entering additional function setting mode: Press and hold the [MODE] and [<] buttons at the same time for at least two seconds.**

No.	Item	Description	Reference page
20.	Select preset data	Select the data to use when performing the preset.	5-36
21.	Preset memory	Set whether or not to save "zero-point correction".	5-37

No.	Item	Description	Reference page
22.	Preset point setting	Set the memory method for "zero-point correction" when using the bank function.	5-38
23.	Power-saving function (ECO)	To decrease the power consumption or not to display the numerical value, set this function.	5-39
24.	Jam detection function	When the spindle does not return due to an undetected event in external timing input, set to detect such an event as an error.	5-40
-	Jam detection teaching	Set the reference position for the jam detection.	5-44
25.	Jam detection position	Set the position to perform the jam detection function with the reference position being 0.	5-45
26.	Batch setting*	Set whether or not to apply the preset and the bank switching by key operations on ID 00 to all IDs.	5-46
27.	Valid ID Setting*	You can set the number of sensor heads (expansion units) that can be connected to the amplifier. The number of connectable sensor heads changes in accordance with the number of the installed expansion boards (zero to three boards).	5-47

* Can be set only on ID 00.

■ Calibration setting mode

"5-5 Calibration Setting Mode" (page 5-48)

- **Entering calibration setting mode: Press and hold the [MODE] and [>] buttons at the same time for at least two seconds.**

No.	Item	Description	Reference page
30.	Calibration function setting	Set the calibration function.	5-49
-	1st point detection/ capture	Set the zero point (1st point).	5-50
31	2nd point target value	Set the target value of the span adjustment (2nd point).	5-51
-	2nd point detection/ capture	Set the detection position for the span adjustment.	5-52

■ Calculation setting mode

"5-6 Calculation Setting Mode" (page 5-54)

- **Entering calculation setting mode: After setting an expansion unit, press and hold the [MODE] button on the main unit (ID 00) while it is displayed for at least two seconds.**

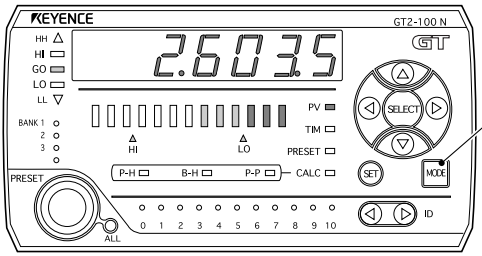
No.	Item	Description	Reference page
A1	Calculation mode setting	Set the calculation mode when an expansion head(s) is added. * The calculation mode will appear only when an expansion head(s) is added.	5-54
A2.	Calculation method	Set the calculation method when "noCALc" is selected in A1.	5-55

5-2 Function Setting Mode

Entering Function Setting Mode

Enter the function setting mode by the following procedure.

- **On the main screen, press and hold the [MODE] button for at least two seconds.**



Main screen (P.V. value display screen)

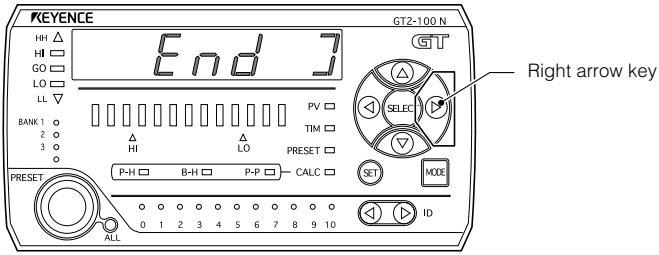
Reference

When "CALc (Calculation mode)" is selected in "A1. Calculation Mode" (except when "C5.rEF (Reference difference)" is selected in "A2. Calculation method"), the expansion unit cannot enter the function setting mode.

Exiting Function Setting Mode

Exit the function setting mode by either of the following procedures to display the main screen.

- **Press and hold the [MODE] button for at least two seconds.**
- **Or press the right arrow key several times until the setting completion display appears, and press the right arrow key once more.**

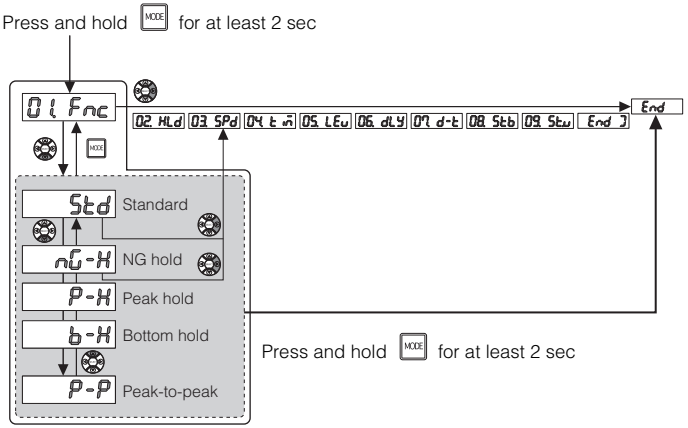


Setting completion display

01. Detection Mode

01. Fnc

Select the mode when detecting the target.



"Entering Function Setting Mode" (page 5-5)

Detection mode		Description	Initial value
Standard detection Std		On "P.V. value display screen", the displayed values and criterion output are always updated. In addition, the displayed values and criterion output can be held by the timing input. "4-1 Judging with the Current Value" (page 4-2)	O
NG hold detection nG-H		Holds the output when the detected value exceeds (drops below) the HIGH (LOW) setting during external timing. "4-6 Holding HIGH/LOW Output" (page 4-32)	
Hold detection	Peak hold P-H	Holds the peak value during external (or internal) timing. "4-3 Judging by the Maximum Value (Peak Hold)" (page 4-10)	
	Bottom hold b-H	Holds the bottom value during external (or internal) timing. "4-4 Judging by the Minimum Value (Bottom Hold)" (page 4-19)	
	Peak-to-peak P-P	Holds the peak-to-peak value by within the "Sampling period" defined external timing. "4-5 Judging with the Difference between Maximum and Minimum Values" (page 4-28)	

"Chapter 4 Using Detection Modes" (page 4-1)

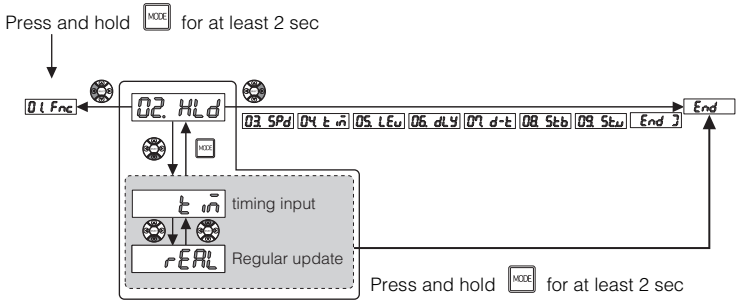
02. Hold Update Method

02. HLd

Selects the method by which the hold display P.V. value is updated.

Reference This is only available when P-H (peak hold), b-H (bottom hold) or P-P (peak-to-peak) is selected in "01 IFnc (Detection mode)".

"01. Detection Mode" (page 5-6)



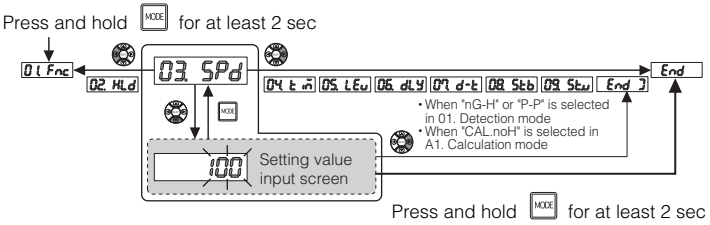
"Entering Function Setting Mode" (page 5-5)

Item	Description	Default Setting
Timing input t in	The P.V. value to hold and display is not updated during the sampling period, and is updated after the sampling period finishes.	O
Regular update rEAL	During the sampling period, each hold value (P.V. value) is displayed with regular updates.	

Reference For more details about operations, refer to "Chapter 4 Using Detection Modes" (page 4-1).

03. Response Time

The response time is the time from when the sensor head start detection until the measured value has been processed.



"Entering Function Setting Mode" (page 5-5)

When using GT2-H***/A***

Item	Setting range	Default Setting
Response time	hSP*/5/10/100/500/1000 (unit: ms)	100

* Response time is 3 ms when hSP is selected.

When using GT2-P***/PA***

Item	Setting range	Default Setting
Response time	hSP*/20/40/400/2000/4000 (unit: ms)	400

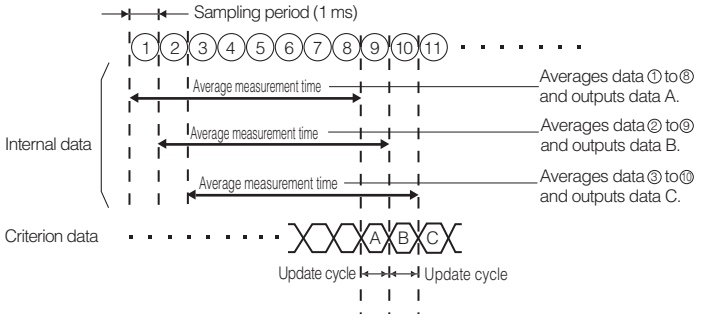
* Response time is 12 ms when hSP is selected.

With the GT2-100 Series, the internal data that have been sampled are averaged according to the response time. If you increase the response time, the number of averaged samples will be increased. If you decrease the response time, the number of averaged samples will be decreased.

When using GT2-H***/A***

Response time (ms)	Average frequency (times)	Average time (ms)	Internal value update cycle (ms)
hSP (3)	1	1	1
5	3	3	1
10	8	8	1
100	94	94	4
500	480	480	16
1000	960	960	32

Example If you set a response time of 10 ms (average time: 8 ms, number of averaged samples: 8), data will be obtained and output as follows:



Reference

- If you want to detect instantaneous changes, set a short response time.
- If you want to ignore instantaneous changes or fluctuations of values, set a long response time.

When using GT2-S1/S5/P***/PA***

Item	Setting range	Default Setting
Response time	hSP*/20/40/400/2000/4000 (unit: ms)	400

* Response time is 12 ms when hSP is selected.

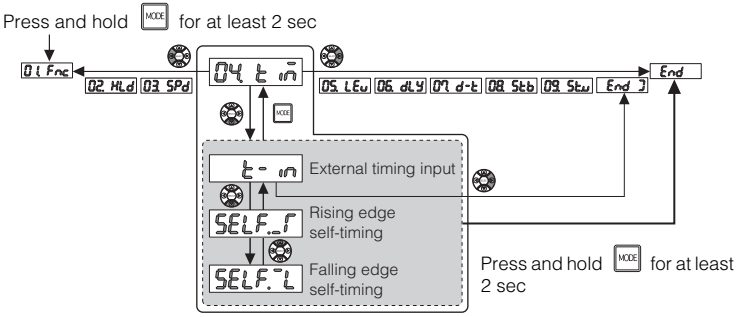
Response time (ms)	Average frequency (times)	Average time (ms)	Internal value update cycle (ms)
hSP (12)	1	4	4
20	3	12	4
40	8	32	4
400	94	376	16
2000	480	1920	64
4000	960	3840	128

04. Timing Type

Selects a type of timing input.

Reference This item can be set only when **Std** (Standard), **P-H** (Peak hold), or **b-H** (Bottom hold) is selected for "**01 Fnc** (Detection mode)".

"01. Detection Mode" (page 5-6)



"Entering Function Setting Mode" (page 5-5)

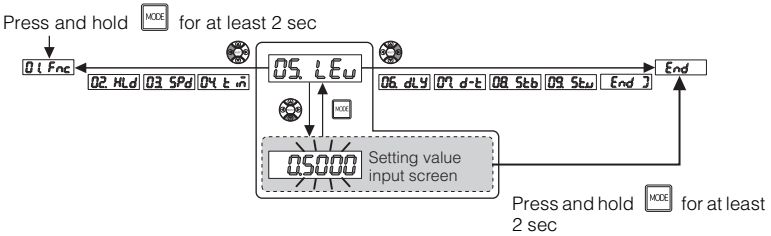
Item	Description	Default Setting
External timing input t-in	Select this when using the input from an external device. "6-2 I/O Circuit Diagram" (page 6-13)	O
Rising edge self-timing SELF_r	When the detected value exceeds the self-timing level (a change from the value below the self-timing level to the one above the self-timing level), the timing input occurs.  "05. Self-timing Level" (page 5-11)	
Falling edge self-timing SELF_F	When the detected value drops below the self-timing level (a change from the value above the self-timing level to the one below the self-timing level), the timing input occurs.  "05. Self-timing Level" (page 5-11)	

Reference For more details about operations, refer to "Chapter 4 Using Detection Modes" (page 4-1).

05. Self-timing Level

The self-timing level is the set point to trigger the timing input automatically when it detects a chance in the values.

Reference This item can be set only when either SELF_r (Rising edge self-timing) or SELF_L (Falling edge self-timing) is selected for "04. t in (Timing type)".
"04. Timing Type" (page 5-10)



"Entering Function Setting Mode" (page 5-5)

Item	Setting range	Default Setting
Self-timing level	-199.9999 to 199.9999 (unit: mm)	0.5000

Reference The hysteresis can be set for the self-timing level.
"14. Hysteresis" (page 5-21)

06. Self Timing Delay Types

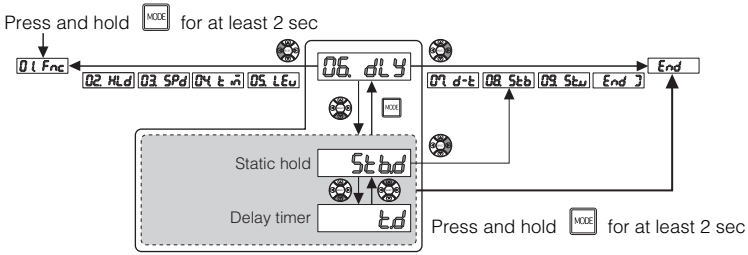
The Self timing delay is basically an on-delay. The delayed time is the point from where the timing input activates to the point where the desired value is measured and held.

Reference

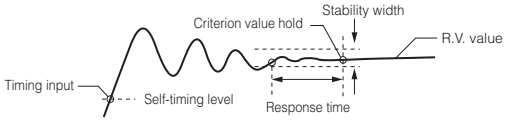
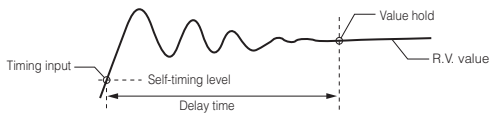
This item can be set only under the following conditions.

- **Std** (Standard) is selected for "**01 Fnc** (Detection mode)".
- Either SELF_r (Rising edge self-timing) or **SELF.FL** (Falling edge self-timing) is selected for "04. tim (Timing type)".

"01. Detection Mode" (page 5-6)
"04. Timing Type" (page 5-10)



"Entering Function Setting Mode" (page 5-5)

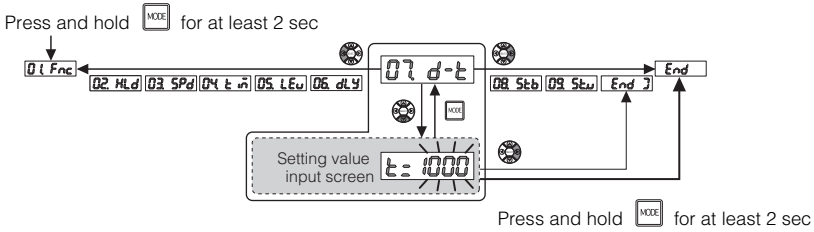
Item	Description	Default Setting
Static hold Stbd	After the timing input by the self-timing level occurs, when the range of fluctuation of the detected value stays below a constant value, the value is considered to be "stabilized" and it is held. (The range of fluctuation can be set to any value.)  "08. Static Hold Delay Stability" (page 5-14)	O
Delay timer td	After the timing input by the self-timing level occurs, the delay timer starts operation. It holds the value after the delay time specified has elapsed.  "07. User-specified Delay Time" (page 5-13)	

07. User-specified Delay Time

Set the delay time to fix the criterion value after the timing input occurs using the self-timing input.
Adjusting the on-delay time.

Reference This item can be set only when "t.d (Delay timer) is selected for "06.dLY (Self-timing delay type)".

"06. Self Timing Delay Types" (page 5-12)



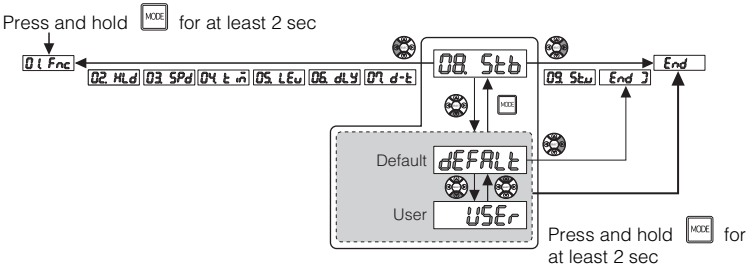
"Entering Function Setting Mode" (page 5-5)

Item	Setting range	Default Setting
User-specified delay time	0 to 9999 (unit: ms)	1000

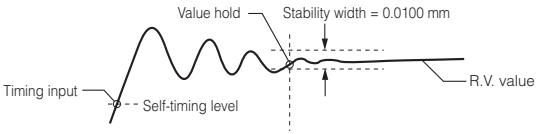
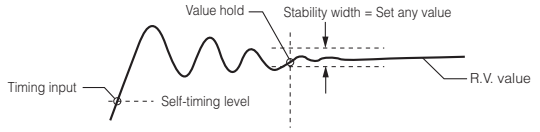
08. Static Hold Delay Stability

Select the setting method for the value of the stability width in the static hold delay stability.
Adjusting the stability width.

Reference This item can be set only when "StbD (Static hold) is selected for "06dLY (Self-timing delay type)".
"06. Self Timing Delay Types" (page 5-12)



"Entering Function Setting Mode" (page 5-5)

Item	Description	Default Setting
Default dEFALt	The stability width is set to the default value (0.0100 mm).  "06. Self Timing Delay Types" (page 5-12)	O
User USEr	The stability width can be set to any value. You can specify the value in "09. Static hold delay stability width" .  "09. Static Hold Delay Stability Width" (page 5-15)	

Reference For more details about operations, refer to "Chapter 4 Using Detection Modes" (page 4-1).

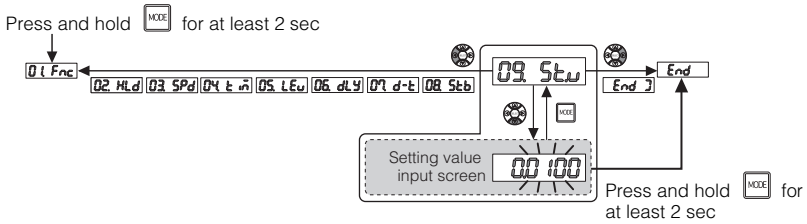
09. Static Hold Delay Stability Width

Set the value of the stability width when the static hold delay is set.

Reference

This item can be set only when "USEr (User) is selected for "08Stb (Static hold delay stability criterion)".

"08. Static Hold Delay Stability" (page 5-14)



"Entering Function Setting Mode" (page 5-5)

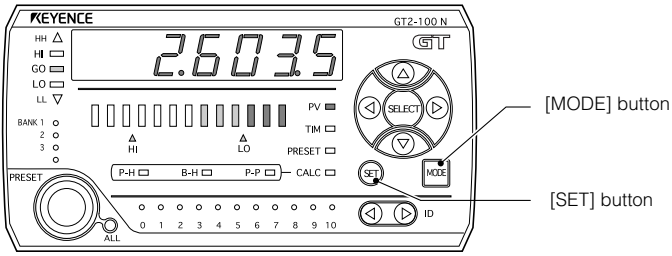
Item	Setting range	Default Setting
Static hold delay stability width	0.0000 to 199.9999 (unit: mm)	0.0100

5-3 Basic Setting Mode

Entering Basic Setting Mode

Enter the function setting mode by the following procedure.

- **From the main screen, press and hold the [MODE] and [SET] buttons at the same time for at least two seconds.**

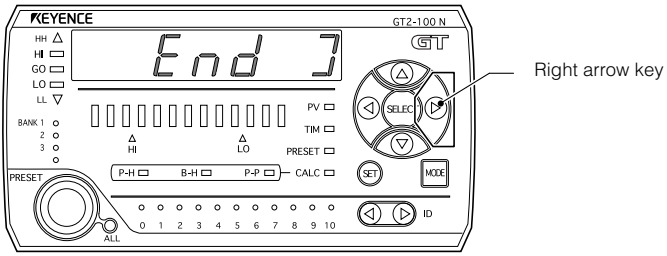


Main screen (P.V. value display screen)

Exiting Basic Setting Mode

Use one of the following methods to exit basic setting mode and display the main screen.

- **After the settings are complete, press and hold the [MODE] button for at least two seconds.**
- **After the settings are complete, press the right arrow key several times until the setting completion display appears, and press the right arrow key once more.**



Setting completion display

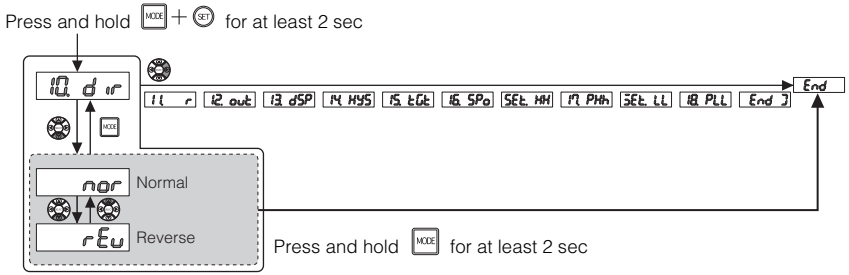
10. Measurement Direction

Display the value detected when the sensor head spindle is pressed as a positive (normal) or negative (reverse) value.

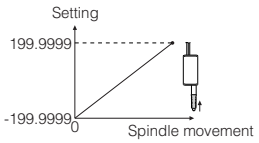
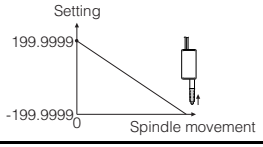
Reference

On the main unit, this setting is available to set only when "noCALc (No calculation)" or "CALc (Calculation mode)" is selected in "AIAPL (Calculation mode)".

"5-6 Calculation Setting Mode" (page 5-54)



"Entering Basic Setting Mode" (page 5-16)

Measurement direction	Description	Default Setting
Normal nor	Value increases based on the amount that the spindle is pushed in (amount of movement). 	O
Reverse rEu	Value decreases based on the amount that the spindle is pushed in (amount of movement). 	

NOTICE	**When changing the measurement direction, reset the following parameters:** **• HIGH setting value ("(5) HIGH setting value display" (page 3-9))** **• LOW setting value ("(6) LOW setting value display" (page 3-10))** **• Timing type ("04. Timing Type" (page 5-10))** **• Self-timing level ("05. Self-timing Level" (page 5-11))**

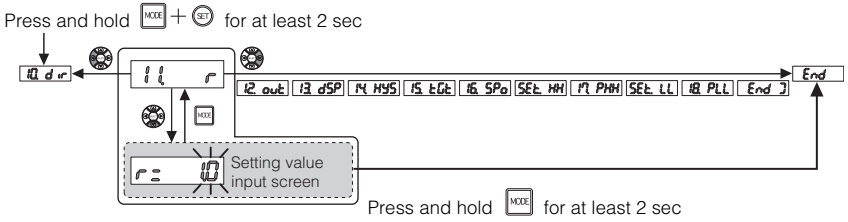
11. Multiplier

When the detection point is located beyond a lever or in other similar cases, the display value can be displayed by multiplying the actual detected value.

Reference

On the main unit, this setting is available to set only when "noCALc (No calculation)" or "CALc (Calculation mode)" is selected in "AIAPL (Calculation mode)".

