

## INSTRUCTION MANUAL

### DIGITAL GAP SWITCH

#### GPS3 Series



- Please read this instruction manual carefully before using this product, particularly the section describing safety.
- Retain this instruction manual with the product for further consultation whenever necessary.

## Safety precautions

When designing and manufacturing a device using CKD products, the manufacturer is obligated to manufacture a safe product by confirming safety of the system comprising the following items:

- Device mechanism
- Pneumatic or water control circuit
- Electric control that controls the above

It is important to select, use, handle, and maintain the product appropriately to ensure that the CKD product is used safely.

Observe warnings and precautions to ensure device safety.

Check that device safety is ensured, and manufacture a safe device.

## WARNING

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1. This product is designed and manufactured as a general industrial machine part  
It must be handled by someone having sufficient knowledge and experience.
2. Use this product within its specifications.  
Consult with CKD for details when using the product beyond the unique specification range, outdoors, or in the following conditions or environment: Additionally, the product must not be modified or machined.
  - ① Use for special applications requiring safety including nuclear energy, railroad, aviation, ship, vehicle, medical equipment, equipment or applications coming into contact with beverage or food, amusement equipment, emergency shutoff circuits, press machine, brake circuits, or for safeguard.
  - ② Use for applications where life or assets could be adversely affected, and special safety measures are required.
3. Observe corporate standards and regulations, etc., related to the safety of device design and control, etc.  
ISO4414, JIS B 8370 (pneumatic system rules)  
JFPS2008(principles for pneumatic cylinder selection and use)  
Including High Pressure Gas Maintenance Law, Occupational Safety and Sanitation Laws, other safety rules, body standards and regulations, etc.
4. Do not handle, pipe, or remove devices before confirming safety.
  - ① Inspect and service the machine and devices after confirming safety of the entire system related to this product.
  - ② Note that there may be hot or charged sections even after operation is stopped.
  - ③ When inspecting or servicing the device, turn off the energy source (air supply or water supply), and turn off power to the facility. Discharge any compressed air from the system, and pay enough attention to possible water leakage and leakage of electricity.
  - ④ When starting or restarting a machine or device that incorporates pneumatic components, make sure that the system safety, such as pop-out prevention measures, is secured.
5. Observe warnings and cautions on the pages below to prevent accidents.

■ The safety cautions are ranked as "DANGER", "WARNING" and "CAUTION" in this section.



## DANGER

: When a dangerous situation may occur if handling is mistaken leading to fatal or serious injuries, or when there is a high degree of emergency to a warning.



## WARNING

: When a dangerous situation may occur if handling is mistaken leading to fatal or serious injuries.



## CAUTION

: When a dangerous situation may occur if handling is mistaken leading to minor injuries or physical damage.

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Note that some items described as "CAUTION" may lead to serious results depending on the situation. In any case, important information that must be observed is explained.

## Precautions with regard to guarantee

### ● Guarantee period

The guarantee period of our product shall be one (1) year after it is delivered to the place specified by the customer.

### ● Guarantee coverage

If any failure for which CKD CORPORATION is recognized to be responsible occurs within the above warranty period, a substitute or necessary replacement parts shall be provided free of charge, or the product shall be repaired free of charge at the plant of CKD CORPORATION.

However, the guarantee excludes following cases:

- ① Defects resulting from operation under conditions beyond those stated in the catalogue or specifications.
- ② Failure resulting from malfunction of the equipment and/or machine manufactured by other companies.
- ③ Failure resulting from wrong use of the product.
- ④ Failure resulting from modification or repairing that CKD CORPORATION is not involved in. Failure resulting from causes that could not be foreseen by the technology available at the time of delivery.
- ⑥ Failure resulting from disaster that CKD is not responsible of.

Guarantee stated here covers only the delivered products. Any other damage resulting from failure of the delivered products is not covered by this guarantee.

### ● Confirmation of product compatibility

Our customer shall be responsible of confirming compatibility of our product used in our customer's system, machinery or device.

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## 1. UNPACKING




### CAUTION

To prevent foreign matter from entering the product, unpack the product just before piping starts.

- (1) Check the model number imprinted on the product to make sure that the product you received is exactly the product you ordered.
- (2) Check the exterior of the product for any damage.
- (3) Before using the product, read the supplied documentation.

## 2. INSTALLATION


### 2. 1 Installation environment

 <b>CAUTION</b>	<p>a) Avoid installing this product where it is subject to ultraviolet rays.</p> <p>b) Prevent installation where the product is exposed to a direct sunlight.</p> <p>c) Avoid installation at places where there is excessive vibration or impact.</p> <p>d) Large drainage            Install the air dryer and drain separator before the air filter.            If there is a large drainage from the compressor. Hot and highly humid air could shorten the device life or result in corrosion.</p> <p>e) For compressor circuit of water lubrication method            Take measures to prevent chlorine-based substances from entering the compressed air.</p>
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(1) Avoid using this product under the following conditions.

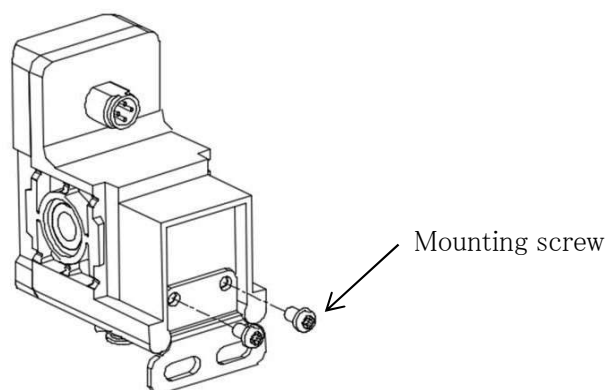
- Where ambient temperature and product temperature may fall outside the range of 0 to 50°C.
- The air may be frozen.
- The humidity is high and the temperature changes largely, causing dew condensation.
- Sea breeze or seawater is splashed onto the product.
- Avoid using the product in an atmosphere containing corrosive gas.
- Avoid using the product in an atmosphere where ozone is produced.