"5-6 Calculation Setting Mode" (page 5-54)



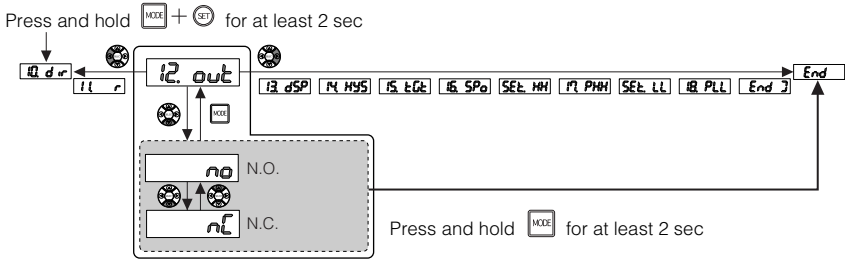
"Entering Basic Setting Mode" (page 5-16)

Item	Setting range	Default Setting
Multiplier	0.1 to 100.0	1.0

12. Output Mode

12. out

Set the output mode (ON (N.O.) or OFF (N.C.)) of the criterion output.



"Entering Basic Setting Mode" (page 5-16)

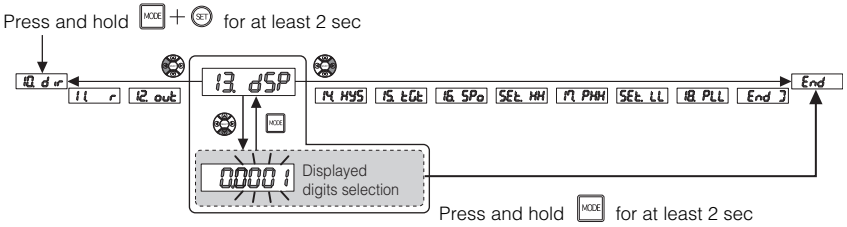
Output mode	Description	Default Setting
N.O. (Normal open) no	Turns on output for criterion output.	O
N.C. (Normal close) nC	Turns off output for criterion output.	

Example

Judgment	Output mode	Criterion output
HIGH criterion	N.O. (Normal open)	HIGH output: On
		GO output: Off
		LOW output: Off
	N.C. (Normal close)	HIGH output: Off
		GO output: On
		LOW output: On

13. Displayed Number of Digits

Set the number of digits of the display value in the digital display.
Set this when you want to display only the necessary digits.



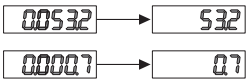
"Entering Basic Setting Mode" (page 5-16)

Item	Setting range	Default Setting
Displayed number of digits	0.0001 / 0.001 / 0.01 / _ _ _0.1 (unit: mm)	0.0001

Reference

- Changes to the displayed number of digits are applied only to the P.V. value, R.V. value, and calculated value displays.
- When the displayed value is less than 1.000.0, "_ _ _ 0.1" is displayed by omitting the first 0.

Example



Changes to the displayed number of digits do not affect criterion output.

14. Hysteresis

14. HYS

Set the hysteresis value.

The hysteresis value is common among the HH setting value, HIGH setting value, LOW setting value, LL setting value, and self-timing level.

"(5) HIGH setting value display" (page 3-9)

"(6) LOW setting value display" (page 3-10)

"3-5 Setting the HH/LL Criterion Value" (page 3-24)

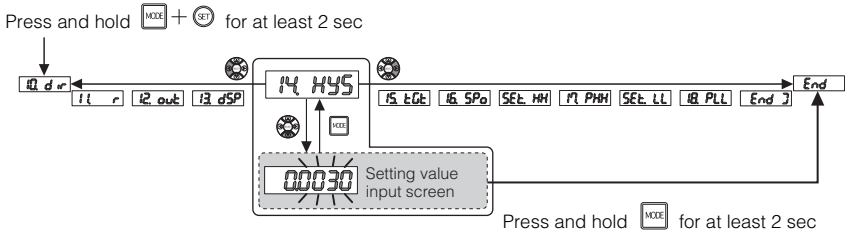
"05. Self-timing Level" (page 5-11)

Reference

The hysteresis setting is not applied to the limit output.

"Limit output" (page 5-25)

- Hysteresis refers to the characteristic where the criterion value that turns on the criterion output and the one that turns off the criterion output are different.
- If the P.V. value is fluctuating around the tolerances the outputs may repeatedly turn on and off.
  Setting the hysteresis changes the width between the tolerances that turn the outputs on and off, thus preventing this phenomenon.
  "3-4 Setting the Tolerances" (page 3-17)



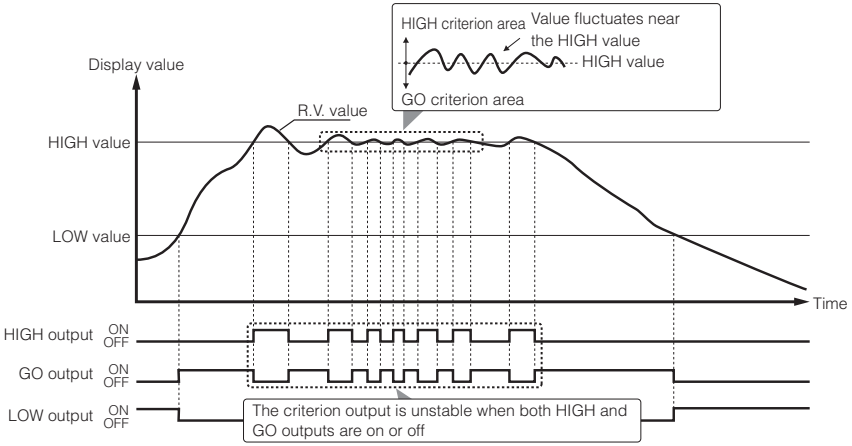
"Entering Basic Setting Mode" (page 5-16)

Item	Setting range	Default Setting
Hysteresis	0.0000 to 199.9999 (unit: mm)	0.0030

When hysteresis is not set (setting is 0)

Setting the hysteresis to 0 causes fluctuations in the P.V. value to directly affect the criterion output, so it is useful for applications that require strict tolerance measurements.

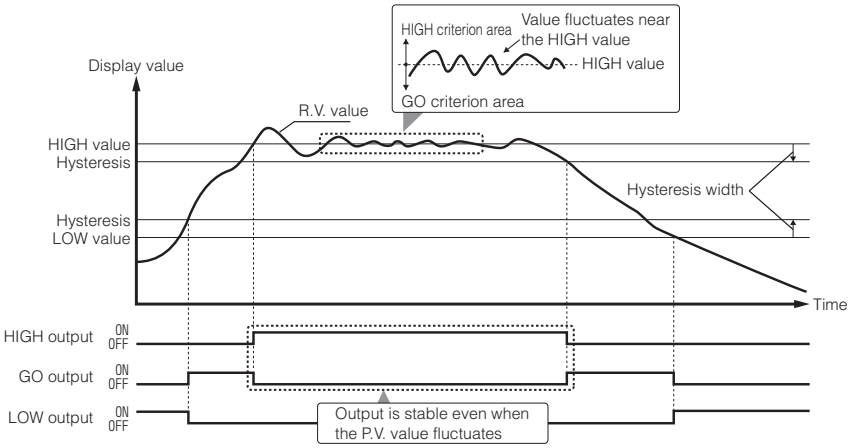
However, when the detected values fluctuate close to the tolerances, the criterion output becomes unstable.



When hysteresis is set

When the hysteresis is set, the output is stable and does not react excessively to fine variations in the P.V. value close to the tolerances.

A large hysteresis tends to produce a more stable output, but it also becomes more difficult to output for GO when the P.V. value varies close to the tolerances.



15. Batch Input Settings

When there is input on the line to the main unit, settings can be batch input to all expansion units.

Batch input settings allow timing input and preset input to the main unit to be input to all expansion units when expansion units are connected.

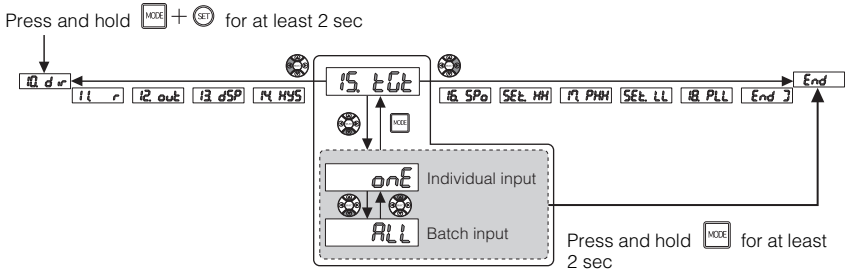
"6-2 I/O Circuit Diagram" (page 6-13)

Reference

When using batch input, conditions such as the minimum input time change.

"Timing Chart" (page 6-15)

- This setting is only available for main units that have expansion units connected.
- Batch input is available with the following functions.
  - External timing input
  - External preset input
  - Reset input
  - External bank A switch input
  - External bank B switch input



"Entering Basic Setting Mode" (page 5-16)

Item	Description	Default Setting
Individual input onE	Input into main and expansion units individually.	O
Batch input ALL	Input to the main unit is also input to any connected expansion units.	

Reference

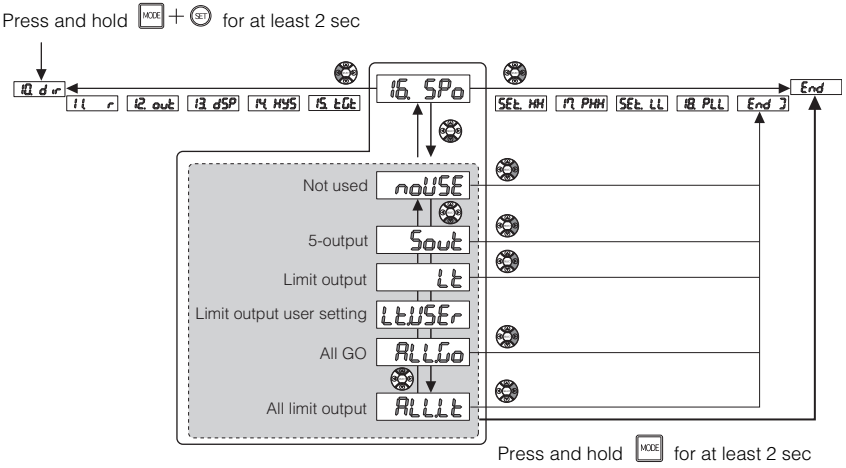
When batch input settings are being used, the input lines to all expansion units are deactivated.

16. Special Output Setting

16. SPo

Selects the special output function.

"6-2 I/O Circuit Diagram" (page 6-13)



Reference

The items that can be selected (displayed) are different depending on the settings in "A1 Calculation mode". (When the expansion head is not added, the items that can be selected (displayed) are the same as for "noCALc".)

A1 Calculation mode \ 15. Special output setting	noUSE	Sout	Lt	LtUSEr	ALLGo*1	ALLLt*1
noCALc	O	O	O	O	O	-
CALc	O	O*2	O	O	O*3	-
CALnoH	O	O	-	-	O	O

*1 This can be set only on the main unit that an expansion head is added.

*2 On the expansion unit, this can be set only when "C5.rEF (Reference difference) is selected in "A2. Calculation Mode".

*3 This can be set only when "C5.rEF (Reference difference)" is selected in "A2. Calculation method".

"Entering Basic Setting Mode" (page 5-16)

Item	Description	Default Setting
Not used noUSE	Special output functions are not used.	O
5-output 5out	Uses the special outputs as the HH and LL criterion output. The HH and LL side criterion values are set on the main screen. "(4) 5 output HH setting value display" (page 3-8) "(7) 5 output LL setting value display" (page 3-11)	
Limit output Lt	Inspects the sensor head spindle mechanical position (extension-side end, contraction-side end) for limit output.	
Limit output user setting LtUSEr	Sets the sensor head spindle mechanical position (extension-side end, contraction-side end).	
All GO ALLGo	Outputs HH output when all connected expansion units and the main unit* are set to GO criterion output, otherwise it outputs LL output.	
All limit output ALLLt	Outputs HH output when the HH-side limit output is ON for all connected expansion units and outputs LL output when the LL-side limit output is ON for all connected expansion units	

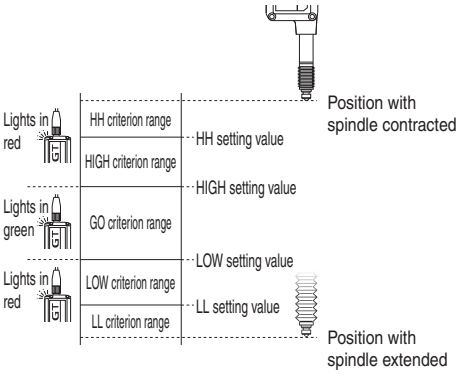
* Main unit output is not included when "CAL.noH" is selected in "A1. Calculation mode".

Special Output Settings

■ When "5out (5-output)" is selected

If "5out" is selected under "16. Special output settings", HH and LL criterion can be output in addition to normal criterion output (HIGH, GO, LOW).

The HH criterion performs criterion output according to the value set above the HIGH setting value (HH setting value > HIGH setting value). The LL criterion performs criterion output according to the value set below the LOW setting value (LL setting value < LOW setting value).



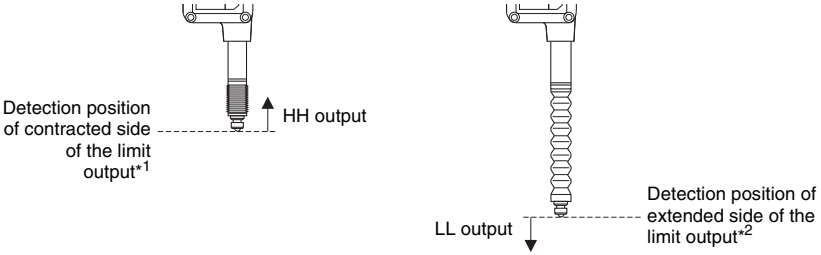
Reference

- Make settings such that the HH setting value is higher than the HIGH setting value. If the HH setting value is set below the HIGH setting value, the HIGH criterion will not be output.
- Make settings such that the LL setting value is lower than the LOW setting value. If the LL setting value is set above the LOW setting value, the LOW criterion will not be output.
- If the HH setting value is lower than the LL setting value, each output will be as follows.
  - GO, HIGH and LOW criterion will not be output regardless of the detection value.
  - If values above the HH setting value or below the LL setting value are detected, HH criterion output and LL criterion output are both output.
- When setting criterion values, make sure that the HH setting value is the largest, the LL setting value is the smallest and that the HIGH setting value is greater than the LOW setting value.
- Set the HH setting value on the "5-output HH setting value screen" of the main screen.
  "(4) 5 output HH setting value display" (page 3-8)
- Set the LL setting value on the "5-output LL setting value screen" of the main screen.
  "(7) 5 output LL setting value display" (page 3-11)

■ When "Lt (limit output)" is selected

When "Lt" is selected from "16. Special output settings", HH is output on the spindle contraction side and LL is output on the spindle extension side.

The factory default mechanical positions are detected for both the HH and LL output positions, and so they are output with no effect from settings such as measurement adjustment direction or multiplier.



*1 Position when contracted the amount of the detection range from the origin position set when shipped from the factory

*2 Origin position set when shipped from the factory

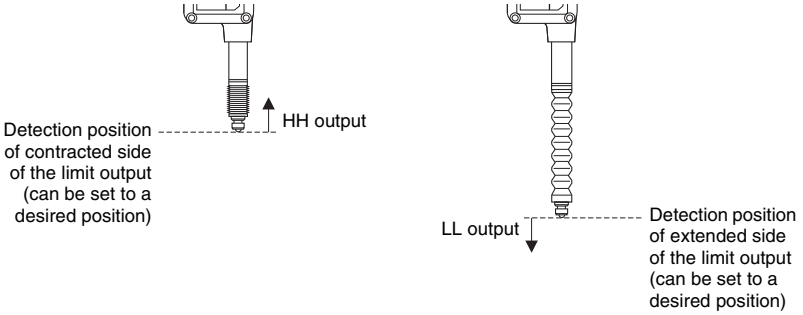
Reference

- When "Lt" is selected, limit output detection position for the HH or LL sides cannot be changed. Select "LtUSEr" to set a specific detection position.
- Contraction side HH and extension side LL will normally be output even if the measurement adjustment direction is changed.

■ When "Lt.USEr (limit output user settings)" is selected

When "Lt.USEr" is selected from "16. Special output settings", limit output extension (HH) side detection position and contraction (LL) side detection position can be set to specific positions.

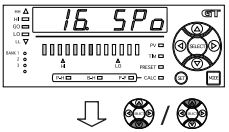
The detection positions for the contraction (HH) side and the extension (LL) side are output without any effects from settings such as measurement change position or multiplier.



Setting procedure

1 **Enter basic setting mode, select "16. Special Output Settings", and then select "Lt.USEr (limit output user setting)".**

"Entering Basic Setting Mode" (page 5-16)



Use the ▲/▼ buttons to display "16. SPo (16.Special output settings)", then use the ◀/▶ buttons to select "Lt.USEr (limit output user settings)".

Use the ▲/▼ buttons or the MODE button to confirm the setting.

2 **Select "SEt.HH".**

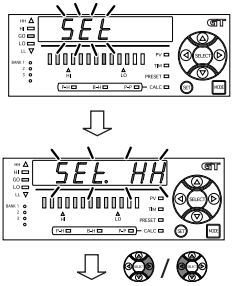
"Limit Output HH Side Teaching" (page 5-31)

"SEt.HH" will not be displayed if any selection other than "Lt.USEr" under "16. Special output settings" is selected.

3 **Move the spindle to the position you wish to set as the HH side limit output detection reference position, then press the "SET" button.**

This calibrates the HH side limit output detection reference position.

"SEt" will blink and the HH side limit output will be set when "SET" is pressed at the reference position.



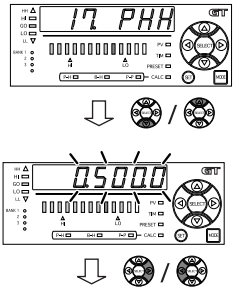
The screen will return to "SEt.HH" after the setting is made.

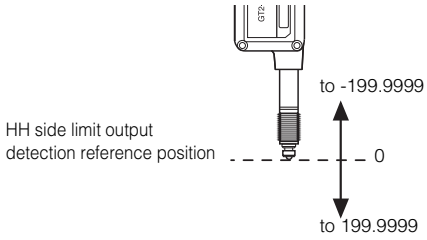
4 **Select "17. Limit output HH side criterion position settings" to specify the HH side ON position.**

"17. Limit Output HH Side Criterion Position Setting" (page 5-32)

Setting range: -199.9999 to 199.9999 (mm)

Default setting: 0.5000

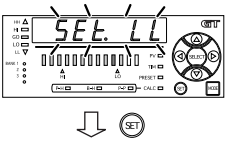




Use the / buttons or the MODE button to confirm the setting.

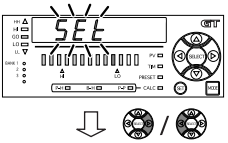
5 **Select "SEt.LL".**

"Limit Output LL Side Teaching" (page 5-33)



5 Setting Various Functions

6 **Move the spindle to the position you wish to set as the LL side limit output detection reference position, then press the "SET" button.**

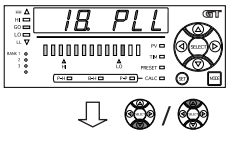


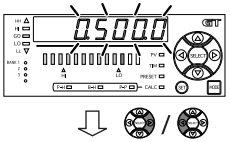
This calibrates the LL side limit output detection reference position.

"SEt" will blink and the LL side limit output will be set when "SET" is pressed at the reference position.

The screen will return to "SEt.LL" after the setting is made.

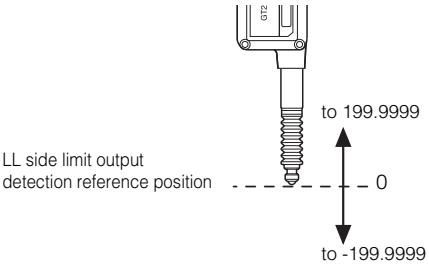
7 **Select "18. Limit output LL side criterion position settings" to specify the LL side ON position.**





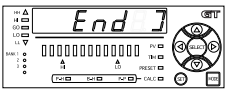
"18. Limit Output LL Side Criterion Position Setting" (page 5-34)

Setting range: -199.9999 to 199.9999 (mm)
Default setting: 0.5000



Use the ▲/▼ buttons or the MODE button to confirm the setting.

8 **Close the settings.**



Press ▼ or press and hold MODE for at least 2 sec

Return to the main screen

Press the [Right] arrow button or the [MODE] button for at least two seconds to cancel the setting.

■ When "ALL.Go (all go)" is selected

The HH output is output only if "ALL.Go" is selected under "16. Special output settings" and the main unit and all connected expansion units are judged as the GO criterion. In other cases, the LL output of the main unit is output.

Reference

- This is only available for main units that are connected to one or more expansion units.
- If the number of expansion units is changed after configuring the settings, reconfigure the settings.

Condition for the main unit HH output to turn ON: When all connected expansion units and the main unit* output the GO criterion

Condition for the main unit LL output to turn ON: When the main unit HH output is OFF

* Main unit output is not included when "CAL.noH" is selected in "A1. Calculation mode".

■ When "ALL.Lt (all limit output)" is selected

When "16. Special output setting" is set to "ALL.Lt", if the HH side limit outputs for all connected expansion units are set to ON, the main unit HH output will be ON and if the LL side limit outputs for all connected expansion units are set to ON, the main unit LL output will be ON.

Reference

- This can only be set on the main unit when "CAL.noH" is set under "A1. Calculation mode" and there are 2 or more expansion units connected.
- The main unit judges output for HH and LL output for expansion units with "16. Special output settings" set to "Lt" or "Lt.USEr".

Condition for the main unit HH output to turn ON: When all connected expansion units with "16. Special output settings" is set to "Lt" or "Lt.USEr" have their limit output set to HH criterion

Condition for the main unit LL output to turn ON: When all connected expansion units with "16. Special output settings" is set to "Lt" or "Lt.USEr" have their limit output set to LL criterion

Reference

The main unit judges output for HH and LL output for When "16. Special output settings" is set to "noUSE" or "5out" on all expansion units, HH and LL output are not output on the main unit.

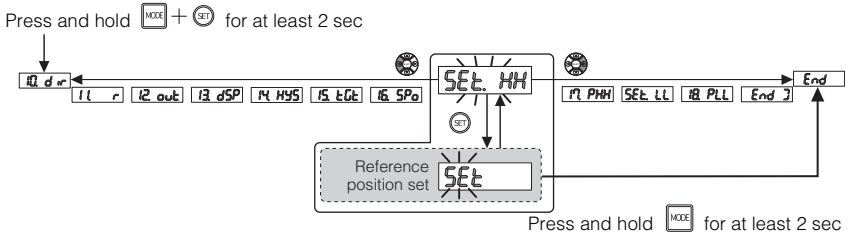
Limit Output HH Side Teaching

SEt. HH

This section describes how to set the limit output HH side detection position to the desired position.

For information about the setting procedure, refer to "When "Lt.USEr (limit output user settings)" is selected" (page 5-27).

Reference Limit output HH side teaching is only available when "Lt.USEr (limit output user settings)" under "16. Special output settings" is selected.



"Entering Basic Setting Mode" (page 5-16)

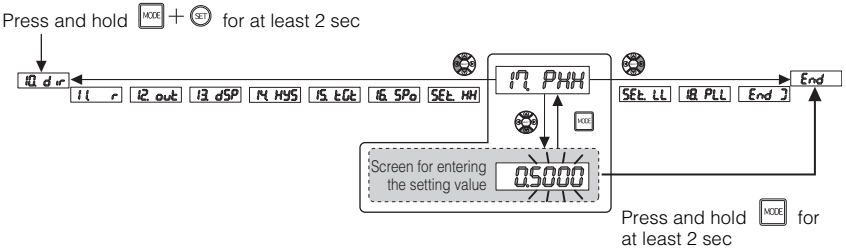
17. Limit Output HH Side Criterion Position Setting

This sets the limit output HH side criterion position to a specified position.

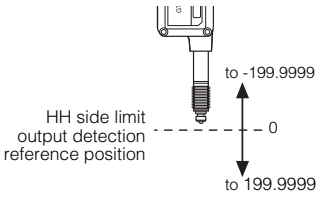
For information about the setting procedure, refer to "When "Lt.USEr (limit output user settings)" is selected" (page 5-27).

Reference

Limit output HH side criterion position setting is available only when "Lt.USEr (limit output user settings)" is selected in "16. Special output settings".



"Entering Basic Setting Mode" (page 5-16)

Item	Setting range	Default Setting
Limit output HH side criterion position settings	-199.9999 to 199.9999 	0.5000

Reference

- Make sure the settings reflect multipliers and calibration.
  "11. Multiplier" (page 5-18)
  "30. Calibration Function Setting" (page 5-49)
- There is no effect from the settings in "10. Measurement Direction".
  "10. Measurement Direction" (page 5-17)

Limit Output LL Side Teaching

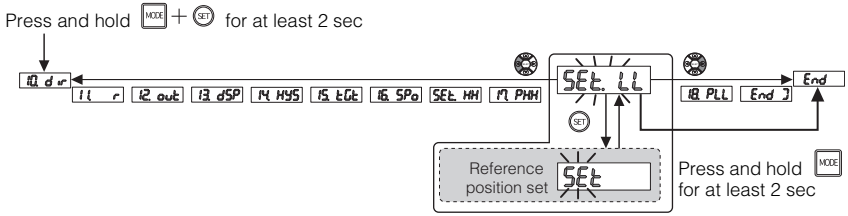
SEt. LL

This section describes how to set the limit output LL side detection position to the desired position.

For information about the setting procedure, refer to "When "Lt.USEr (limit output user settings)" is selected" (page 5-27).

Reference

Limit output LL side teaching is only available when "Lt.USEr (limit output user settings)" under "16. Special output settings" is selected.



"Entering Basic Setting Mode" (page 5-16)

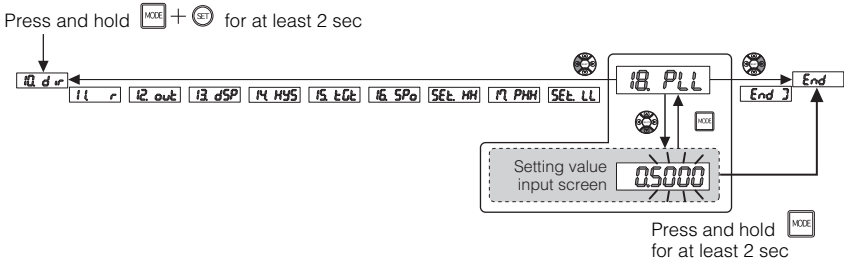
18. Limit Output LL Side Criterion Position Setting

This sets the limit output LL side criterion position to a specified position.

For information about the setting procedure, refer to "When "Lt.USEr (limit output user settings)" is selected" (page 5-27).

Reference

Limit output LL side criterion position setting is available only when "Lt.USEr (limit output user settings)" is selected in "16. Special output settings".



"Entering Basic Setting Mode" (page 5-16)

Item	Setting range	Default Setting
Limit output LL side criterion position settings	-199.9999 to 199.9999 to 199.9999 LL side limit output detection reference position 0 to -199.9999	0.5000

Reference

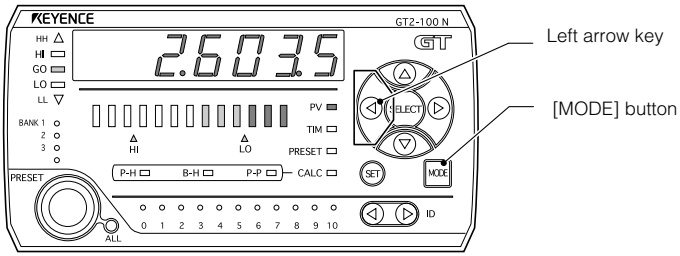
- Make sure the settings reflect multipliers and calibration.
  "11. Multiplier" (page 5-18)
  "30. Calibration Function Setting" (page 5-49)
- There is no effect from the settings in "10. Measurement Direction".
  "10. Measurement Direction" (page 5-17)

5-4 Additional Function Setting Mode

Entering Additional Function Setting Mode

The following method can be used to enter additional function setting mode.

- **On the main screen, press and hold the [MODE] button and the left arrow key at the same time for at least two seconds.**

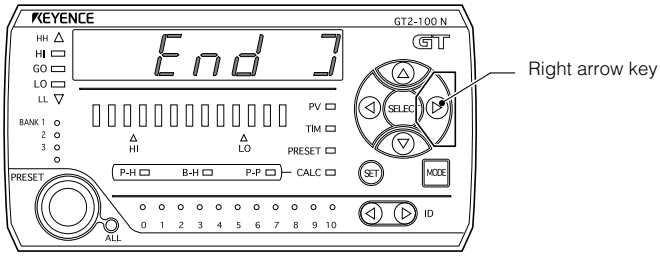


main screen (P.V. value display screen)

Exiting Additional Function Setting Mode

Use one of the following methods to exit additional function setting mode and display the main screen.

- **After the settings are complete, press and hold the [MODE] button for at least two seconds.**
- **After the settings are complete, press the right arrow key several times until the setting completion display appears, and press the right arrow key once more.**



Setting completion display

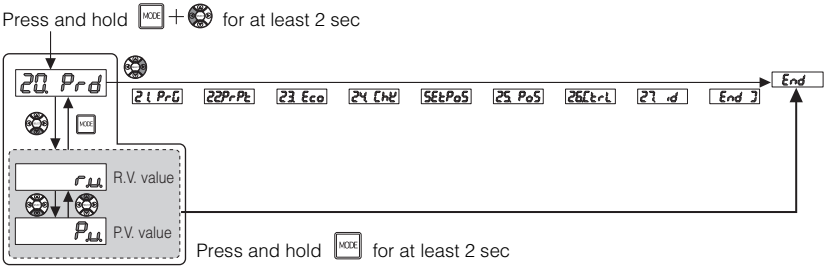
20. Select Preset Data

Selects the data to be used when making presets (origin alignment).

"3-3 Origin Alignment" (page 3-14)

Reference

- This is not available on main units with "CAL.noH" selected under "A1. Calculation Mode".
- This is preset by the R.V. value at the time of external preset input for main units with "CALc" selected under "A1. Calculation Mode". (The CALC value is not preset)
- This is preset by the R.V. value at the time of external preset input for main units with "C5.rEF" selected under "A2. Calculation Method" that have expansion units where "P.V." is selected. (The CALC value is not preset)
- When "01. Detection Mode" is set to "P-P", the R.V. value will be preset even if "P.V." is selected.



"Entering Additional Function Setting Mode" (page 5-35)

Item	Description	Default Setting
R.V. value	Records the R.V. value when making presets (origin alignment).	O
P.V. value	Records the P.V. value when making presets (origin alignment).	

21. Store Preset Value

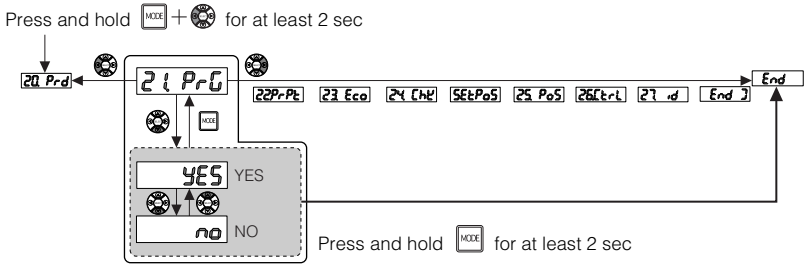
The origin information is stored into memory. The information is saved even after the power is turned off.

When the sensor amplifier turns on, it loads the latest saved origin information.

"3-3 Origin Alignment" (page 3-14)

Reference

- Information can be saved in the storage area even when the power is turned off about one million times.
  Set "NO" in situations such as when the origin is frequently aligned with an external signal.
- This is not available on main units with "CAL.noH" selected under "A1. Calculation Mode".



"Entering Additional Function Setting Mode" (page 5-35)

Item	Description	Default Setting
YES (save) YES	The origin information is saved in memory region that is not cleared when the power is turned off when the origin alignment is set. Set this parameter when the origin for the detected workpieces does not change frequently.	O
NO (do not save) no	The origin information is saved temporary in memory but is cleared when the power is turned off. The origin information is cleared when the power is turned off, so origin alignment must be performed every time that the power is turned on.	

22. Preset Point

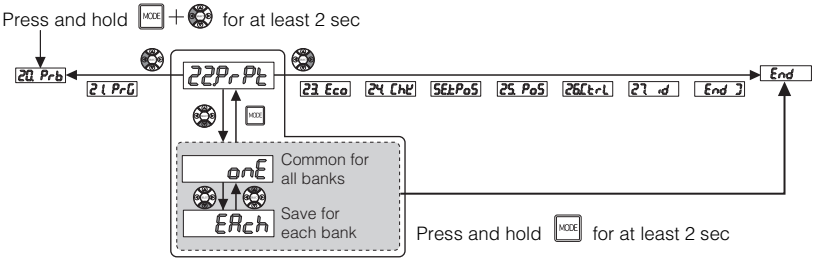
22.Pr.Pt

Selects the data to be used when making presets (origin alignment) with per-bank memory.

When "onE" is selected, the last preset point (origin alignment) written at power on is used for all banks.

"3-3 Origin Alignment" (page 3-14)

Reference This is not available on main units with "CAL.noH" selected under "A1. Calculation Mode".



"Entering Additional Function Setting Mode" (page 5-35)

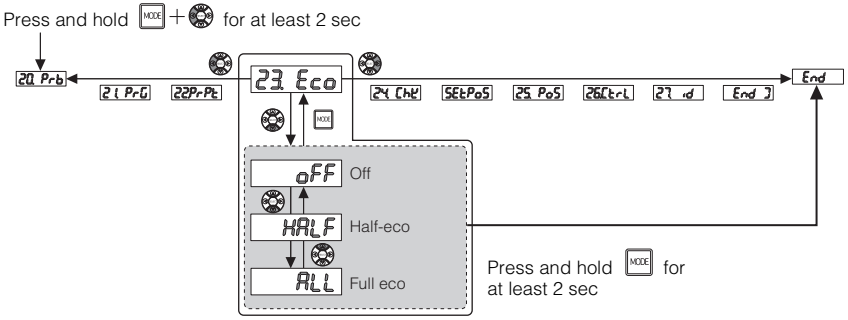
Item	Description	Default Setting
onE onE	Use the information for the last preset point (origin alignment) written to memory for all banks.	O
EAch EAch	Store the preset point (origin alignment) information separately for each bank.	

23. Power Save Function

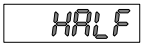
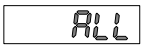
Set this parameter when you want to reduce the consumption power or when you do not want to display the specific values.

When operating in the power save state, pressing any button will return to the normal display. If buttons are not pressed in the normal display for one minute, the GT2-100 Series returns to power save mode.

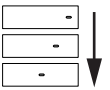
Reference When operating in power save mode, only "Origin alignment" is active. To perform other operations, press any button to return to the normal display before operating.



"Entering Additional Function Setting Mode" (page 5-35)

Item	Description	Default Setting
Off 	Power save is turned off. Sensor amplifier: Normal display Operation indicator: Normal display	O
Half-eco 	Only the sensor amplifier enters power save mode. Sensor amplifier: Animation display* Operation indicator: Normal display	
Full eco 	The sensor amplifier and sensor head both enter power save mode. Sensor amplifier: All indicators off (nothing is displayed) Operation indicator: Indicators off	

* Only one segment blinks at a time on the digital display, moving in order on the display from right to left. If an error occurs, the error is not displayed.



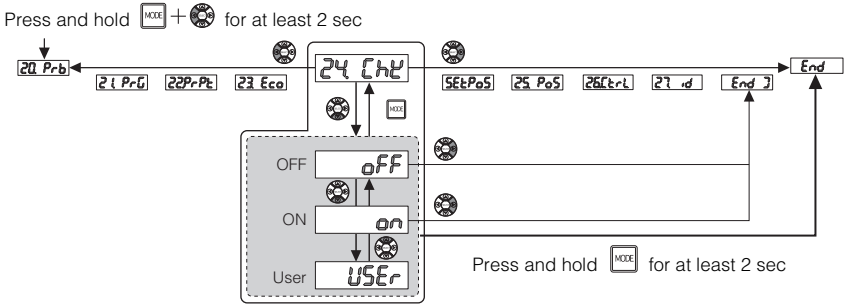
"Status Table" (page 6-11)

24. Jam Detection Function

If a contact sensor is used for a long period of time, the spindle may lose its ability to fully extend which reduces its ability to perform detection correctly. The jam detection function checks for this malfunction and outputs error.

Reference

- This is not available on main units with "CAL.noH" selected under "A1. Calculation Mode".
- Jam detection function can only be set if "t-in" (External timing) is selected in "04. Timing type".



"Entering Additional Function Setting Mode" (page 5-35)

Item	Description	Default Setting
OFF oFF	The jam detection function is not used.	O
ON on	Checks* whether the spindle moves to the "-FFFF (fully extended)" or "FFFF (fully compressed)" position when the external input is on (while not performing detection).	
User USEr	Sets a custom position for the jam detection checkpoint.	

* When a problem is detected, the core alarm error display appears and an error is output.

Er. CHY

Core alarm error display

Jam detection

■ When enabled

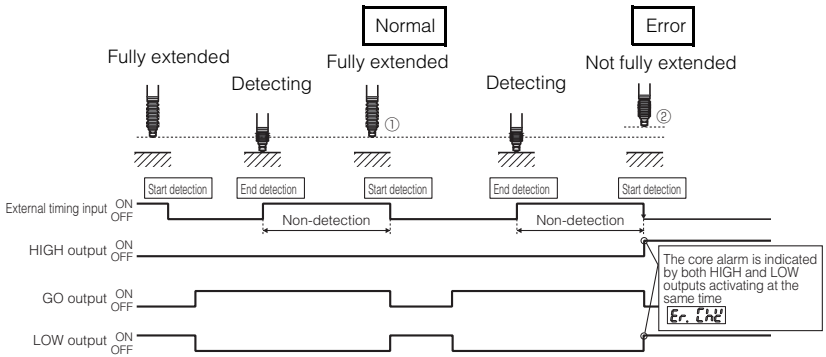
When "on" is selected in "24. Jam detection function", the points where the spindle is fully extended or fully compressed are used as checkpoints for the core alarm. These checkpoints are used to determine whether the spindle is operating correctly.

The jam detection function checks whether the spindle returns to its original position (if it is fully extended or fully compressed) during the non-detection state*1 that occurs after detection ends and before the next detection begins. An error outputs if the spindle fails to return to its original position.

The non-detection state is determined by the external timing input. The non-detection state occurs when the external timing input is on. While the external timing input is on, if the spindle reaches a fully extended (or fully compressed) state even once*2, this is recognized as normal operation. If the fully extended (or fully compressed) state is not reached*2, an error is output.

*1 The non-detection state is when the external timing input is on.

*2 The fully compressed state is the position where the HH limit output of the spindle turns on, and the fully extended state is the position where the LL limit output of the spindle turns on.
If "USEr" is selected, the jam detection checkpoint can be set at a desired position.



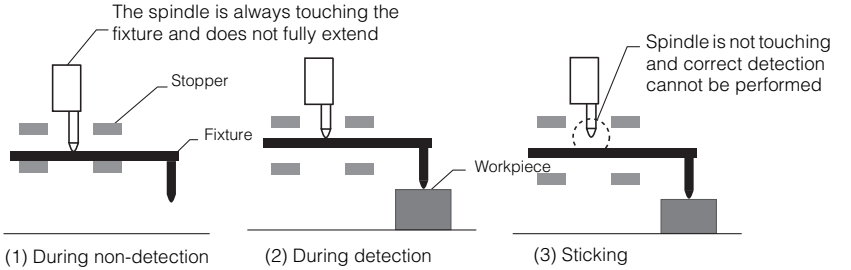
In the diagram above, detection is started while the spindle is extended (external timing input is off) and detection ends when the detection point is reached (external timing input ON: output hold).

Figure (1) is in the non detection state (external timing input ON) and has the spindle extended without generating an error. Figure (2) has the spindle setting off a core alarm and thus not being extended so that entering the detection state (external timing input OFF) generates an error (Core alarm error "Er. CHE", HIGH and LOW criterion output both ON).

■ **When "USEr" is selected**

When "USEr" is selected for "24. Jam detection function", the jam detection checkpoint (reference point for core alarm) can be set to any position.

Set the position when using with a fixture or when the spindle does not fully extend (or fully compress) during the non-detection state.

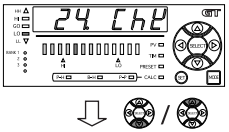


(1) During non-detection, the sensor head is always touching the fixture, so the spindle is not fully extended (does not reach the position where the LL limit output turns on).
(2) During detection, the fixture is used to detect the workpiece.
(3) If the spindle sticks, detection cannot be performed correctly.

Setting procedure

1 **Enter additional function setting mode, select "24. Jam detection function" and select "USEr (User)".**

"Entering Additional Function Setting Mode" (page 5-35)



After displaying the "24. CHU (24. Jam detection function)" by using the / button, select "USEr (User)" using the / button.

The setting is fixed by pressing the / button (or the MODE button).

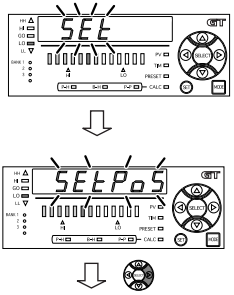
2 **Select "SEt PoS".**

"Jam Detection Teaching" (page 5-44)

If "24. Jam detection function" is set to "on" or "oFF", "SEt PoS" is not displayed.

3 **Move to the position that you want to set as the reference point for the spindle checkpoint and press the [SET] button.**

Teaching is performed to recognize the reference position for the core alarm.



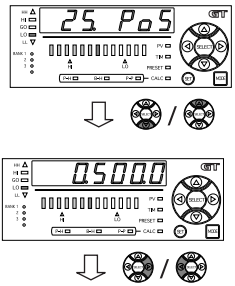
Pressing the [SET] button at the reference position causes "SEt" to blink. The position is fixed as the reference position for the checkpoint.

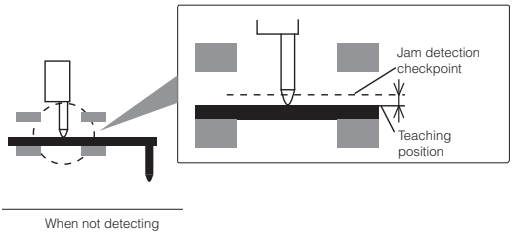
After fixing the position, the display returns to "SEt PoS".

4 **Select "25. Jam detection checkpoint setting" and set the jam detection checkpoint (position).**

"25. Jam Detection Checkpoint Setting" (page 5-45)

Setting range:-199.9999 to 199.9999 (mm)
Initial value:0.5000 (mm)

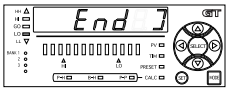




The setting is fixed by pressing the ◁/▷ button (or the MODE button).

5 **End the setting.**

Press the ◁/▷ button or press and hold the MODE button for at least two seconds to end the setting.



Press ◁/▷ or press and hold MODE for at least 2 sec

Return to the main screen

5 Setting Various Functions

Jam Detection Teaching

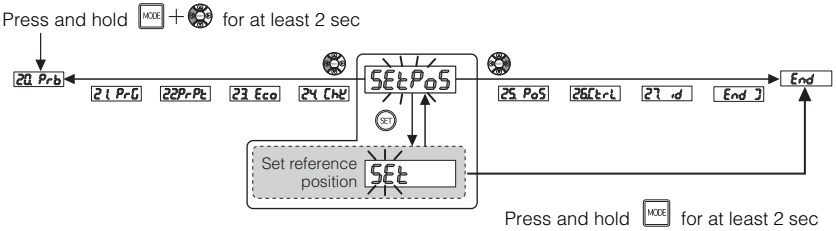
SEtPoS

Sets the reference point when setting a custom position for the jam detection checkpoint.

For information about the setting procedure, refer to "When "USEr" is selected" (page 5-42).

Reference

Jam detection teaching can only be set if "24. Jam detection function" is set to "USEr (User)".



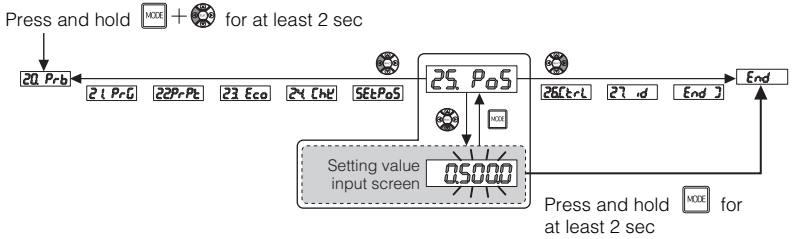
"Entering Additional Function Setting Mode" (page 5-35)

25. Jam Detection Checkpoint Setting

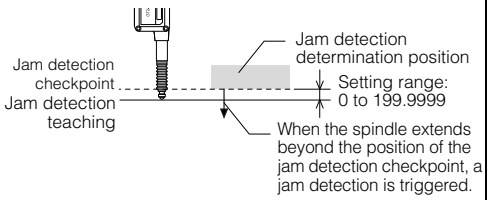
Sets a custom position for the jam detection checkpoint.

For information about the setting procedure, refer to "When "USEr" is selected" (page 5-42).

Reference Jam detection teaching can only be set if "24. Jam detection function" is set to "USEr (User)".



"Entering Additional Function Setting Mode" (page 5-35)

Item	Setting range	Default Setting
Jam detection checkpoint setting	-199.9999 to 199.9999 0 to 199.9999: 	0.5000

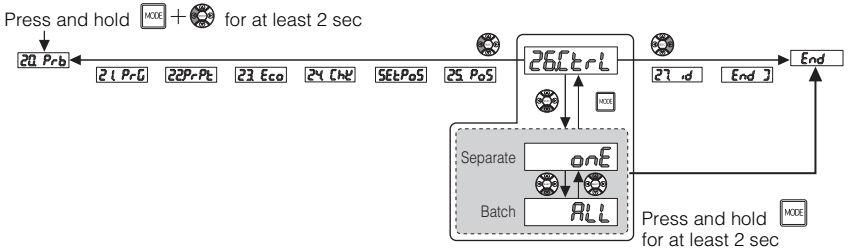
Reference

- Set this parameter according to the value applied in Multiplier or Calibration.
  "11. Multiplier" (page 5-18)
  "30. Calibration Function Setting" (page 5-49)
- There is no effect from the settings in "10. Measurement Direction".
  "10. Measurement Direction" (page 5-17)
- To perform jam detection during compression, set the range to "-199.9999 to 0".

26. Batch Setting

Configure this setting to perform zero-point correction (preset) and bank switching on all heads at the same time.

Reference This can be set only on the main unit (ID: 00).



"Entering Additional Function Setting Mode" (page 5-35)

Item	Description	Default Setting
onE	Select to perform zero-point correction and bank switching on each individual head.	O
ALL	The zero-point correction and the bank switching by the key operations on the main unit (ID: 00) are performed on all heads at the same time.	

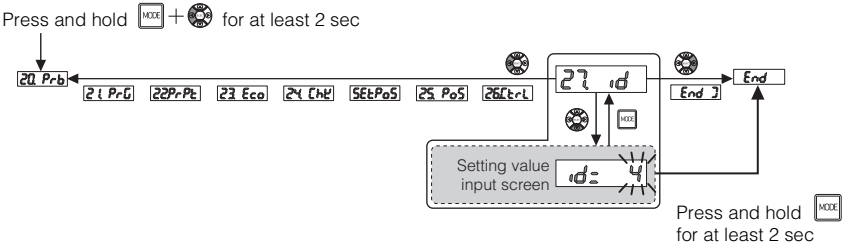
Reference This is not applied to preset and bank switching by external input. When you want to apply the data input to the main unit (ID: 00) to all heads, configure the settings in "15. Batch input setting".
"15. Batch Input Settings" (page 5-23)

27. Valid ID Setting

This setting sets the number of sensor heads (expansion units) that can be connected to an amplifier. The number of connectable sensor heads differs depending on the number of expansion boards.

Reference

- This can be set only on the main unit (ID: 00).
- The valid ID setting is not initialized.



"Entering Additional Function Setting Mode" (page 5-35)

Item	Number of head expansion boards	Setting range	Initial value*
Maximum number of valid ID	0	0 to 1	1
	1	0 to 4	4
	2	0 to 7	7
	3	0 to 10	10

* Default settings change depending on the number of connected head expansion boards when the power is turned on for the first time.

Reference

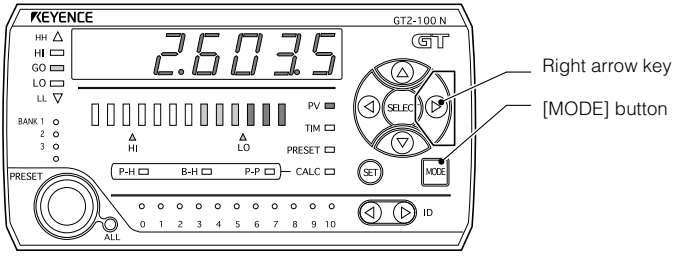
When the valid ID setting exceeds the setting range due to a change in the number of connected head expansion boards, the valid ID setting is set to the maximum value according to the number of the connected head expansion boards.

5-5 Calibration Setting Mode

Entering Calibration Setting Mode

The following method can be used to enter calibration setting mode.

- **On the main screen, press and hold the [MODE] button and the right arrow key at the same time for at least two seconds.**



<Main screen (P.V. value display screen)>

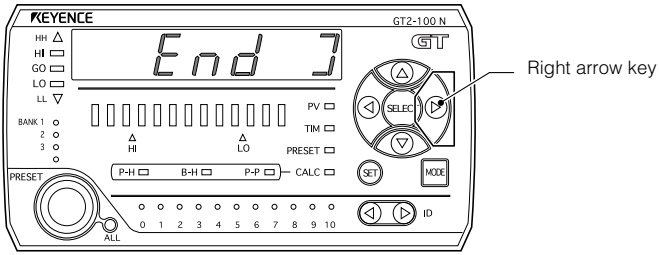
Reference

On the main unit, the error display shown to the right appears and calibration setting mode cannot be entered when "CAL.noH" is selected in "A1. Calculation Mode".

Exiting Calibration Setting Mode

Use one of the following methods to exit calibration setting mode and display the main screen.

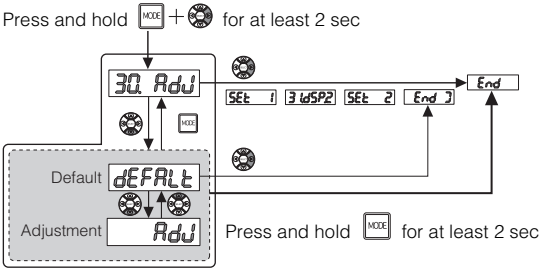
- **After the settings are complete, press and hold the [MODE] button for at least two seconds.**
- **After the settings are complete, press the right arrow key several times until the setting completion display appears, and press the right arrow key once more.**



<Setting completion display>

30. Calibration Function Setting

After replacing a sensor head, this parameter can be used to perform origin alignment or span adjustment, which reduces the effects of misalignment that occur during installation and produces detection values that are closer to the values achieved before replacement.



"Entering Calibration Setting Mode" (page 5-48)

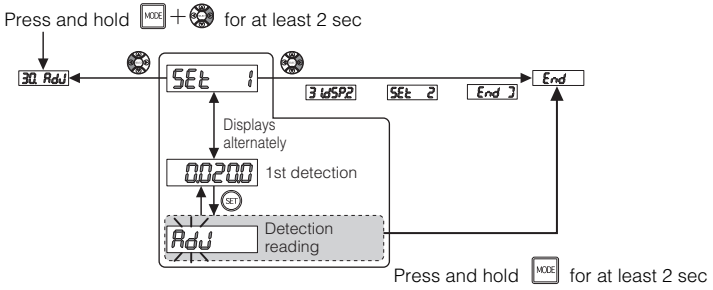
Item	Description	Default Setting
Default dEFALt	Reset the span adjustment value to the default state. "31. 2nd Target Setting" (page 5-51)	O
Adjustment Adj	Performs origin alignment and span adjustment.	

1st Detection

SEt 1

Sets the origin, which is used as the reference for the calibration settings.

Reference The parameter can be set only when "30. Calibration function setting" is set to "AdJ (Adjustment)".

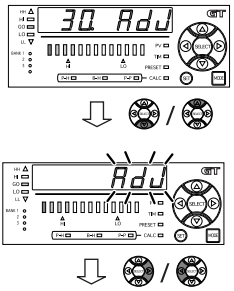


"Entering Calibration Setting Mode" (page 5-48)

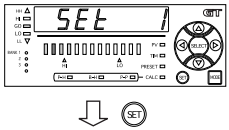
Setting procedure

1 **Enter the calibration setting mode and select "30. Calibration function setting" and then "AdJ (Adjustment)".**

"30. Calibration Function Setting" (page 5-49)



2 **Select "SEt 1".**



3 **Move to the spindle origin position and press the [SET] button.**

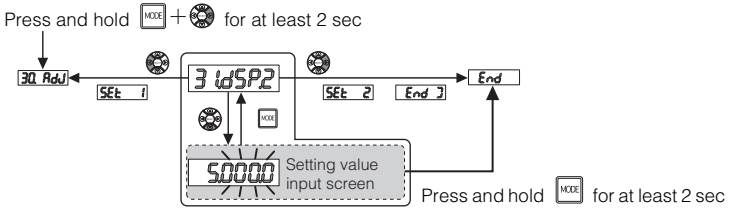
"AdJ" blinks and the origin position (preset value).

"Preset Function (Displaying the Value by Adding or Subtracting a Desired Value)" (page 3-30)

31. 2nd Target Setting

Sets the target value for span adjustment.

Reference The parameter can be set only when "30. Calibration function setting" is set to "AdJ (Adjustment)".



"Entering Calibration Setting Mode" (page 5-48)

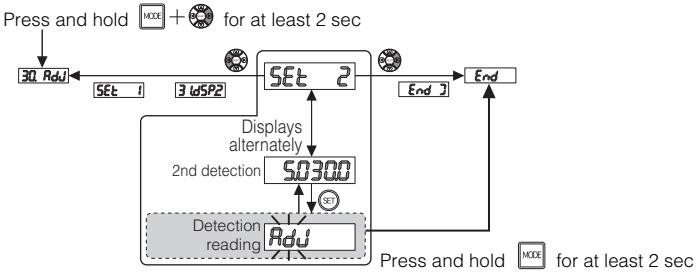
Item	Setting range	Initial value
2nd target setting	-199.9999 to 199.9999 (unit: mm)	5.0000

2nd Detection

SEt 2

Reads the detection value for span adjustment and corrects for the amount of difference between the 2nd target value.

Reference The parameter can be set only when "30. Calibration function setting" is set to "AdJ (Adjustment)".



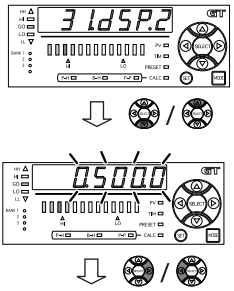
"Entering Calibration Setting Mode" (page 5-48)

Setting procedure

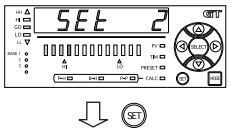
1 **Enter calibration mode and define the 1st detection position.**

"30. Calibration Function Setting" (page 5-49)
"1st Detection" (page 5-50)

2 **Select "31. 2nd target setting" and enter the target value.**

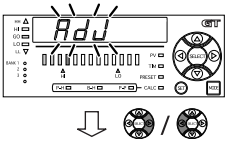


3 **Select "SEt 2".**



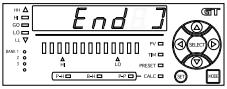
4 **Move to the detection position that is to be set as the 2nd spindle position and press the [SET] button.**

"AdJ" blinks and the difference between the target value and the detected value is corrected.



5 **End the calibration setting.**

Press the ◎ button or press and hold the MODE button for at least two seconds to end the setting.



Press ◎ or press and hold MODE for at least 2 sec

Return to the main screen

Reference

- A calibration error occurs under the following situations and the error screen is displayed. And calibration cannot be performed.
  - When the 1st position is not determined
  - When the values between the target and detection values does not match
  - When the results of the span adjustment is more than twice the factory default value (Increase the Multiplier before performing calibration.)

Calibration error screen

- When performing calibration, reset the following parameters:
  - HIGH setting value (📖 "(5) HIGH setting value display" (page 3-9))
  - LOW setting value (📖 "(6) LOW setting value display" (page 3-10))
  - Self-timing level (📖 "05. Self-timing Level" (page 5-11))

To reset the span adjustment to the factory default state, select "Default" in "30. Calibration function setting".

📖 "30. Calibration Function Setting" (page 5-49)

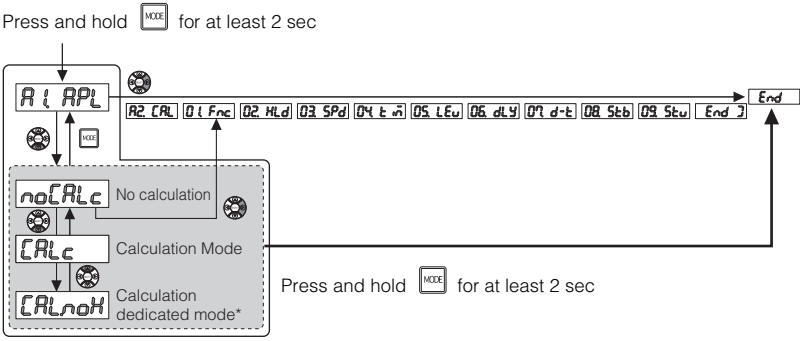
5-6 Calculation Setting Mode

The calculation setting mode is one of the function setting modes and it is available only when an expansion unit is added.

Calculation Setting Mode

This is one of the function setting modes for the main unit when an expansion unit is added. It sets the calculation setting mode.

"5-2 Function Setting Mode" (page 5-5)



* This is only available for main units that are connected to two or more expansion heads.

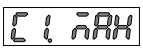
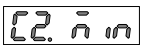
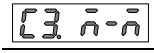
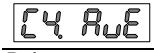
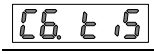
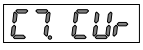
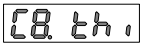
"Entering Function Setting Mode" (page 5-5)

Item	Description	Default Setting
No calculation noCALc	No calculations are performed. The main unit and all expansion units operate independently.	O
Calculation Mode CALc	The detection values of the main unit and the expansion units are calculated via the application and the main unit outputs the criterion result. "Applications" (page 5-55)	
Calculation dedicated mode CALnoH	• Calculates expansion unit detection values and outputs the criterion result without connecting the main unit to the sensor head.* • Connected expansion units output the individual criterion results based on settings and detection values, regardless of the application being used.	

* When using the calculation dedicated mode, connecting a sensor head to the main unit will cause "Er.noH" to be displayed and the main unit will produce error output (HIGH criterion output and LOW criterion output are ON simultaneously).

Applications

The following applications can be used in the calculation mode and calculation dedicated mode:

Application	Description	Default Setting	Max. units		Reference page
			Calculation mode	Calculation dedicated mode	
Max. value 	The maximum detected value from the expansion units is taken as a criterion value.	O	1 unit or more	2 units or more	5-63
Min. value 	The minimum detected value from the expansion units is taken as a criterion value.		1 unit or more	2 units or more	5-64
Degree of flatness 	Extracts maximum and minimum detected values from the expansion units, and the difference between them is taken as a criterion value.		1 unit or more	2 units or more	5-65
Average 	The total of the values from the expansion units is divided by the number of units. The resulting average value is taken as a criterion value.		1 unit or more	2 units or more	5-66
Reference difference 	Subtracts the display value of the main unit from each expansion unit and uses the resulting value as the criterion value for the expansion unit.		1 unit or more	——— *	5-67
Twist 	The degree of twist calculated based on the detected values from four detection points is taken as the criterion value.		Only when three units are connected.	Only when four units are connected.	5-68
Warpage 	The degree of warpage calculated based on the detected values from three detection points is taken as the criterion value.		Only when two units are connected.	Only when three units are connected.	5-70
Thickness 	Places the detection target between the expansion units and uses the thickness as the criterion value.		Only when one unit is connected.	Only when two units are connected.	5-72

* During the calculation dedicated mode, "C5. rEF (Reference difference)" is not available.

Reference

- When the calculation function is set, if the number of expansion units is changed the next time the power is turned on, the error display as shown to the right appears.
  Reset the error by following the procedure below.
  - Turn off the power, and change the number of units back to the previous number of units, then turn on the power again.
  - Reset the calculation function on the main unit.

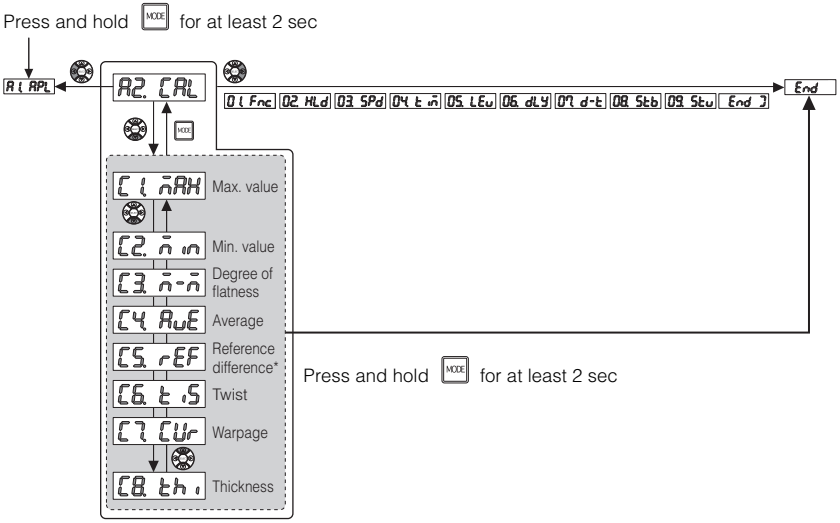
  An error also occurs when the valid ID setting is changed while the display is set to twist, warpage, or thickness. If this occurs, returning the valid ID setting back to the previous setting will clear the error.


Number of expansion units error

- The available calculation methods vary depending on the number of expansion units added.

Selecting an application

The procedure for selecting an application is as follows.



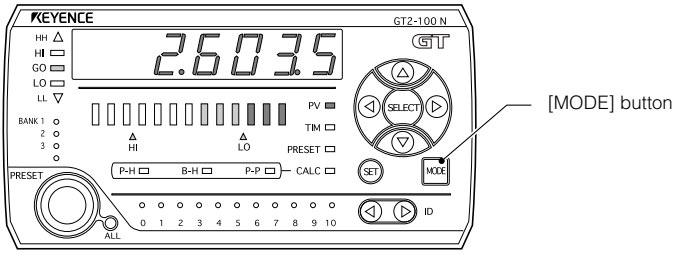
* Not displayed when "CAL.noH (calculation dedicated mode)" is selected in "A1. Calculation mode".

Entering calculation setting mode

The following can be used to enter calculation setting mode.

- **On the main screen, press and hold the [MODE] button for at least two seconds. Enter the function setting mode, then select "CALc" or "CAL. noH".**

"Entering Function Setting Mode" (page 5-5)



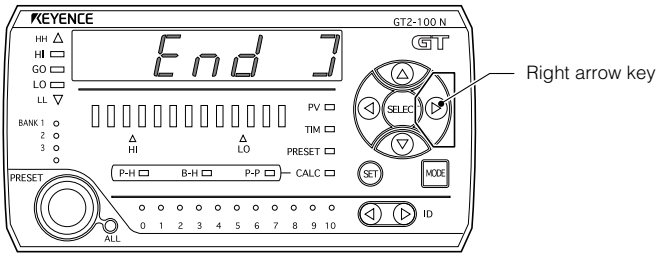
Main screen (P.V. value display screen)

Reference Calculation setting mode cannot be entered if there are not any expansion heads.

Exiting calculation setting mode

Use one of the following methods to exit calculation setting mode and display the main screen.

- **After the calculation mode settings are complete, press and hold the [MODE] button for at least two seconds.**
- **After the calculation mode settings are complete, press the right arrow key several times until the setting completion display appears, then press the right arrow key once more.**



Setting completion display

Precautions When Using Calculation Setting Mode

■ Response time when the calculation function is used

When the calculation function is used, the response time varies depending on the response time set in the main unit, the number of units that have been added, and the types of main/expansion units.

This section describes the response time when the calculation function is used.

"ALL.Go output" when "noCALc" is set in "A1.APL"

The actual ALL.Go output response time of the main unit is determined by either of the slower one: "the response time of the main unit" or "the value where the time in the following table is added to the slowest response time set in the expansion unit".

"When "ALL.Go (all go)" is selected" (page 5-30)

Number of connected units	Time to be added (ms)
2 units	55.5
3 units	56.5
4 units	61.5
5 units	62.5
6 units	67.5
7 units	68.5
8 units	73.5

Number of connected units	Time to be added (ms)
9 units	74.5
10 units	79.5
11 units	80.5

Reference

- If connecting RS-232C Communication Unit DL-RS1A or the BCD Output Unit DL-RB1A, add "7 ms" to the value in the table above.
- ALL.Go output is output only on the main unit.
- Refer to pages 5-8 and 5-9 for response time.

Criterion output when a setting other than "C5. rEF (Reference difference)" is set

The actual criterion output response time is determined by adding the following time to the response time that has been set in the main unit.

Number of connected units	Time to be added (ms)
2 units	55.5
3 units	56.5
4 units	61.5
5 units	62.5
6 units	67.5
7 units	68.5
8 units	73.5

Number of connected units	Time to be added (ms)
9 units	74.5
10 units	79.5
11 units	80.5

Reference

- When "RS-232C Communication Unit DL-RS1A" or "BCD Output Unit DL-RB1A" is connected, add "7 ms" to the above time.
- When a setting other than "C5. rEF" is set, the criterion output is output only on the main unit.

Criterion output when "C5. rEF (Reference difference)" is set

The actual criterion output response time is determined by adding the following time to the response time that has been set in the main unit.

"C5. Reference Difference" (page 5-67)

Number of connected units	Time to be added (ms)
2 units	55.5
3 units	56.5
4 units	61.5
5 units	62.5
6 units	67.5
7 units	68.5
8 units	73.5

Number of connected units	Time to be added (ms)
9 units	74.5
10 units	79.5
11 units	80.5

Reference

When "RS-232C Communication Unit DL-RS1A" or "BCD Output Unit DL-RB1A" is connected, add "7 ms" to the above time only for the expansion unit.

"ALL.Go output" when "C5. rEF (Reference difference)" is set

The actual ALL.Go output response time is determined by adding the following time to the response time that has been set in the main unit.

"When "ALL.Go (all go)" is selected" (page 5-30)

Number of connected units	Time to be added (ms)
2 units	83.0
3 units	84.5
4 units	92.0
5 units	93.5
6 units	101.0
7 units	102.5
8 units	110.0

Number of connected units	Time to be added (ms)
9 units	111.5
10 units	119.0
11 units	120.5

Reference

- When "RS-232C Communication Unit DL-RS1A" or "BCD Output Unit DL-RB1A" is connected, add "7 ms" to the above time.
- ALL.Go output is output only on the main unit.

Criterion output when "CAL.noH (calculation dedicated mode)" is set

The actual criterion output response time is determined by adding the following time to the response time that has been set in the main unit.

"Calculation Setting Mode" (page 5-54)

Number of connected units	Time to be added (ms)	
	Main unit	Expansion unit
2 units		
3 units	56.5	0
4 units	61.5	0
5 units	62.5	0
6 units	67.5	0
7 units	68.5	0
8 units	73.5	0

Number of connected units	Time to be added (ms)	
	Main unit	Expansion unit
9 units	74.5	0
10 units	79.5	0
11 units	80.5	0

Reference

When "RS-232C Communication Unit DL-RS1A" or "BCD Output Unit DL-RB1A" is connected, add "7 ms" to the above time only for the main unit.

"ALL.Go output" when "CAL.noH (calculation dedicated mode)" is set

The actual ALL.Go output response time is determined by adding the following time to the response time that has been set in the main unit.

"Calculation Setting Mode" (page 5-54)

"When "ALL.Go (all go)" is selected" (page 5-30)

Number of connected units	Time to be added (ms)
2 units	
3 units	56.5
4 units	61.5
5 units	62.5
6 units	67.5
7 units	68.5
8 units	73.5

Number of connected units	Time to be added (ms)
9 units	74.5
10 units	79.5
11 units	80.5

Reference

- When "RS-232C Communication Unit DL-RS1A" or "BCD Output Unit DL-RB1A" is connected, add "7 ms" to the above time only for the main unit.
- ALL.Go output is output only on the main unit.

"ALL.Lt output" when "CAL.noH (calculation dedicated mode)" is set

The ALL.Lt output response time is determined by adding the following time to the response time that has been set in the main unit.

"Calculation Setting Mode" (page 5-54)

"When "ALL.Lt (all limit output)" is selected" (page 5-30)

Number of connected units	Time to be added (ms)
2 units	
3 units	56.5
4 units	61.5
5 units	62.5
6 units	67.5
7 units	68.5
8 units	73.5

Number of connected units	Time to be added (ms)
9 units	74.5
10 units	79.5
11 units	80.5

Reference

- When "RS-232C Communication Unit DL-RS1A" or "BCD Output Unit DL-RB1A" is connected, add "7 ms" to the above time only for the main unit.
- ALL.Lt output is output only on the main unit.

Precautions when using the calculation function or calculation only mode.

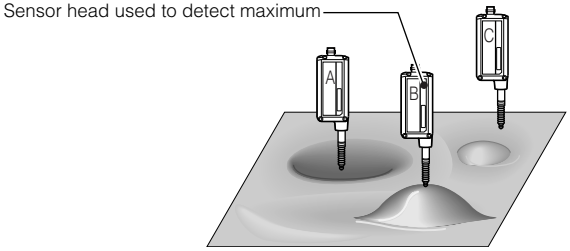
If the sensor head connected to the main unit is GT2-H/A*** and the sensor head connected to the expansion unit is GT2-P/PA***, the response time of the expansion unit becomes 4 times slower than that of the main unit.

Furthermore, if the sensor head connected to the main unit is GT2-P/PA*** and the sensor head connected to the expansion unit is GT2-H/A***, the response time of the expansion unit becomes 4 times faster than that of the main unit.

C1. Max. Value

C1. MAX

When "C1. Max. Value" is selected, the maximum value detected from the main unit and expansion units is used as the value.



The value detected by the sensor head B is taken as the criterion value.

■ Amplifier display

Main screens that can be displayed are as follows:

Calculation Setting Mode	Sensor amplifier	P.V. value display	Calculated value (CALC value) display	R.V. value display	HIGH/LOW setting display	HH/LL setting display	Preset value setting display
Calculation mode	Main unit	Yes*1	Yes*2	Yes*3	Yes	Yes	Yes
	Expansion unit	-	-	Yes*3	-	-	Yes
Calculation only mode	Main unit	Yes*4	Yes*5	-	Yes	Yes	-
	Expansion unit	Yes*6	-	Yes*3	Yes	Yes	Yes

*1 Displays the largest detection value (criterion value) from the main unit and expansion units according to the hold settings.

*2 Displays the largest detection value from the main unit and expansion units as an R.V. value (without holding the value when using hold).

*3 Displays the detected value for the sensor head connected to each amplifier as an R.V. value (without holding the value when using hold).

*4 Displays the largest detection value (criterion value) from the expansion units according to the hold settings.

*5 Displays the largest detection value from the expansion units as an R.V. value (without holding the value when using hold).

*6 Displays the detected value for the sensor head connected to each amplifier according to the hold settings.

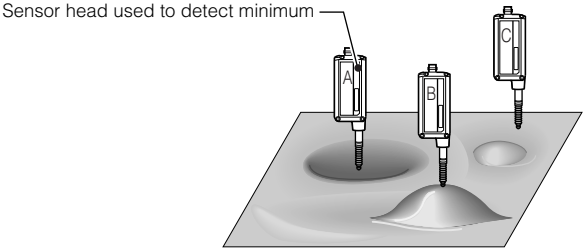
■ Output

Outputs are as follows:

Sensor amplifier		Output
Main unit		The maximum value detected with the main unit and expansion units is taken as the value and the result is output.
Expansion unit	Calculation Mode	Criterion output is not performed (always off).
	Calculation dedicated mode	Criterion output is performed individually based on the detection value from the connected sensor head.

C2. Min. Value

When "C2. Min. Value" is selected, the minimum value detected from the main unit and expansion units used as the value.



The value detected by the sensor head A is taken as the value.

■ Amplifier display

Main screens that can be displayed are as follows:

Calculation Setting Mode	Sensor amplifier	P.V. value display	Calculated value (CALC value) display	R.V. value display	HIGH/LOW setting display	HH/LL setting display	Preset value setting display
Calculation mode	Main unit	Yes*1	Yes*2	Yes*3	Yes	Yes	Yes
	Expansion unit	-	-	Yes*3	-	-	Yes
Calculation only mode	Main unit	Yes*4	Yes*5	-	Yes	Yes	-
	Expansion unit	Yes*6	-	Yes*3	Yes	Yes	Yes

*1 Displays the smallest detection value (criterion value) from the main unit and expansion units according to the hold settings.

*2 Displays the smallest detection value from the main unit and expansion units as an R.V. value (without holding the value when using hold).

*3 Displays the detected value for the sensor head connected to each amplifier as an R.V. value (without holding the value when using hold).

*4 Displays the smallest detection value (criterion value) from the expansion units according to the hold settings.

*5 Displays the smallest detection value from the expansion units as an R.V. value (without holding the value when using hold).

*6 Displays the detected value for the sensor head connected to each amplifier according to the hold settings.

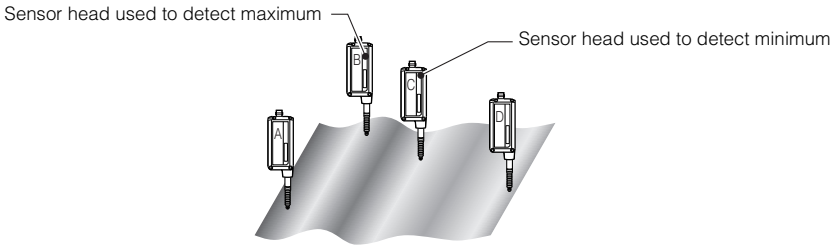
■ Output

Outputs are as follows:

Sensor amplifier		Output
Main unit		The minimum value detected from the main unit and expansion units is taken as a value, and the result is output.
Expansion unit	Calculation Mode	Criterion output is not performed (always off).
	Calculation dedicated mode	Criterion output is performed individually based on the detection value from the connected sensor head.

C3. Degree of flatness

When "C3. Degree of flatness" is selected, the maximum and minimum values detected with the main unit and expansion units are extracted and the difference between them (maximum value - minimum value) is used as a the value.



The criterion value is calculated as the detection value of sensor head B minus the detection value of sensor head C.

■ Amplifier display

Main screens that can be displayed are as follows:

Calculation Setting Mode	Sensor amplifier	P.V. value display	Calculated value (CALC value) display	R.V. value display	HIGH/LOW setting display	HH/LL setting display	Preset value setting display
Calculation mode	Main unit	Yes*1	Yes*2	Yes*3	Yes	Yes	Yes
	Expansion unit	-	-	Yes*3	-	-	Yes
Calculation only mode	Main unit	Yes*4	Yes*5	-	Yes	Yes	-
	Expansion unit	Yes*6	-	Yes*3	Yes	Yes	Yes

*1 Displays the result (criterion value) after calculating the maximum value minus the minimum value from the main unit and expansion units according to the hold settings.
*2 Displays the difference between the maximum value and minimum value from the main unit and expansion units as an R.V. value (without holding the value when using hold).
*3 Displays the detected value for the sensor head connected to each amplifier as an R.V. value (without holding the value when using hold).
*4 Displays the result (criterion value) after calculating the maximum value minus the minimum value from the expansion units according to the hold settings.
*5 Displays the result after calculating the maximum value minus the minimum value from the expansion units as an R.V. value (without holding the value when using hold).
*6 Displays the detected value for the sensor head connected to each amplifier according to the hold settings.

■ Output

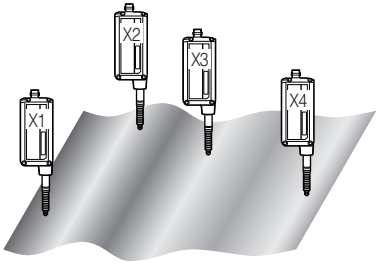
Outputs are as follows:

Sensor amplifier		Output
Main unit		The calculation result of the maximum value minus the minimum value detected with the main unit and expansion units is taken as the value and the result is output.
Expansion unit	Calculation Mode	Criterion output is not performed (always off).
	Calculation dedicated mode	Criterion output is performed individually based on the detection value from the connected sensor head.

C4. Average

C4. AvE

When "C4. Average" is selected, the average detected value from the main unit and expansion units is used as the value.



The formula for obtaining an average value is shown below.
(X1 + X2 + X3 + ... Xn) / n
n: The total number of sensor amplifiers that are connected.

■ Amplifier display

Main screens that can be displayed are as follows:

Calculation Setting Mode	Sensor amplifier	P.V. value display	Calculated value (CALC value) display	R.V. value display	HIGH/LOW setting display	HH/LL setting display	Preset value setting display
Calculation mode	Main unit	Yes*1	Yes*2	Yes*3	Yes	Yes	Yes
	Expansion unit	-	-	Yes*3	-	-	Yes
Calculation only mode	Main unit	Yes*4	Yes*5	-	Yes	Yes	-
	Expansion unit	Yes*6	-	Yes*3	Yes	Yes	Yes

*1 Performs calculations to average the detection values from the main unit and expansion units, and then displays the calculation result (criterion value) according to the hold settings.
*2 Performs calculations to average the detection values from the main unit and expansion units, and then displays the calculation result as an R.V. value (without holding the value when using hold).
*3 Displays the detected value for the sensor head connected to each amplifier as an R.V. value (without holding the value when using hold).
*4 Performs calculations to average the detection values from the connected expansion units, and then displays the calculation result (criterion value) according to the hold settings.
*5 Performs calculations to average the detection values from the connected expansion units, and then displays the calculation result as an R.V. value (without holding the value when using hold).
*6 Displays the detected value for the sensor head connected to each amplifier according to the hold settings.

■ Output

Outputs are as follows:

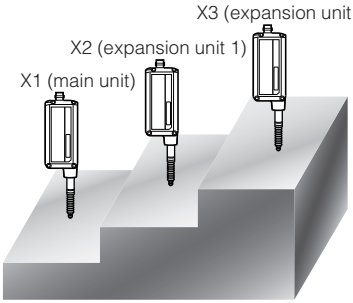
Sensor amplifier		Output
Main unit		Performs calculation to obtain an average value of those detected from the main unit and expansion units. The resulting value of calculation is taken as the value and the result is output.
Expansion unit	Calculation Mode	Criterion output is not performed (always off).
	Calculation dedicated mode	Criterion output is performed individually based on the detection value from the connected sensor head.

C5. Reference Difference

C5. rEF

If "C5. Reference difference" is selected, each expansion unit calculates (Detected value in the expansion unit) - (detected value in the main unit) based on the main unit. The calculation result is displayed as the value.

Reference Can be set only when "CALc (Calculation mode)" is selected in "A1. Calculation Mode".



The formula to obtain a reference difference is shown below.
Expansion unit 1 = X2 - X1
Expansion unit 2 = X3 - X1
.
.
.

■ Amplifier display

Main screens that can be displayed are as follows:

Sensor amplifier	P.V. value display	Calculated value display	R.V. value display	HIGH/LOW setting display	HH/LL setting display	Preset value setting display
Main unit	O	-	O*3	O	O	O
Expansion unit	O*1	O*2	O*3	O	O	O

*1 Performs calculation to obtain a reference difference of "Expansion unit - main unit" based on the main unit, and then displays the calculation result (criterion value) according to the hold settings.

*2 Performs the calculation to obtain a reference difference of "Expansion unit - main unit" based on the main unit, and then displays the calculation result by keeping the R.V. value (without holding the calculation result even when using the hold function).

*3 Displays the detected value for the sensor head connected to each amplifier as an R.V. value (without holding the value when using hold).

■ Output

Outputs are as follows:

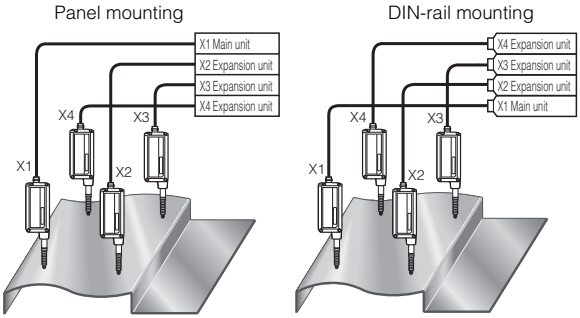
Sensor amplifier	Output
Main unit	Calculation is not performed and the criterion is output based on the detection value from the main unit according to each setting.
Expansion unit	"Detection value of this unit" minus "Detection value of the main unit" is calculated, and the calculation result is output as the criterion value for the criterion result.

C6. Twist

If "C6. Twist" is selected, the degree of twist is calculated from the four detected values and the calculation result is displayed as the value.

Reference

- When "CALc (Calculation mode)" is selected in "A1. Calculation mode":
  "C6. Twist" can be selected only when four units are configured (1 main unit + 3 expansion units).
- When "CAL.noH (Calculation dedicated mode)" is selected in "A1. Calculation mode":
  "C6. Twist" can be selected only when five units are configured (1 main unit + 4 expansion units).



The formula to obtain a degree of twist is shown below.
(X1 - X2) - (X4 - X3)
* X1 is a main unit and X2 to X4 are expansion units.

■ Amplifier display

Main screens that can be displayed are as follows:

Calculation Setting Mode	Sensor amplifier	P.V. value display	Calculated value (CALC value) display	R.V. value display	HIGH/LOW setting display	HH/LL setting display	Preset value setting display
Calculation mode	Main unit	Yes*1	Yes*2	Yes*3	Yes	Yes	Yes
	Expansion unit	-	-	Yes*3	-	-	Yes
Calculation only mode	Main unit	Yes*4	Yes*5	-	Yes	Yes	-
	Expansion unit	Yes*6	-	Yes*3	Yes	Yes	Yes

*1 Performs calculations to obtain the degree of twist from the detection values from the main unit and expansion units, and then displays the calculation result (criterion value) according to the hold settings.

*2 Performs calculations to obtain the degree of twist from the detection values from the main unit and expansion units, and then displays the calculation result as an R.V. value (without holding the value when using hold).

*3 Displays the detected value for the sensor head connected to each amplifier as an R.V. value (without holding the value when using hold).

*4 Performs calculations to obtain the degree of twist from the detection values from the connected expansion units, and then displays the calculation result (criterion value) according to the hold settings.

*5 Performs calculations to obtain the degree of twist from the detection values from the connected expansion units, and then displays the calculation result as an R.V. value (without holding the value when using hold).

*6 Displays the detected value for the sensor head connected to each amplifier according to the hold settings.

■ **Output**

Outputs are as follows:

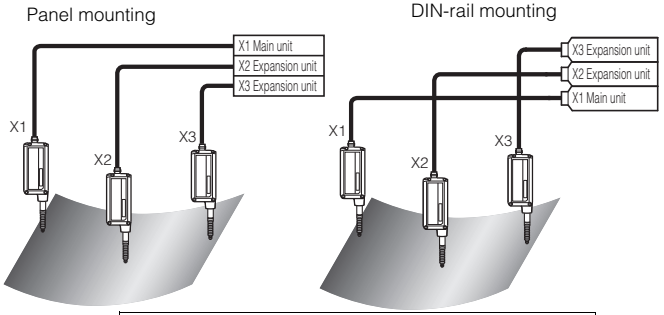
Sensor amplifier		Output
Main unit		Performs calculation to obtain a degree of twist by using the values detected from the main unit and expansion units. The resulting value of calculation is taken as the value and the result is output.
Expansion unit	Calculation Mode	Criterion output is not performed (always off).
	Calculation dedicated mode	Criterion output is performed individually based on the detection value from the connected sensor head.

C7. Warpage

If "C7. Warpage" is selected, the degree of warpage is calculated from the three detected values and the calculation result is displayed as the value.

Reference

- When "CALc (Calculation mode)" is selected in "A1. Calculation mode":
  "C7. Warpage" can be selected only when three units are configured (1 main unit + 2 expansion units).
- When "CAL.noH (Calculation dedicated mode)" is selected in "A1. Calculation mode":
  "C7. Warpage" can be selected only when four units are configured (1 main unit + 3 expansion units).



The formula to obtain a warpage is shown below.
(X1 + X3) / 2 - X2
* X1 is a main unit and X2 and X3 are expansion units.

■ Amplifier display

Main screens that can be displayed are as follows:

Calculation Setting Mode	Sensor amplifier	P.V. value display	Calculated value (CALC value) display	R.V. value display	HIGH/LOW setting display	HH/LL setting display	Preset value setting display
Calculation mode	Main unit	Yes*1	Yes*2	Yes*3	Yes	Yes	Yes
	Expansion unit	-	-	Yes*3	-	-	Yes
Calculation only mode	Main unit	Yes*4	Yes*5	-	Yes	Yes	-
	Expansion unit	Yes*6	-	Yes*3	Yes	Yes	Yes

*1 Performs calculations to obtain the warpage from the detection values from the main unit and expansion units, and then displays the calculation result (criterion value) according to the hold settings.

*2 Performs calculations to obtain the warpage from the detection values from the main unit and expansion units, and then displays the calculation result as an R.V. value (without holding the value when using hold).

*3 Displays the detected value for the sensor head connected to each amplifier as an R.V. value (without holding the value when using hold).

*4 Performs calculations to obtain the warpage from the detection values from the connected expansion units, and then displays the calculation result (criterion value) according to the hold settings.

*5 Performs calculations to obtain the warpage from the detection values from the connected expansion units, and then displays the calculation result as an R.V. value (without holding the value when using hold).

*6 Displays the detected value for the sensor head connected to each amplifier according to the hold settings.

■ **Output**

Outputs are as follows:

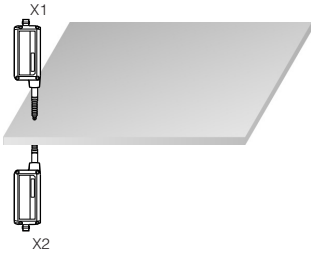
Sensor amplifier		Output
Main unit		Performs calculation to obtain a warpage value by using the values detected from the main unit and expansion units. The resulting value of calculation is taken as the value and the result is output.
Expansion unit	Calculation Mode	Criterion output is not performed (always off).
	Calculation dedicated mode	Criterion output is performed individually based on the detection value from the connected sensor head.

C8. Thickness

If "C8. Thickness" is selected, the thickness of the target is calculated from the detected value obtained by placing the target between the two sensor heads. The calculation result is displayed as the value.

Reference

- When "CALc (Calculation mode)" is selected in "A1. Calculation mode": "C8. Thickness" can be selected only when two units are configured (1 main unit + 1 expansion unit).
- When "CAL.noH (Calculation dedicated mode)" is selected in "A1. Calculation mode": "C8. Thickness" can be selected only when three units are configured (1 main unit + 2 expansion units).



The formula to obtain a thickness is shown below.
X1 + X2

■ Amplifier display

Main screens that can be displayed are as follows:

Calculation Setting Mode	Sensor amplifier	P.V. value display	Calculated value (CALC value) display	R.V. value display	HIGH/LOW setting display	HH/LL setting display	Preset value setting display
Calculation mode	Main unit	Yes*1	Yes*2	Yes*3	Yes	Yes	Yes
	Expansion unit	-	-	Yes*3	-	-	Yes
Calculation only mode	Main unit	Yes*4	Yes*5	-	Yes	Yes	-
	Expansion unit	Yes*6	-	Yes*3	Yes	Yes	Yes

*1 Performs calculations to obtain the thickness from the detection values from the main unit and expansion units, and then displays the calculation result (criterion value) according to the hold settings.

*2 Performs calculations to obtain the thickness from the detection values from the main unit and expansion units, and then displays the calculation result as an R.V. value (without holding the value when using hold).

*3 Displays the detected value for the sensor head connected to each amplifier as an R.V. value (without holding the value when using hold).

*4 Performs calculations to obtain the thickness from the detection values from the connected expansion units, and then displays the calculation result (criterion value) according to the hold settings.

*5 Performs calculations to obtain the thickness from the detection values from the connected expansion units, and then displays the calculation result as an R.V. value (without holding the value when using hold).

*6 Displays the detected value for the sensor head connected to each amplifier according to the hold settings.

■ Output

Outputs are as follows:

Sensor amplifier		Output
Main unit		Performs calculation to obtain a thickness by using detected values from the main unit and expansion units. The resulting value of calculation is taken as a criterion value and the result is output.
Expansion unit	Calculation Mode	Criterion output is not performed (always off).
	Calculation dedicated mode	Criterion output is performed individually based on the detection value from the connected sensor head.

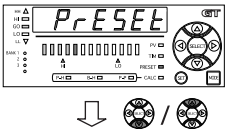
■ Origin alignment when "C8. Thickness" is selected

Perform the origin alignment using the following steps if "C8. Thickness" is selected in the calculation mode.

Setting procedure

1 **Display the preset value display from the main screen of the main and expansion units.**

"(8) Preset value setting display" (page 3-12)



2 **Set preset values for the main and expansion units.**

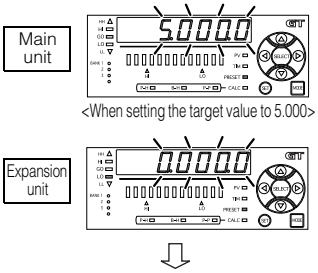
Set the following preset values:

- Main unit: Detected value of the master workpiece (target value)
- Expansion unit: 0.0000

In calculation only mode

- Expansion unit 1: Detected value of the master workpiece (target value)
- Expansion unit 2: 0.0000

* When the [PRESET] button is pressed, "no uAL" is displayed, and preset values cannot be set.

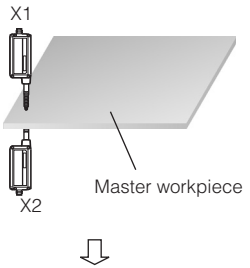


3 **Detects the master workpiece.**

4 **Perform the origin alignment on the main and expansion units.**

To perform the origin alignment, press the [PRESET] button.

"Origin Alignment" (page 3-14)



MEMO

Specifications

6

This chapter describes the specifications, circuit diagrams, and dimensions of the GT2-100 Series.

6-1 Specifications

Sensor Head

■ Short type

Model		GT2-S1	GT2-S5
Detection system		Differential transformer	
Measuring range*1		1 mm	5 mm
Operation range*1		2 mm	7 mm
Resolution		0.1 µm	
Indication accuracy*2, *4		1 µm (P-P)	
Measuring force*3	When installed facing down	1.12 N	1.0 N
	When installed sideways	1.1 N	0.95 N
	When installed facing up	1.08 N	0.9 N
Sampling interval		1 ms	
Mechanical response*4		40 Hz	20 Hz
Operation indicator		2-color LED (red, green)	
Environmental resistance	Enclosure rating*5	IP67G (JIS), IP67 (IEC)	
	Surrounding air temperature	-10 to +55°C (No freezing)	
	Relative humidity	10 to 85%RH (No condensation)	
	Vibration resistance	10 to 55 Hz, Compound amplitude 1.5 mm, 2 hours each in X, Y, and Z axis	
	Shock resistance	1000 m/s^2 (IEC60068-2-27)	
Material	Main unit	Main unit cover: SUS440C (GT2-S1), SUS430F (GT2-S5) Cable between the sensor head and relay connector: PUR, Relay amplifier: PPSU	
	Dust boot	NBR	
	Contact*6	SUS304, tungsten carbide	
Head cable		Sold separately (connected to relay connector)	
Weight (excluding cable)*7		Approx. 30 g	Approx. 40 g

*1 The measuring range indicates the range over which the measured value is displayed. The operation range indicates the range over which the spindle can actually move.

*2 For the GT2-S1, the indication accuracy is 1 µm for an arbitrary width of 0.1 mm within the area of measuring range center ± 0.15 mm and is 2 µm over this whole area.
For the GT2-S5, the indication accuracy is 1 µm for an arbitrary width of 0.2 mm within the area of measuring range center ± 0.3 mm and is 2 µm over this whole area.
Over the whole measuring range, the indication accuracy is linearity ± 0.15% of F.S. (F.S. is 1 mm for the GT2-S1 and 5 mm for the GT2-S5.)

*3 Typical value in the vicinity of the measured center value. Note that the measuring force varies depending on the installation status of the dust boot.

*4 When the surrounding temperature is 20°C.

*5 When an M8 oil-resistant cable (GT2-CHP2M/CHP5M/CHP10M) is used for the sensor head cable.

*6 The contact is a separately sold option.

*7 Including the relay connector.

Note: Cannot be used with amplifier units purchased before April 15th, 2014.

■ Pencil type

Model		GT2-P12K	GT2-P12KF	GT2-P12KL	GT2-P12	GT2-P12F	GT2-P12L
Detection system		Scale shot system II Absolute type (without tracking error)					
Measuring range		12 mm					
Resolution		0.1 µm			0.5 µm		
Indication accuracy *1		1 µm (P-P)			2 µm (P-P)		
Measuring force *2	When installed facing down	1.0 N		0.2 N	1.0 N		0.2 N
	When installed sideways	0.95 N		0.15 N	0.95 N		0.15 N
	When installed facing up	0.9 N		0.1 N	0.9 N		0.1 N
Sampling interval		4 ms					
Mechanical response *1		10 Hz		4 Hz	10 Hz		4 Hz
Operation indicator		2-color LED (red, green)					
Environmental resistance	Enclosure rating	IP67G (JIS)*3 IP67 (IEC) NEMA Type 13*3		-	IP67G (JIS)*3 IP67 (IEC) NEMA Type 13*3		-
	Surrounding air temperature	-10 to +55°C (No freezing)					
	Relative humidity	35 to 85% RH (No condensation)					
	Vibration resistance	10 to 55 Hz, Compound amplitude 1.5 mm, 2 hours each in X, Y, and Z axis					
	Shock resistance	1000 m/s² (IEC60068-2-27)					
Material	Main unit	Main unit cover: SUS303, Indicator: PET, Sensor head - Connection cable: PUR, Relay connector: PBT					
	Dust boot	NBR		-	NBR		-
	Contact point *4	SUS304, tungsten carbide			SUS304, SUS440C		
Head cable		Sold separately (connected to relay connector)					
Weight (excluding cable) *5		Approx. 35 g	Approx. 45 g	Approx. 35 g		Approx. 45 g	Approx. 35 g

*1 When the surrounding temperature is 20°C. Entire measuring range.

*2 This is a typical value at the center of the measuring range. The measuring force varies depending on the mounted condition of the dust boot.
Also, add 0.4 N to the measuring force listed above when using the OP-87859.

*3 When using an M8 oil resistant cable (GT2-CHP2M//CHP5M/CHP10M) as the sensor head cable.

*4 The contact is a separately sold option.

*5 Including the relay connector.

Note: Cannot be used with amplifier units purchased before April 15th, 2014.

■ Air cylinder types

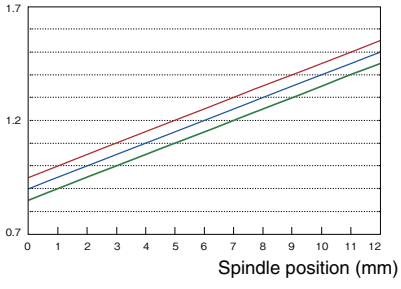
Model		GT2-PA12K	GT2-PA12KL	GT2-PA12	GT2-PA12L
Detection system		Scale shot system II Absolute type (without tracking error)			
Measuring range		12 mm			
Resolution		0.1 µm		0.5 µm	
Indication accuracy *1		1 µm (P-P)		2 µm (P-P)	
Measuring force *2	When installed facing down	1.2 N	0.4 N	1.2 N	0.4 N
	When installed sideways	1.15 N	0.35 N	1.15 N	0.35 N
	When installed facing up	1.1 N	0.3 N	1.1 N	0.3 N
Sampling interval		4 ms			
Pressure range		0.24 to 0.26 MPa	0.05 to 0.07 MPa	0.24 to 0.26 MPa	0.05 to 0.07 MPa
Max. pressure		0.5 MPa			
Fluid to use		Clean dry air			
Operation indicator		2-color LED (red, green)			
Environmental resistance	Enclosure rating	IP67 (IEC)	-	IP67 (IEC)	-
	Surrounding air temperature	0 to +55°C (No freezing)			
	Relative humidity	35 to 85% RH (No condensation)			
	Vibration resistance	10 to 55 Hz, Compound amplitude 1.5 mm, 2 hours each in X, Y, and Z axis			
	Shock resistance	1000 m/s2 (IEC60068-2-27)			
Material	Main unit	Main unit cover: SUS303, Spindle: SUS430, Indicator: PET, Sensor head - Connection cable: PUR, Relay connector: PBT			
	Spindle	SUS430 (Fluorine-based coating), Dust seal: SUS303/SU304/ aluminium (alumite treated)/special polyester fiber	SUS430/ SUS440C	SUS430 (Fluorine-based coating), Dust seal: SUS303/SU304/ aluminium (alumite treated)/special polyester fiber	SUS430/ SUS440C
	Contact point *3	SUS304, tungsten carbide		SUS304, SUS440C	
Head cable		Sold separately (connected to relay connector)			
Weight (excluding cable) *4		Approx. 35 g			

*1 When the surrounding temperature is 20°C. Entire measuring range.
*2 This is a representative value when using the GT2-PA12K/PA12 with a pressure of 0.25 MPa and when using the GT2-PA12KL/PA12L with a pressure of 0.06 MPa. The measuring force varies depending on the air pressure used. See table 1 for more details.
*3 The contact is a separately sold option.
*4 Including the relay connector.
Note: Cannot be used with amplifier units purchased before April 15th, 2014.

GT2-PA12K/PA12

Table 1. Relationship between spindle position and measuring force grouped according to used air pressure.

Measuring force (N)

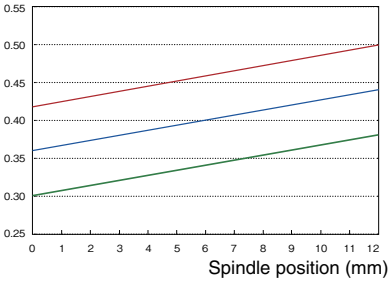


* When installing side mounting, the measuring force is -0.05 N. When installing upward mounting, the measuring force is -0.1 N.

GT2-PA12KL/PA12L

Table 2. Relationship between spindle position and measuring force grouped according to used air pressure.

Measuring force (N)



* When installing side mounting, the measuring force is -0.05 N. When installing upward mounting, the measuring force is -0.1 N.

■ Box type

Model		GT2-H12K	GT2-H12KF	GT2-H12KL	GT2-H12KLF	GT2-H12	GT2-H12F	GT2-H12L	GT2-H12LF
Detection system		Scale shot system Absolute type (without tracking error)							
Measuring range		12 mm							
Resolution		0.1 µm				0.5 µm			
Indication accuracy *1		1 µm (P-P)				2 µm (P-P)			
Measuring force *2	When installed facing down	1.0 N		0.4 N		1.0 N		0.4 N	
	When installed sideways	0.9 N		0.3 N		0.9 N		0.3 N	
	When installed facing up	0.8 N		0.2 N		0.8 N		0.2 N	
Sampling interval		1 ms							
Mechanical response *1		10 Hz		4 Hz		10 Hz		4 Hz	
Operation indicator		2-color LED (red, green)							
Environmental resistance	Enclosure rating	IP67(IEC)		-		IP67(IEC)		-	
	Surrounding air temperature	-10 to +55°C (No freezing)							
	Relative humidity	35 to 85% RH (No condensation)							
	Vibration resistance	10 to 55 Hz, Compound amplitude 1.5 mm, 2 hours each in X, Y, and Z axis							
	Shock resistance	1000 m/s² (IEC60068-2-27)							
Material	Main unit	Main unit cover: zinc die-cast, Indicator: polyarylate (PAR)							
	Dust boot	NBR		-		NBR		-	
	Contact point *3	SUS304, tungsten carbide				SUS304, SUS440C			
Cable		Sold separately (connected to M8 connector)							
Weight (excluding cable)		Approx. 95 g	Approx. 100 g	Approx. 95 g	Approx. 100 g	Approx. 95 g	Approx. 100 g	Approx. 95 g	Approx. 100 g

*1 When the surrounding temperature is 20°C. Entire measuring range.

*2 This is a typical value at the center of the measuring range. The measuring force varies depending on the mounted condition of the dust boot.

*3 The contact is a separately sold option.

■ Box type (long range type)

Model		GT2-H32	GT2-H32L	GT2-H50
Detection system		Scale shot system Absolute type (without tracking error)		
Measuring range		32 mm		50 mm
Resolution		0.5 µm		
Indication accuracy *1		3 µm (P-P)		3.5 µm (P-P)
Measuring force *2	When installed facing down	2.1 N	1.2 N	3.2 N
	When installed sideways	1.8 N	0.9 N	2.8 N
	When installed facing up	1.5 N	0.6 N	2.4 N
Sampling interval		1 ms		
Mechanical response *1		6 Hz	5 Hz	7 Hz
Operation indicator		2-color LED (red, green)		
Environmental resistance	Enclosure rating	IP67	-	IP67
	Surrounding air temperature	-10 to +55°C (No freezing)		
	Relative humidity	35 to 85% RH (No condensation)		
	Vibration resistance	10 to 55 Hz, Compound amplitude 1.5 mm, 2 hours each in X, Y, and Z axis		
Material	Main unit	Main unit cover: zinc die-cast, Indicator: polyarylate (PAR)		
	Dust boot	NBR	-	NBR
	Contact point *3	SUS304, SUS440C		
Cable		Sold separately (connected to M8 connector)		
Weight (excluding cable)		Approx. 270 g		Approx. 320 g

*1 When the surrounding temperature is 20°C. Entire measuring range.
*2 This is a typical value at the center of the measuring range. The measuring force varies depending on the mounted condition of the dust boot.
*3 The contact is a separately sold option.

■ **Box type (Air cylinder type)**

Model		GT2-A12K	GT2-A12KL	GT2-A12	GT2-A12L
Detection system		Scale shot system Absolute type (without tracking error)			
Measuring range		12 mm			
Resolution		0.1 µm		0.5 µm	
Indication accuracy *1		1 µm (P-P)		2 µm (P-P)	
Measuring force *2	When installed facing down	1.2 N	0.4 N	1.2 N	0.4 N
	When installed sideways	1.1 N	0.3 N	1.1 N	0.3 N
	When installed facing up	1.0 N	0.2 N	1.0 N	0.2 N
Sampling interval		1 ms			
Pressure range		0.25 to 0.5 MPa			
Max. pressure		1.0 MPa			
Fluid to use		Dry air			
Operation indicator		2-color LED (red, green)			
Environmental resistance	Enclosure rating	IP67(IEC)*3	-	IP67(IEC)*3	-
	Surrounding air temperature	0 to +55°C (No freezing)			
	Relative humidity	35 to 85% RH (No condensation)			
	Vibration	10 to 55 Hz, Compound amplitude 1.5 mm, 2 hours each in X, Y, and Z axis			
	Shock resistance	1000 m/s2 (IEC60068-2-27)			
Material	Main unit	Main unit cover: zinc die-cast, Cylinder: aluminum alloy, Air coupling socket (resin part): polyacetal, Air coupling socket (metal part): nickel plated brass, Indicator: polyarylate (PAR)			
	Dust boot	FKM	-	NBR	-
	Contact point *4	SUS304, tungsten carbide		SUS304, SUS440C	
Sensor head cable		Sold separately (connected to M8 connector)			
Weight (excluding sensor head cable)		Approx. 145 g			

*1 When the surrounding temperature is 20°C. Entire measuring range.

*2 This is a typical value at the center of the measuring range. The measuring force varies depending on the mounted condition of the dust boot.
The measuring force is not affected by the air supply pressure.

*3 Connect an air tube to the exhaust valve so that no foreign materials enter from the valve.

*4 The contact is a separately sold option.

■ **Box type (Air cylinder type/long range type)**

Model		GT2-A32	GT2-A50
Detection system		Scale shot system Absolute type (without tracking error)	
Measuring range		32 mm	50 mm
Resolution		0.5 µm	
Indication accuracy *1		3 µm (P-P)	3.5 µm (P-P)
Measuring force *2	When installed facing down	2.1 N	3.2 N
	When installed sideways	1.8 N	2.8 N
	When installed facing up	1.5 N	2.4 N
Sampling interval		1 ms	
Pressure range		0.25 to 0.5 MPa	
Max. pressure		1.0 MPa	
Fluid to use		Dry air	
Operation indicator		2-color LED (red, green)	
Environmental resistance	Enclosure rating	IP67(IEC) *3	
	Surrounding air temperature	0 to +55°C (No freezing)	
	Relative humidity	35 to 85% RH (No condensation)	
	Vibration *4	10 to 55 Hz, Compound amplitude 1.5 mm, 2 hours each in X, Y, and Z axis	
Material	Main unit	Main unit cover: zinc die-cast, Cylinder: aluminum alloy, Air coupling socket (resin part): polyacetal, Air coupling socket (metal part): nickel plated brass, Indicator: polyarylate (PAR)	
	Dust boot	NBR	
	Contact point *5	SUS304, SUS440C	
Sensor head cable		Sold separately (connected to M8 connector)	
Weight (excluding sensor head cable)		Approx. 340 g	Approx. 405 g

*1 When the surrounding temperature is 20°C. Entire measuring range.
*2 This is a typical value at the center of the measuring range. The measuring force varies depending on the mounted condition of the dust boot.
The measuring force is not affected by the air supply pressure.
*3 Connect an air tube to the exhaust valve so that no foreign materials enter from the valve.
*4 When using mounting bracket D (OP-84327), the double amplitude becomes 0.75 mm.
*5 The contact is a separately sold option.

Sensor Amplifier

■ Amplifier (GT2-100N/100P)/expansion board (GT2-E3N/E3P)

Item		Specifications	
Model	NPN output	GT2-100N	GT2-E3N
	PNP output	GT2-100P	GT2-E3P
Number of heads that can be connected		2 heads as standard, maximum of 11 heads by adding head expansion boards	3 boards
Supply voltage		20 to 30 VDC, including 10% ripple (P-P). Class 2	Provided by the GT2-100N/100P
Display range		-199.9999 to 199.9999	-
Display resolution		0.1 µm	-
Current consumption	Normal	4500 mW max. (150 mA max. at 30 V)	4200 mW max. (140 mA max. at 30 V)
	Power saving (eco half)*1	3700 mW max. (123.3 mA max. at 30 V)	4200 mW max. (140 mA max. at 30 V)
	Power saving (eco)*1	3600 mW max. (120 mA max. at 30 V)	4000 mW max. (133.3 mA max. at 30 V)
Response time		hsp (3 ms), 5 ms, 10 ms, 100 ms, 500 ms, 1000 ms (hsp (12 ms), 20 ms, 40 ms, 400 ms, 2000 ms, 4000 ms when using GT2-P***/PA*** with a sensor head)	
Control output (HH/HIGH/GO/ LOW/LL)	NPN	NPN open collector 40 V 50 mA max.*3 Residual voltage: 1 V max.	
	PNP	PNP open collector 30 V 50 mA max.*3 Residual voltage: 1 V max.	
Control input	Timing input	Input time: 2 ms min.	
	Preset input	Input time: 20 ms min.	
	Reset input		
	Bank input		
I/O connector*2		Power supply: terminal block connection, I/O: 20-pin connector (MIL standard)	30-pin connector (MIL standard)
Environmental resistance	Surrounding air temperature	-10 to +50°C (No freezing)	
	Relative humidity	35 to 85%RH (No condensation)	
	Vibration	10 to 55 Hz, compound amplitude 0.15 mm, 2 hours for each of X, Y, and Z axes	
Material	Main unit cover	Polycarbonate (PC)	-
	Keytop	Polyacetal (POM)	-
	Front sheet	Polyethylene terephthalate (PET)	-
Weight	GT2-71N/71P/ 72N/72P	Approx. 380 g	Approx. 80 g

*1 When the maximum number of sensor heads are connected, and all the sensor heads are set to the power-saving mode.

*2 A connector and a cable are sold separately.

*3 20 mA or less when two or more sensor heads are connected.

Status Table

State		Amplifier		Control input			Control output	Sensor head
		Digital display	Criterion indicator	Timing	Preset	Bank switching * During key lock only	Criterion output	indicator
Detecting (P.V./R.V.)	Normal	No. of digits for the detection result*1	Criterion result	Yes	Yes	Yes	Criterion result	On *3 When all are OFF: Off
	Criterion standby	"------"	Off	No	No		All OFF (All ON when N.C. is selected)	Off
During setting		Setting display	According to detection	According to detection	According to detection		Criterion result	Blinks*4
During error		Error display	HIGH/ LOW on	No ("Er.Chk" or "ErC" according to detection)	No *2		HIGH/ LOW output	Lights in red
When power is turned on		Off	Off				All OFF (All ON when N.C. is selected)	Off

*1 When the detection result is out of the display range (-199.9999 to 199.9999), -FFFF/FFFF is displayed.
*2 "Er.Chk", "ErC", "Er.com", and "Er.CAL" are on ("ErH", "ErE", and "Er.Unit" are off)
*3 GO: green, HH/HIGH/LOW/LL: red (For HH/LL, when "5out (5 output)" is selected)
*4 GO: green, HH/HIGH/LOW/LL/All OFF (All ON when N.C. is selected): red (For HH/LL, when "5out (5 output)" is selected)

Reference

When the power save function is set, the state changes to the following. Set the power-saving function for each head.
"23. Power Save Function" (page 5-39)

Power-saving function	Amplifier				Sensor head
	Digital display	Bar LED	Criterion indicator	OK/NG indicator for each head*2 Head ID indicator*2	Indicator
HALF	Animation display*1	Off	Normal display or normal operations		
ALL	Off				

*1 Displays one segment at a time sequentially
*2 Operations are the same as the power-saving function of the main unit (ID: 00) regardless of the ID currently displayed

Power On Reset Time

The following table shows the time from when the power is turned on until the sensor outputs a signal.
Note that the times depend on the response times.

When the connected sensor head is GT2-P***/PA***

Response time	Time until output
hsp (12 ms)	Approx. 3 s
20 ms	Approx. 3 s
40 ms	Approx. 3 s
400 ms	Approx. 3.5 s
2000 ms	Approx. 5 s
4000 ms	Approx. 7 s

When the connected sensor head is GT2-S1/S5/H***/A***

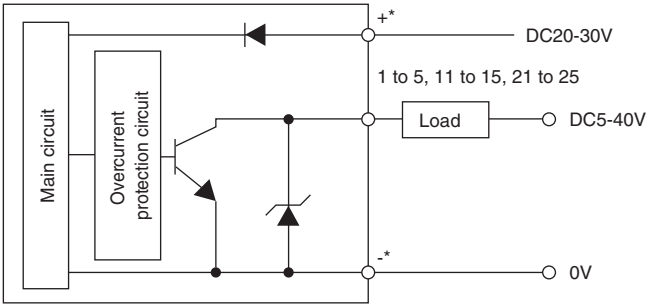
Response time	Time until output
hsp (3 ms)	Approx. 3 s
5 ms	Approx. 3 s
10 ms	Approx. 3 s
100 ms	Approx. 3 s
500 ms	Approx. 3.5 s
1000 ms	Approx. 4 s

"03. Response Time" (page 5-8)

6-2 I/O Circuit Diagram

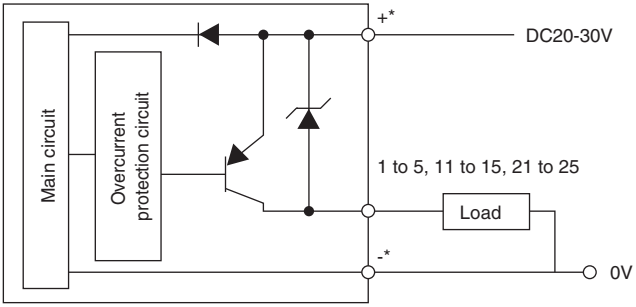
Output circuit diagram (pin Nos. of 1 to 5, 11 to 15, 21 to 25)

■ **GT2-100N/GT2-E3N**



* +/- terminals are available for the GT2-100N only.
Not available for the GT2-E3N.

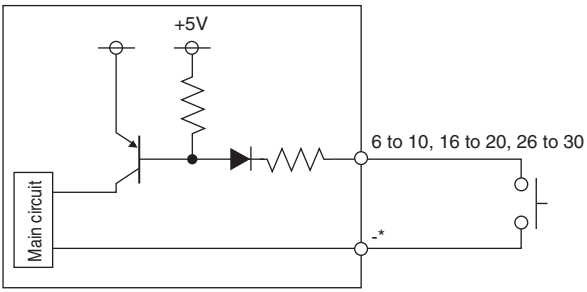
■ **GT2-100P/GT2-E3P**



* +/- terminals are available for the GT2-100P only.
Not available for the GT2-E3N.

Input Circuit Diagram (pin Nos. of 6 to 10, 16 to 20, 26 to 30)

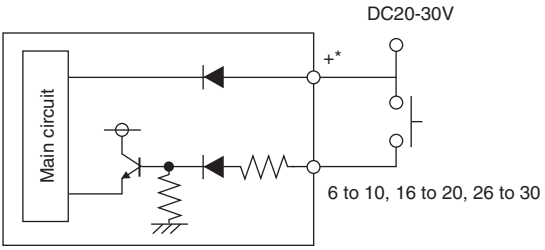
■ **GT2-100N/GT2-E3N**



(Short circuit current: 1 mA max.)

* +/- terminals are available for the GT2-100N only.
Not available for the GT2-E3N.

■ **GT2-100P/GT2-E3P**

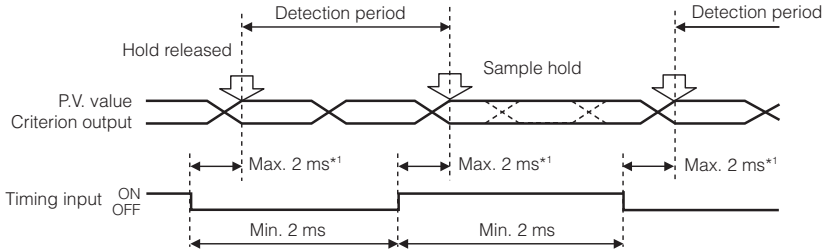


(Short circuit current: 2 mA max.)

* +/- terminals are available for the GT2-100P only.
Not available for the GT2-E3P.

6-3 Timing Chart

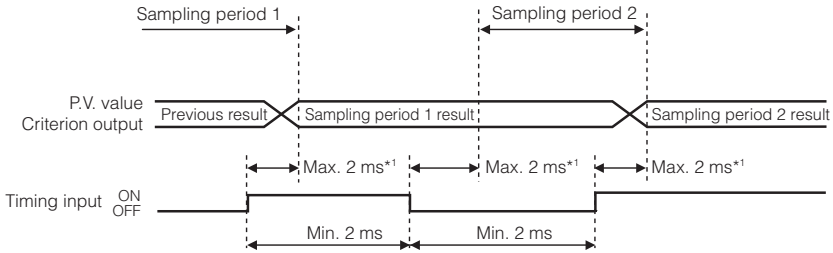
Standard Detection



*1 The duration is max. 4 ms for the expansion unit when "ALL (Batch input)" is selected in "15. Batch input settings".

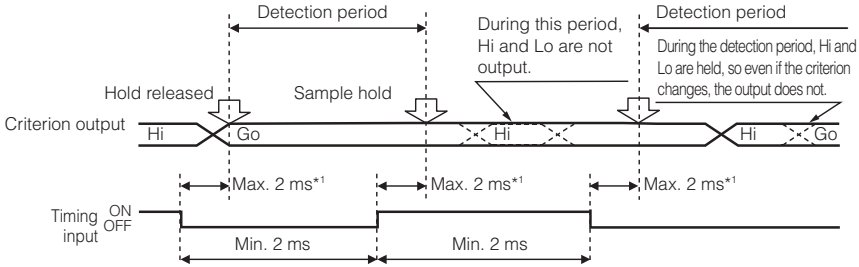
Peak Hold, Bottom Hold, Peak-to-Peak

This is the timing chart when "t-in (timing input)" is selected in "02. Hold update method".



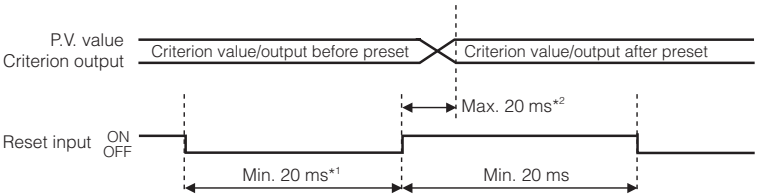
*1 The duration is max. 4 ms for the expansion unit when "ALL (Batch input)" is selected in "15. Batch input settings".

NG Hold



*1 The duration is max. 4 ms for the expansion unit when "ALL (Batch input)" is selected in "15. Batch input settings".

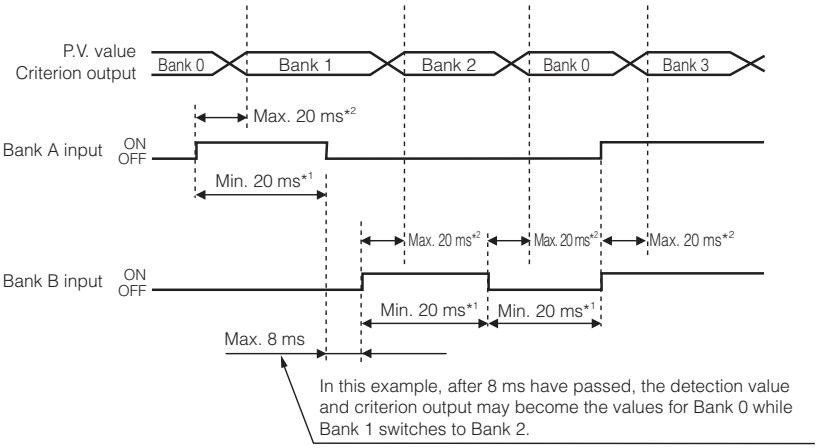
Preset Input



*1*2 When "ALL (Batch input)" is selected in "15. Batch input settings", the preset input is as follows.

Number of connected expansion boards	*1	*2 (expansion unit only)	
0 boards	Min. 80ms	Max. 80ms	When the preset input is performed after the reset input, the required time can become up to twice the value noted to the left.
1 board	Min. 160ms	Max. 160ms	
2 boards	Min. 250ms	Max. 250ms	
3 boards	Min. 350ms	Max. 350ms	

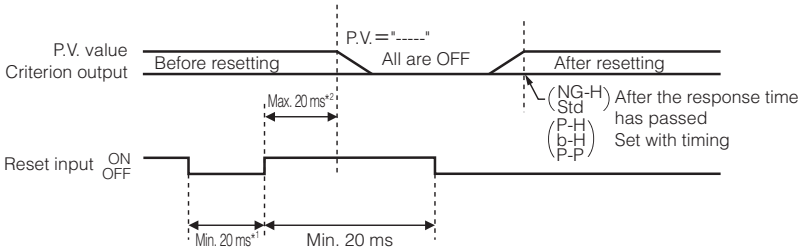
Bank Input



*1*2 When "ALL (Batch input)" is selected in "15. Batch input settings", the preset input is as follows.

Number of connected expansion boards	*1	*2 (expansion unit only)
0 boards	Min. 80ms	Max. 80ms
1 board	Min. 160ms	Max. 160ms
2 boards	Min. 250ms	Max. 250ms
3 boards	Min. 350ms	Max. 350ms

Reset Input



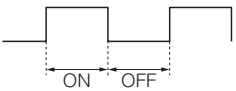
*1*2 When "ALL (Batch input)" is selected in "15. Batch input settings", the preset input is as follows.

Number of connected expansion boards	*1	*2 (expansion unit only)	
0 boards	Min. 80ms	Max. 80ms	When the reset input is performed after the preset input, the required time can become up to twice the value noted to the left.
1 board	Min. 160ms	Max. 160ms	
2 boards	Min. 250ms	Max. 250ms	
3 boards	Min. 350ms	Max. 350ms	

Minimum Input Time

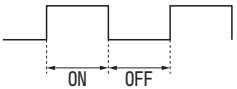
Timing input

ON time : 2 ms
OFF time : 2 ms

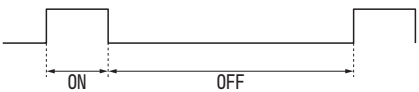


Preset input, Reset input

ON time : 20 ms
OFF time : 20 ms

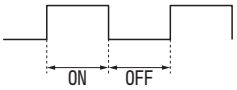


* When "ALL (Batch input)" is selected in "15. Batch input settings"
ON time : 20 ms
OFF time : (Number of connected expansion boards: 0 boards) 80 ms
(Number of connected expansion boards: 1 board) 160 ms
(Number of connected expansion boards: 2 boards) 250 ms
(Number of connected expansion boards: 3 boards) 350 ms

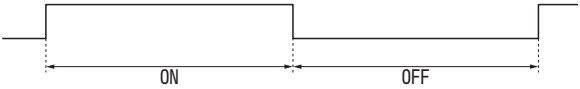


Bank input

ON time : 20 ms
OFF time : 20 ms



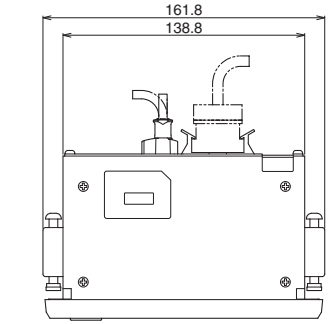
* When "ALL (Batch input)" is selected in "15. Batch input settings"
ON time : (Number of connected expansion boards: 0 boards) 80 ms
(Number of connected expansion boards: 1 board) 160 ms
(Number of connected expansion boards: 2 boards) 250 ms
(Number of connected expansion boards: 3 boards) 350 ms
OFF time : (Number of connected expansion boards: 0 boards) 80 ms
(Number of connected expansion boards: 1 board) 160 ms
(Number of connected expansion boards: 2 boards) 250 ms
(Number of connected expansion boards: 3 boards) 350 ms

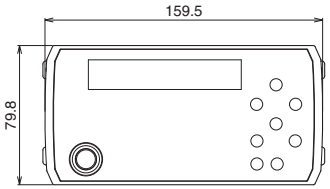


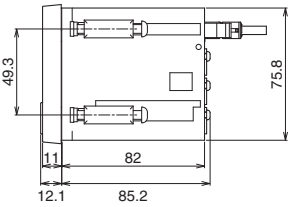
6-4 Dimensions

Sensor Amplifier

■ GT2-100N/100P



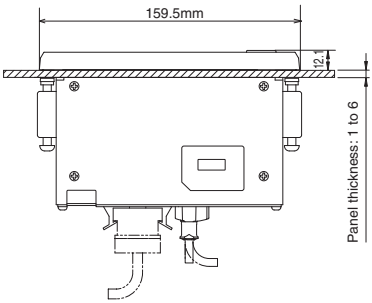




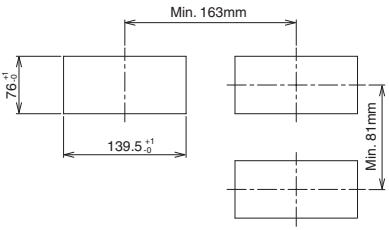
Unit: mm

■ **Panel Cutout Dimensions**

When mounted on a panel



Panel Cutout Dimensions

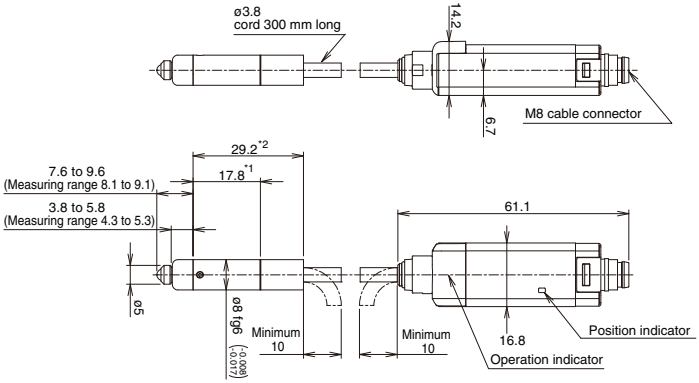


Panel thickness of mounting area
1 to 6 mm

Unit: mm

Sensor Head

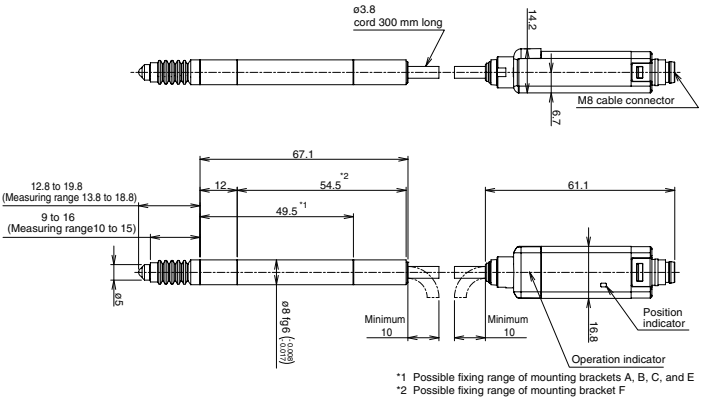
■ GT2-S1



*1 Possible fixing range of mounting brackets A, B, C, and E
*2 Possible fixing range of mounting bracket F

Unit: mm

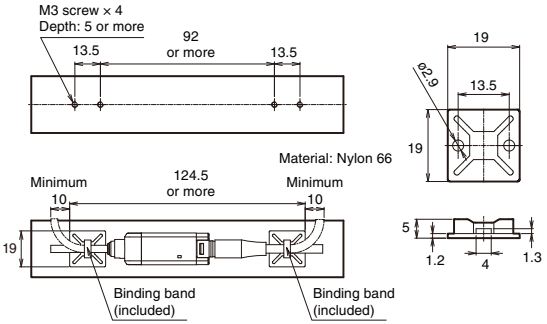
■ GT2-S5



*1 Possible fixing range of mounting brackets A, B, C, and E
*2 Possible fixing range of mounting bracket F

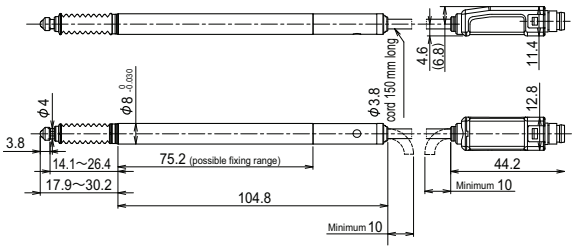
Unit: mm

■ Short amplifier mounting bracket OP-88117



Unit: mm

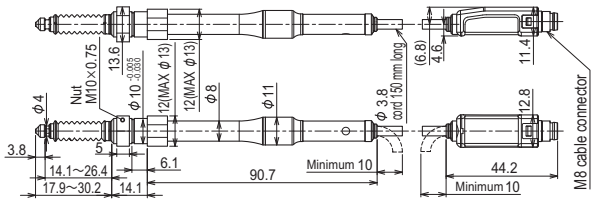
■ GT2-P12K(L)/P12(L)



Unit: mm

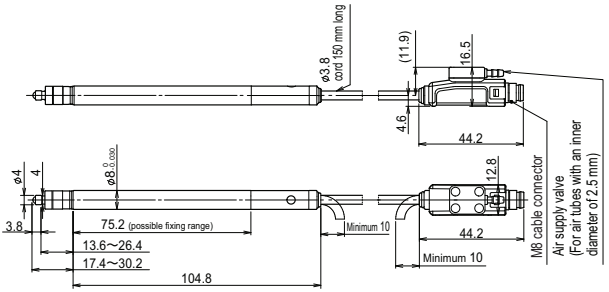
Reference There is no dust boot for GT2-P12KL/P12L.

■ GT2-P12KF/P12F



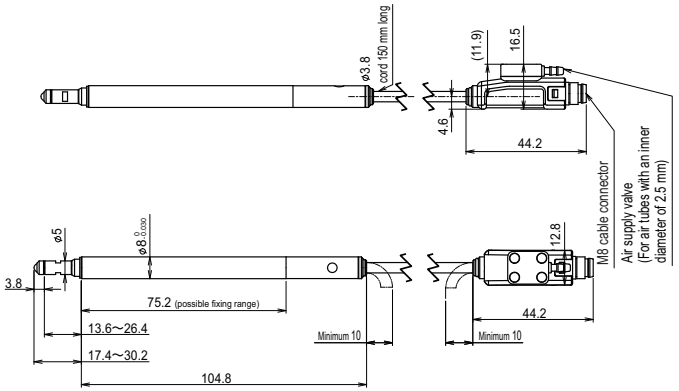
Unit: mm

■ GT2-PA12K/PA12



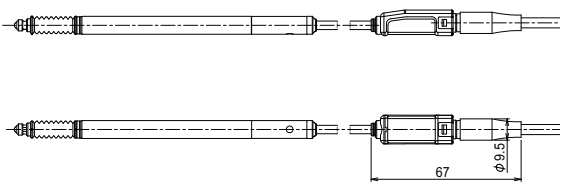
Unit: mm

■ GT2-PA12KL/PA12L



Unit: mm

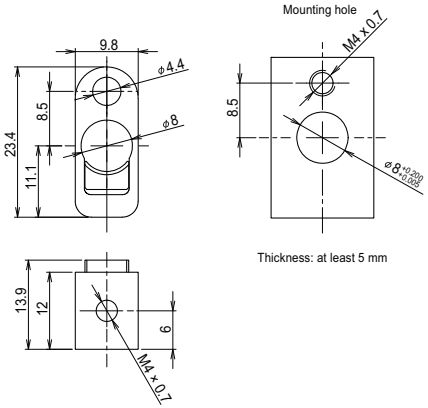
■ With the sensor head cable attached



Unit: mm

Reference ϕ10 when using GT2-CHP2M/5M/10M

■ OP-87863 (Mounting bracket F)

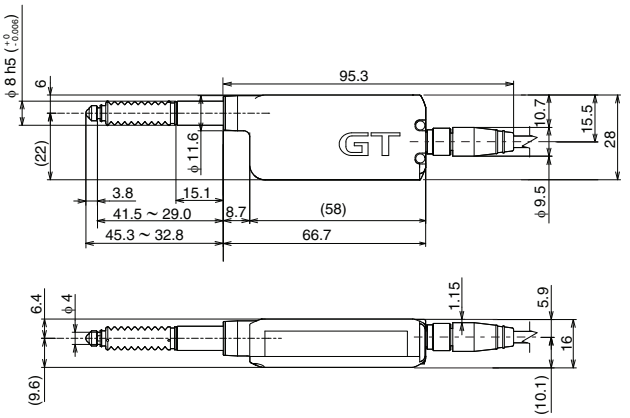


Unit: mm

Reference OP-87863 (Mounting bracket F) cannot be used with GT2-H***/A***.

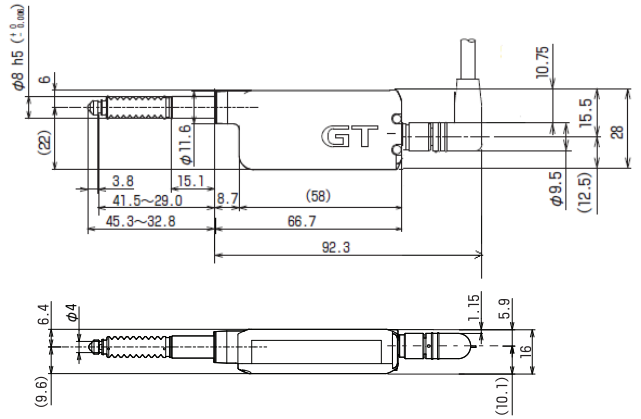
■ GT2-H12K(L)/H12(L)

When GT2-CH2M/5M/10M/20M is mounted



Unit: mm

When GT2-CHL2M/5M/10M/20M is mounted

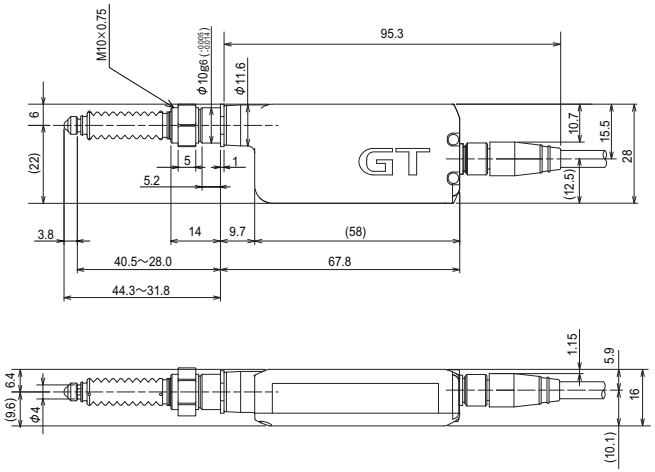


Unit: mm

Reference There is no dust boot for GT2-H12KL/H12L.

■ GT2-H12KF/H12KLF/H12F/H12LF

With GT2-CH2M/5M/10M/20M attached

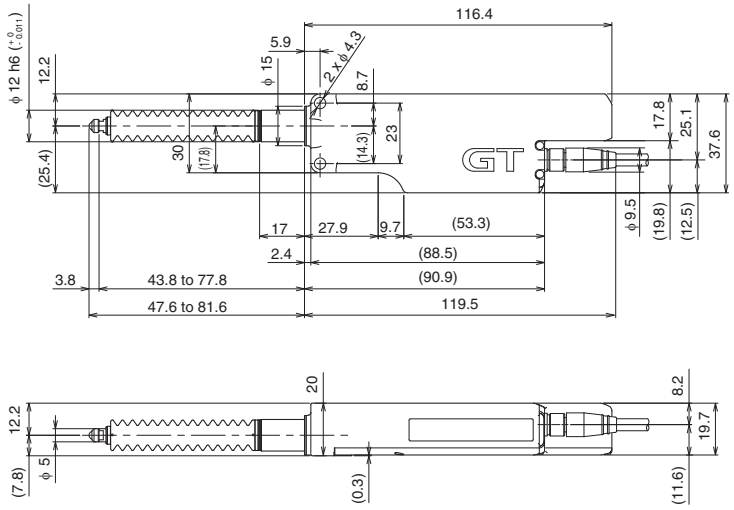


Unit: mm

Reference There is no dust boot for GT2-H12KLF/H12LF.

■ GT2-H32(L)

When GT2-CH2M/5M/10M/20M is mounted

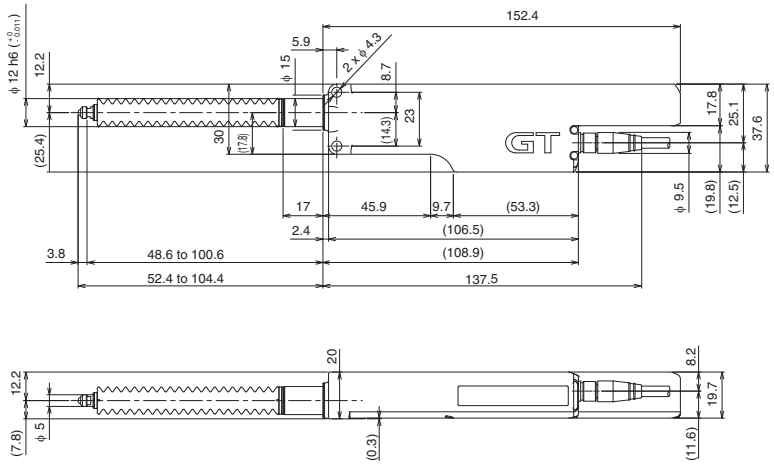


Unit: mm

Reference There is no dust boot for GT2-H32L.

■ GT2-H50

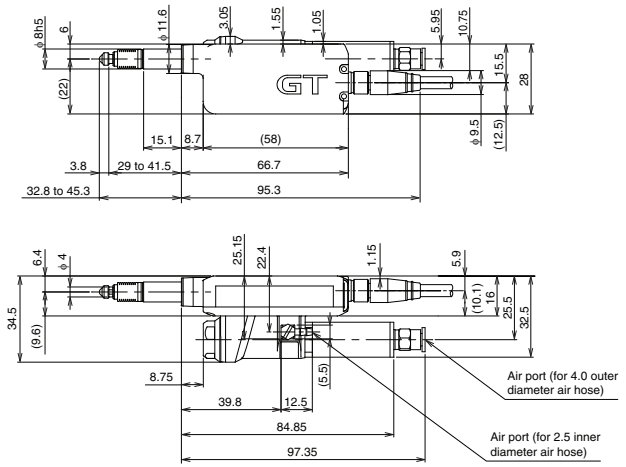
When GT2-CH2M/5M/10M/20M is mounted



Unit: mm

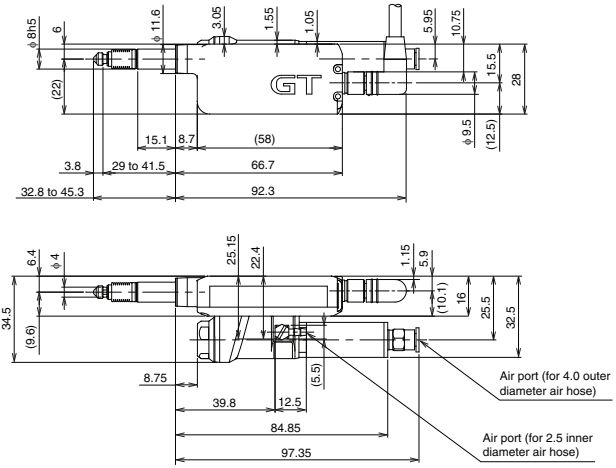
■ GT2-A12K(L)/A12(L)

When GT2-CH2M/5M/10M/20M is mounted



Unit: mm

When GT2-CHL2M/5M/10M/20M is mounted

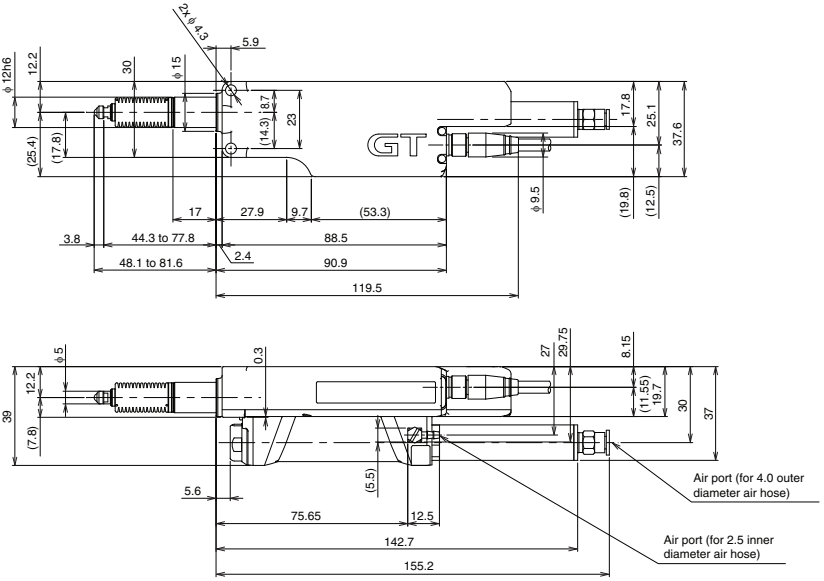


Unit: mm

Reference There is no dust boot for GT2-A12KL/A12L.

■ GT2-A32

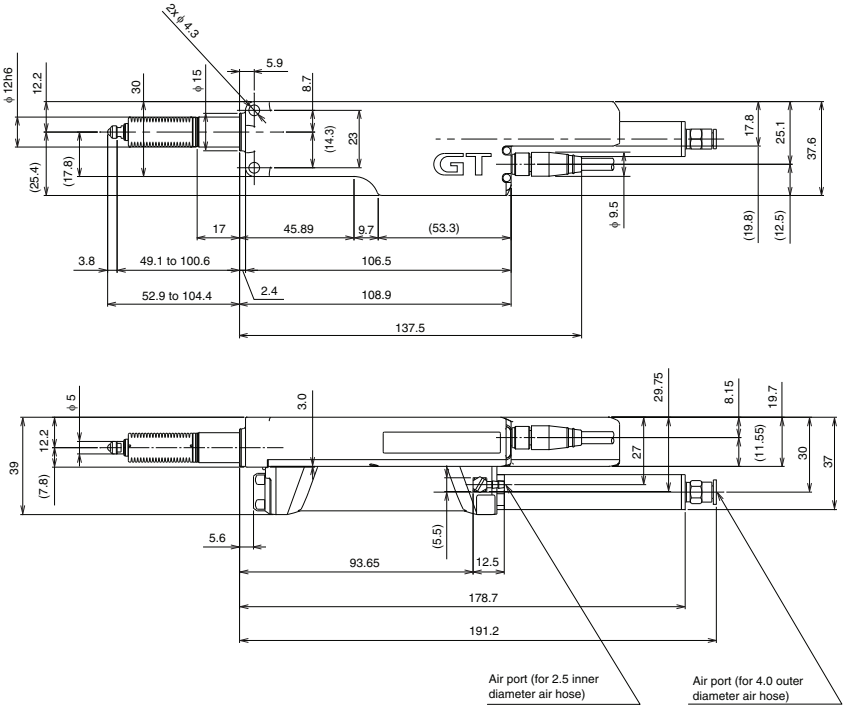
When GT2-CH2M/5M/10M/20M is mounted



Unit: mm

■ GT2-A50

When GT2-CH2M/5M/10M/20M is mounted



Unit: mm

MEMO

Appendix

A

A1 Troubleshooting

This section describes the actions to take when a problem occurs.

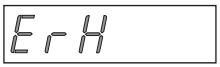
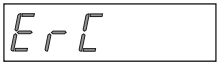
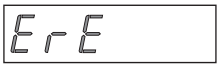
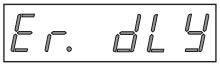
Problem	Check points	Remedy
Nothing is displayed on the panel.	Is the power cable connected correctly?	Connect the power cable correctly. "Sensor Amplifier Wiring" (page 2-5)
	Is the power save function running?	Turn off the power save function. "23. Power Save Function" (page 5-39)
Values are not displayed.	Is the target within the detection range?	Adjust the target to correctly fall within the detection range.
	Is timing control set for the detection mode?	Set the timing control for the detection mode. "01. Detection Mode" (page 5-6)
	Is the internal timing level set correctly?	Correctly adjust the timing level. "05. Self-timing Level" (page 5-11)
	When using static hold, is the stability width set to the correct value?	Set the criterion reference to USEr and increase the stability criterion reference width. "08. Static Hold Delay Stability" (page 5-14)
	Are the output line and input line short-circuited?	Check the wiring.
The value fluctuates.	Is the response time set too fast?	Set the response time to a slower value. "03. Response Time" (page 5-8)
	Are the target or sensor head vibrating?	Take anti-vibration measures.
	When using static hold, is the stability width set to the correct value?	Set the criterion reference to USEr and decrease the stability criterion reference width. "08. Static Hold Delay Stability" (page 5-14)
	Are the output line and input line short-circuited?	Check the wiring.
The values are incorrect.	Is the target tilted or located in an incorrect position?	Adjust the target to correctly fall within the detection range.
	Is the sensor head firmly secured?	Use the optional mounting bracket. "Mounting the Sensor Head" (page 2-14)
	Does the surrounding air temperature significantly change?	Keep the surrounding air temperature constant.
	• Is the origin alignment set correctly? • Is the preset value set correctly? • Is the preset input line connected correctly?	Configure the settings correctly. "3-3 Origin Alignment" (page 3-14) "Preset Function (Displaying the Value by Adding or Subtracting a Desired Value)" (page 3-30)
	Is the proper calibration value set?	Redo the calibration. "30. Calibration Function Setting" (page 5-49)
	Are the contacts aligned correctly?	If the contacts can separate easily, secure them with thread lock.
	Are the output line and input line short-circuited?	Check the wiring.
The outputs change even when paused.	Check the hysteresis. (The factory default hysteresis is 0.003 mm.)	Increase the hysteresis. "14. Hysteresis" (page 5-21)
Bank switching cannot be performed with external input.	Is the key lock turned on?	Turn off the key lock. "Key Lock" (page 3-42)

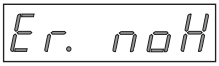
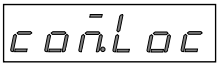
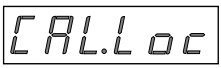
Problem	Check points	Remedy
"- - - - - -" is displayed when the power is turned on.	Is hold detection selected? ("- - - - - -" is displayed until the first criterion value is recognized.)	A value will appear once the first criterion value is recognized. "01. Detection Mode" (page 5-6)
The display stays at 0.000.	Does the value change during the sampling period of Peak-to-Peak hold?	During Peak-to-Peak hold, the amount of variation is displayed, so if the value stays the same, then the displayed value remains as zero.
Criterion output cannot be output properly.	Is the unit properly wired?	Check the output circuit and wiring, and connect properly. "6-2 I/O Circuit Diagram" (page 6-13)
	Are the tolerances set correctly?	Reset the tolerances "3-4 Setting the Tolerances" (page 3-17)
	Is the hysteresis set correctly?	Set it up correctly. "14. Hysteresis" (page 5-21)
The unit in the thousands place (0.0001) does not appear.	Is the displayed number of digits set correctly?	Set it up correctly. "13. Displayed Number of Digits" (page 5-20)
The A1.APL parameters do not appear.	• Are expansion units added? If expansion units are added, it only appears on the main unit.) • Are the amplifiers connected to each other correctly?	Check the connections for the expansion units. "2-1 Mounting and Wiring the Sensor Amplifier" (page 2-2)
Calculations for twist, warpage, and thickness cannot be set.	Are the number of expansion units and the valid ID settings correct? Each of those calculations are available only when there are 4, 3, or 2 units.) Are the amplifiers connected to each other correctly?	Connect the correct number of units. "5-6 Calculation Setting Mode" (page 5-54)
When calculating the reference distance, the response time cannot be set.	Are you attempting to set the response time for an expansion unit?	During calculation, set the response time for the main unit? "03. Response Time" (page 5-8)
The value fluctuates, but the bar LED does not change.	Is R.V. display selected?	Set P.V. display. "3-2 Main Screens" (page 3-4)
	Is the bar LED display method set to OK/NG display mode?	During P.V. display, use the MODE button to switch the bar display mode. "1-2 Identifying Part Names and Functions" (page 1-9)
	Are the HIGH setting value and LOW setting value vastly different from the measured value?	Set the correct value. (When the measured value is far from the HIGH/LOW setting values, or if the value is fairly close to the difference between the HIGH/LOW setting values, the bar LED does not change.)

Problem	Check points	Remedy
The preset values for the HIGH setting value and LOW setting value changed.	Was bank switching performed?	Use key operations to select the original bank. (The factory default is bank 0). Check whether the bank input wire is connected correctly. "Sensor Amplifier Wiring" (page 2-5)
During tolerance calibration, "no vAL" is displayed.	When the measured value (P.V. value) is "- - - - - -", tolerance calibration cannot be performed.	Adjust the target to fall within the detection range. A value will appear once a measured value is recognized through timing.
Some sensor heads cannot be selected even though they are connected.	Are they valid in the valid ID setting?	Set the correct valid ID. "Valid ID Setting" (page 3-2)

A2 Error Messages

When an error occurs, an error message appears on the sensor amplifier.
While the error message that starts with "Er" is displayed, the HIGH and LOW outputs turn ON at the same time (excluding "ErC").

Error screen	Error contents	Action
	The sensor head cable is not connected.	• Connect the sensor head to the amplifier. • Set the correct valid ID setting.
	The sensor head cable is disconnected. The sensor head is damaged.	Replace the sensor head.
	Overcurrent flows through the output wire.	• Check the load and reduce the current to be within the rated range. • Check that the output wire is not touching other wires or the frame.
	Data cannot be read correctly.	Restart the unit and perform initial reset. If the above actions do not correct the problem, replace the amplifier unit.
	The spindle sets off the alarm.	• If the spindle sets off the alarm and does not return to its original position, replace the sensor head. • Check whether the external timing input is functioning properly. (Press the [SET] button to restart.)
	The trigger level falls (or rises) in the set delay time.	The delay time is too long. Change the setting.(Press the [SET] button to restart.) "07. User-specified Delay Time" (page 5-13)
	•When using static hold for internal timing, the value falls below (rises above) the trigger level and the detection ends prematurely before the detection becomes stable and the criterion value (P.V. value) is determined. • When using the delay timer for internal timing, the value falls below (rises above) the trigger level and the detection ends prematurely within the period since the value rises above (falls below) the trigger level until the criterion value (P.V. value) is determined after the specified time.	Set the trigger level so that it does not fall (or rise) until measured value is determined. Or increase the static hold delay stability width so that the measured value can be determined more easily. "09. Static Hold Delay Stability Width" (page 5-15)

Error screen	Error contents	Action
	The communication between the IDs cannot be performed.	After turning the power off, check whether the connections between the head expansion boards are correct and restart the power.
	When using the calculation function, the number of expansion units connected when the power is turned on differs from the number of expansion units programmed in the main unit when setting the calculation settings.	•Set the calculation mode again or initialize the main unit. "Initialization (Initial Reset)" (page 3-38) • After turning the power off, check the connection between the amplifiers.
	An error has occurred in the main unit when performing the reference difference (rEF) of the calculation function, or an error has occurred in one of the expansion units when performing a calculation function item other than the reference difference (rEF).	Check the error contents on the main unit and expansion units.
	The sensor head is connected to the main unit that is set to the calculation dedicated mode.	Remove the sensor head from the main unit or set the main unit to the setting other than the calculation dedicated mode.
	The display reads "com.Loc" and settings cannot be changed.	The connected communication unit DL-RS1A read/write setting switch is set to RW. Set the read/write setting switch to R. "RS-232C Communication Unit DL-RS1A User's Manual" **Reference** Even when "com.Loc" is displayed, the external input can be used for bank switching, reset input, and preset input. When accessing the main unit via Communication Unit <DL-CL1> <DL-DN1> <DL-EP1> (Inputting external input, changing set values) Operations on the sensor amplifier are locked for approximately 10 seconds. Then "com-Unlock" is displayed, and the lock is released.
	The calculation mode is used, so the function setting mode cannot be changed.	Check the calculation mode setting. The function setting mode can be changed only when the calculation mode setting on the main unit is set to "C0.oFF" or "C5.rEF".

A

Appendix

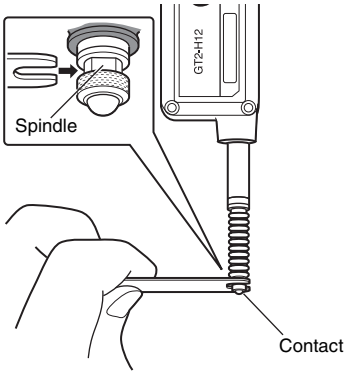
Error screen	Error contents	Action
	During tolerance calibration, the criterion value (P.V. value) is "------". When PRESET is entered on the main unit in calculation only mode	Perform the tolerance calibration after performing the timing input to fix the measured value.
	The criterion value (P.V. value) is not fixed because the timing input is not performed when the hold detection is selected.	Perform the timing input.
	After ALL GO is selected in the special output setting, the number of expansion units changed.	•If the number of expansion units has been changed, set the special output setting again. •If the number of expansion units has not been changed, check if each expansion unit operates correctly, then turn on the power again.

A3 Replacing the Contact

Products other than the GT2-S1/S5

This section describes replacing the contact. Remove the sensor head before performing this operation.

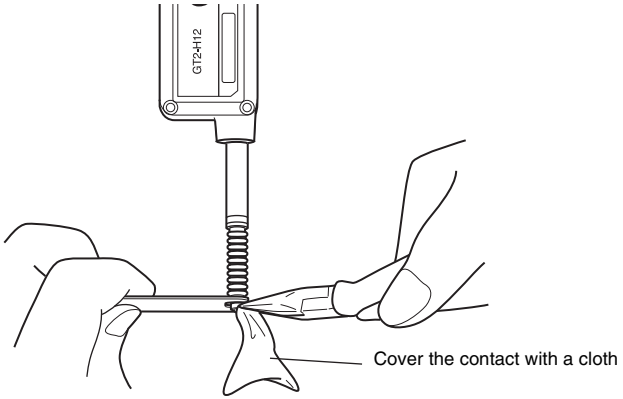
1 **Use the supplied key wrench to hold the spindle securely.**



NOTICE	**If force is applied to twist the spindle, the sensor head may be damaged.**

2 **Use pliers or a similar tool to grasp the contact and remove it.**

Pliers and similar tools cannot be used on the fluorocarbon contact (OP-80228). Remove this contact with your fingers.



NOTICE	• **Cover the contact with a piece of cloth to cushion it while you grasp the contact with the pliers. Pliers and similar tools cannot be used on the fluorocarbon contact (OP-80228). Remove this contact with your fingers.** • **Do not rotate the unit while performing these steps.**

3 **As described in step 1, use the supplied key wrench to hold the spindle securely.**

4 **As described in step 2, replace the contact.**

NOTICE	• **For the roller contact or offset contact, secure the side of the contact being used with a fixing nut. We also recommend using a thread lock to prevent wiggling.** • **When using a roller contact, only apply to the roller in the direction of movement and not along other axes.** • **When installing the contact, never apply tightening torque over 0.2 N·m. Use a tightening torque of 0.002 N·m or less for the fluorocarbon contact (OP-80228) only. We also recommend using thread lock to prevent movement.**

GT2-S1/S5

1 **Remove the sensor head from the metal plate or similar object, and then use pliers or a similar tool to pinch and remove the contact.**
With a fluoroplastic type contact (OP-80228), do not use pliers or a similar tool. Instead, remove the contact with your fingers.

NOTICE	• **Cover the contact with cloth or a similar material before pinching the contact with a tool such as pliers.** • **Ensure that the force exerted in the rotational direction is not applied to the main unit when performing this work.**

2 **Follow the reverse procedure as that shown in step 1 to attach the contact.**

NOTICE	• **When using a roller contact or an offset contact, align the contact in the direction that you want to use it, and then use the intermediate fixing nut to fix the contact in place. We also recommend that you apply adhesive to prevent the contact from becoming loose.** • **When using a roller contact, align it with the direction of movement and ensure that no forces are applied to the shaft other than the force in the rotational direction.** • **Do not attach or remove the contact when the sensor head main unit is fixed in place on a metal plate or similar object. Be sure to perform the attachment or removal operation after first removing the sensor head from the metal plate or similar object.** • **Apply a tightening torque of 0.2 N•m or less.** • **Apply a tightening torque of 0.002 N•m or less only for the fluoroplastic type contact (OP-80228). We also recommend that you apply adhesive to prevent the contact from becoming loose.**

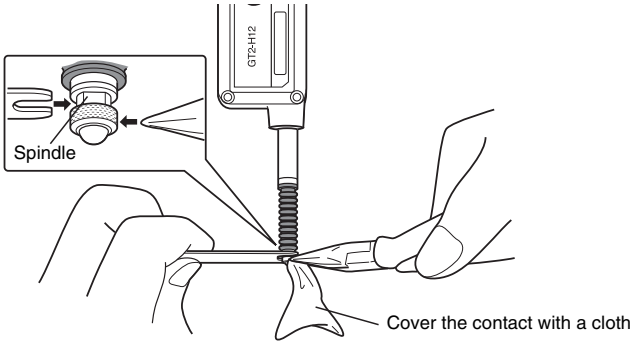
3 **Check that you cannot easily remove the contact by hand.**

A4 Replacing the Dust Boot

This section describes the replacement of the dust boot. Remove the sensor head from the device before replacement.

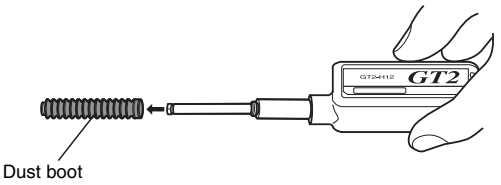
1 **Use the supplied key wrench to secure the spindle and pliers or similar tool to remove the contact.**

Pliers and similar tools cannot be used on the fluorocarbon contact (OP-80228). Remove this contact with your fingers.

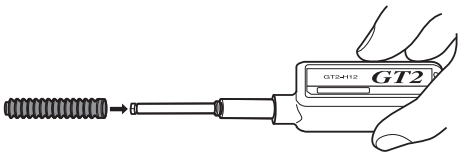


NOTICE	**If force is applied to twist the spindle, the sensor head may be damaged.When using a roller contact, only apply to the roller in the direction of movement and not along other axes.** **Cover the contact with a piece of cloth to cushion it while you grasp the contact with the pliers. Pliers and similar tools cannot be used on the fluorocarbon contact (OP-80228). Remove this contact with your fingers.**

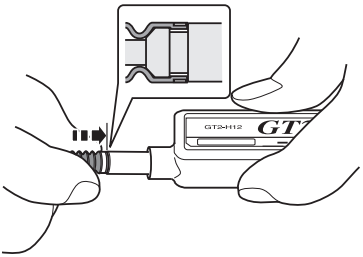
2 **Remove the dust boot.**



3 **Install a new dust boot.**

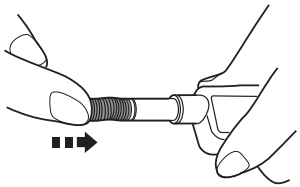


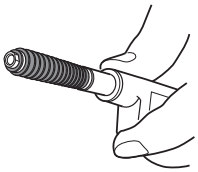
4 **Insert the dust boot until it fits in the spindle groove.**



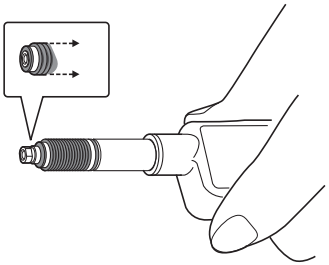
Reference Rotating the dust boot makes it easier to insert.

5 **As shown in the drawing below, press on the end of the dust boot with your fingers and pass the tip of the spindle through the dust boot.**

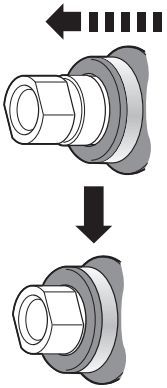




6 **Thread the spindle completely through the end as shown in the drawing below.**



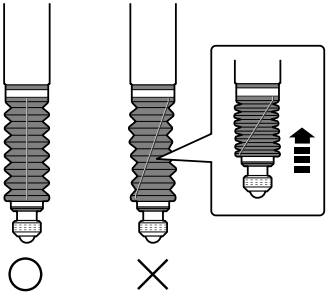
7 **Slide the dust boot so that it fits in the spindle groove.**



8 **As described in step 1, use the supplied key wrench to secure the spindle and use pliers or similar tool to remove the contact.**

9 **Rotate the dust boot either up or down until the ridges on the dust boot (which protrude slightly) line up completely straight.**

This is easier to check with the spindle pushed in.



NOTICE	**If the dust boot is not straight, the spindle may apply stress when it moves, which may damage the sensor head.**

GT2-S1/S5

The dust boots that comply with the sensor head models are shown below.

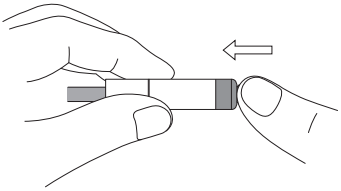
Sensor head	Model
GT2-S1	OP-88063
GT2-S5	OP-88065

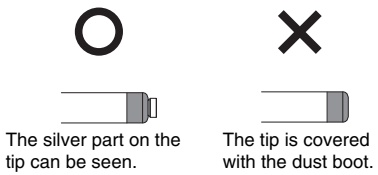
1 **Remove the contact. For the way to remove the contact, see "Replacing the contact."**

2 **Remove the dust boot. Pinch the dust boot between your fingers, and then pull it free.**

3 **Attach the new dust boot.**
Insert the dust boot until it reaches the groove at the back of the section for the dust boot.

Reference When installing the OP-88063 on the GT2-S1, it is easy to attach the dust boot by pressing it and the spindle as shown in the following figure.





The silver part on the tip can be seen.

The tip is covered with the dust boot.

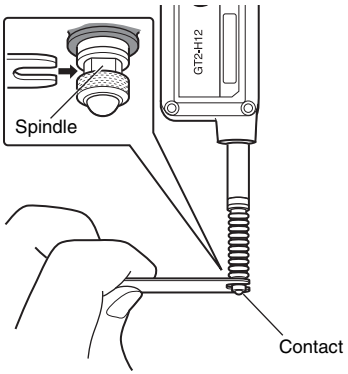
4 Attach the contact.

A5 How to Mount the Lift Lever

Mount the lift lever (OP-84397) between the spindle and the contact. Remove the sensor head from the device beforehand.

The lift lever cannot be mounted on the GT2-S1/S5.

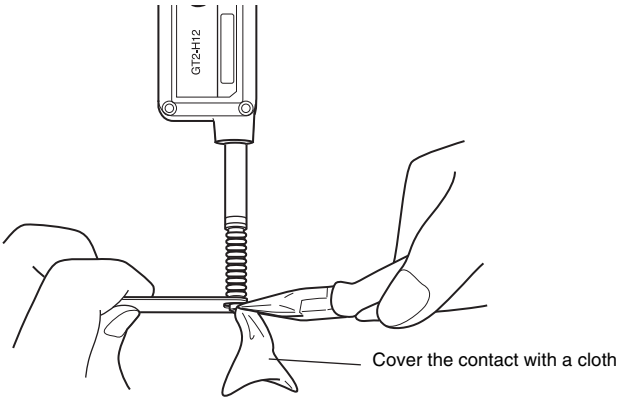
1 **Use the supplied key wrench to hold the spindle securely.**



NOTICE	**If force is applied to twist the spindle, the sensor head may be damaged.**

2 **Use pliers or a similar tool to grasp the contact and remove it.**

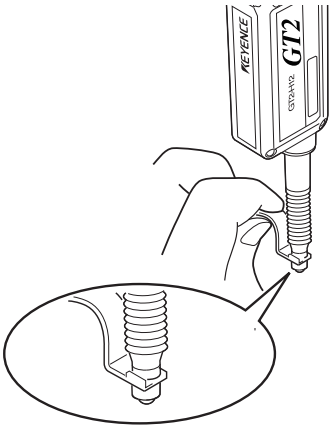
Pliers and similar tools cannot be used on the fluorocarbon contact (OP-80228). Remove this contact with your fingers.



NOTICE	• **Cover the contact with a piece of cloth to cushion it while you grasp the contact with the pliers. Pliers and similar tools cannot be used on the fluorocarbon contact (OP-80228). Remove this contact with your fingers.** • **Do not rotate the unit while performing these steps.**

3 **Mount the lift lever.**

After mounting, secure the lift lever in place with the spindle and remove or attach the contact.



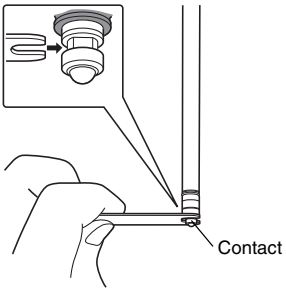
A6 How to replace the dust seal

To prevent foreign objects and liquid from entering the sensor head, be sure to replace the dust seal in a clean environment. Also, be sure to remove the sensor head from any metallic plates, etc. before replacing the contact.

1 **Use a clean cloth soaked in ethanol to wipe off any dirt on the sensor head.**

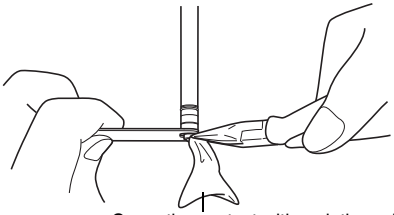
* If you are using the contact attached as standard when the GT2-PA12K/PA12 is shipped, there is no need to detach the contact. Accordingly, steps 2, 3, 9 and 10 in the procedure below can be skipped. Perform steps 4 to 8.

2 **Secure the spindle of the sensor head with the supplied key wrench.**



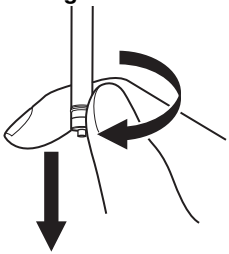
NOTICE	**The sensor head may be damaged if the spindle rotates.**

3 **Use pliers or similar to grip the contact and remove it. Fluoroplastic type contacts (OP-80228) should be removed by hand without using pliers or similar.**

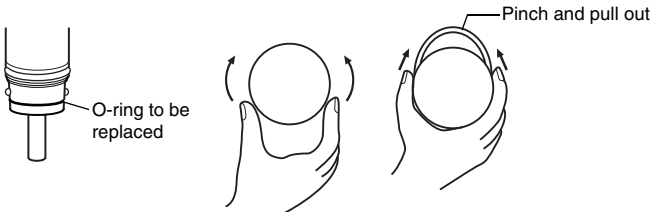


NOTICE	• **Cover the contact with a cloth or similar when gripping it with pliers. Fluoroplastic type contacts (OP-80228) should be removed by hand without using pliers or similar.** • **Ensure that work does not cause the main part to rotate.**

4 **Press the dust seal towards the sensor head and turn in the direction indicated by the arrow in the figure below to remove it.**



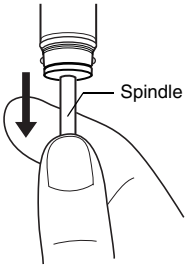
5 **Remove the O-ring to be replaced and clean the groove in which the O-ring was inserted.**



NOTICE	**Be careful not to damage the O-ring groove.** *** It may become damaged if tools are inserted into it.**

6 **Use a clean cloth soaked in ethanol to remove any dirt, grease or similar from the spindle.**

* Also make sure to remove any grease from the part of the spindle that is exposed when the spindle is pulled out or fully extended. The spindle has a fluorine-based coating. Wipe it gently when cleaning it.



NOTICE	**The replacement dust seal comes with specialized grease applied to it. Do not apply more grease or oil to it.**

7 **Fit the O-ring supplied with this product into the groove.**
Make sure that the O-ring does not have any hair, dust, or dirt on it.

NOTICE	**The O-ring may break or become damaged if it becomes caught on a tool or nail, or if it is pulled too much. We recommend completing this procedure by hand.**

8 **Follow the procedure in step 4 in reverse to attach the replacement dust seal. Fit the groove in the side of the replacement dust seal onto the protrusion on the sensor head, and turn it while pushing it in. Wipe off any fluorine-based grease which comes out. When the replacement dust seal has been attached, check that it does not come off when pulled.**

⚠ CAUTION	**Fluorine-based grease is used on the dust seal. If this gets on your hands and you then light a cigarette, gases will be produced which are harmful to humans.**

9 **As in step 1, use a key wrench to secure the spindle.**

10 **Attach the contact as in step 2.**

NOTICE	• **Secure the roller and offset contacts with the securing nut in the middle according to the direction you wish to use. Applying a thread locking agent is recommended to prevent the nut from becoming loose.** • **Be sure not to apply any force that is not in the rotation direction to the axis of the roller contact.** • **Do not attach or remove the contact when the sensor head main unit is fixed in place on a metal plate or similar. Be sure to remove the sensor head from the metal plate or similar before attaching or removing the contact.** • **Apply a tightening torque of 0.2 N•m or less to the contact. Note that a tightening torque of 0.002 N•m or less should be applied only for fluoroplastic type contacts (OP-80228). Applying a thread locking agent is recommended to prevent the nut from becoming loose.**

A7 Index

This index provides a list of terms used in this document. It is arranged in alphabetic order.

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Revision History

Date of printing	Version	Revision contents
February 2014	Official release	
January 2015	1st revision	
August 2016	2nd revision	
September 2019	3rd revision	
September 2020	4th revision	

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189054GB 2090-3 635GB Printed in Japan

635GB-3