### 2. 2 Installation

 <b>CAUTION</b>	<p>a) Securing maintenance space            Please secure enough space for maintenance and inspection.</p> <p>b) Observe the following items when installing:</p> <ul style="list-style-type: none"> <li>• Install this product so the detection port faces downward.</li> <li>• Install this product at a position higher than the seating surface to prevent coolant from entering.</li> <li>• Provide enough space for adjustment, monitoring, and maintenance.</li> <li>• When installing this product on a device, check that no load is applied to the device.</li> <li>• Do not strike or bump this product.</li> <li>• When welding near this product, cover it to prevent spatter from coming in contact.</li> <li>• When housing this product in a box, provide an exhaust port so atmospheric pressure is maintained in the box.</li> </ul>
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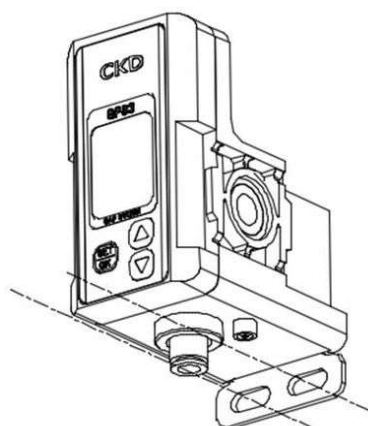
- (1) To install the bracket (model number: GPS3-B), please use the included mounting screws and install from the back of the product.

Mounting screw tightening torque should be  $1.2 \pm 0.12 \text{ N} \cdot \text{m}$ .



- (2) After mounting bracket (model number: GPS3-B), please attach it to the wall.

Install with M5 equivalent screws (2).



### 2. 3 Piping

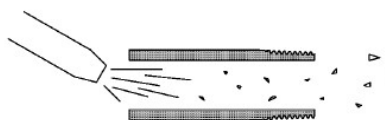


#### CAUTION

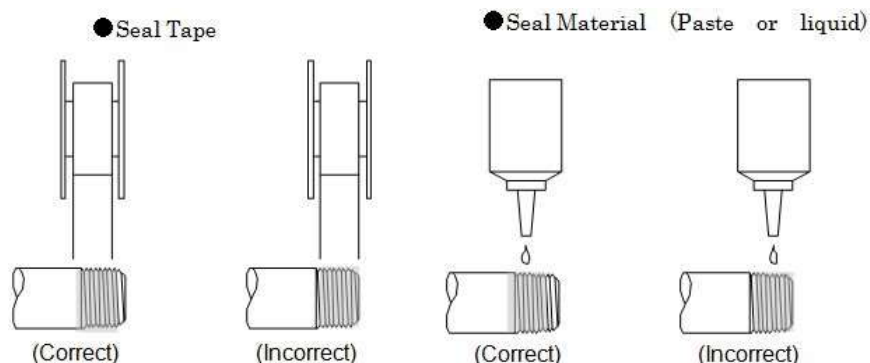
- a) Flush the air piping to be used sufficiently before connecting the regulator.  
If dust or sealant enters the product during piping work, this may cause the product to malfunction or operate incorrectly.
- b) If dust or sealant enters the product during piping work, this may cause the product to decline in performance.
- c) When connecting the piping, tighten with proper tightening torque.
- d) Use rust-resistant material such as nylon tubes or stainless steel pipes for piping material.
- e) When using steel pipes, securely fix the pipe to prevent excessive bending force from being applied to the connection.

## 2 INSTALLATION

- (1) Flush air into the pipe to blow out foreign substances and chips before piping.



- (2) When using seal material, take care to avoid getting it in the pipes or overflowing on the exterior surface of the pipes.



When applying fluororesin sealing tape to the screw threads, wind the tape two or three times around the threads but leave the one or two threads at the pipe end uncovered.

Firmly press the tape against the threads using the tip of your fingernail.

When applying liquid type seal material, apply the material to all the threads except one or two threads at the pipe end and take care not to apply too much of it.

Never apply the seal material to the female threads in the device side piping port.


- (3) Use appropriate torque to tighten the pipes when connecting them.

The purpose is to prevent air leakage and damage to bolts.

First tighten the bolts by hand to ensure that the threads are not damaged, then use a tool.

Port thread	Tightening torque N·m
Rc1/8	3 to 5

### 2. 4 Wiring

 <b>DANGER</b>	<p>a) Use with power supply voltage and output in the specified range.</p> <p>Applying a voltage that is outside of the specified range may cause malfunction, damage to the sensor, electrical shock, and/or fire.</p> <p>Do not use any load that exceeds the rated output.</p> <p>Using such a load may result in damage to the output part or fire.</p> <p>b) When carrying out electrical connections, please perform disassembling and assembling work after reading the Instruction Manual carefully and with full understanding of its contents.</p>
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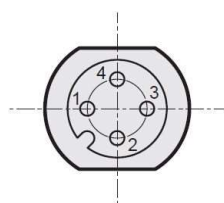
## WARNING

- a) Check the line color and terminal number when connecting wires.  
While an overcurrent protection circuit for the output transistor and a protection circuit for erroneous wiring, using diodes for preventing reverse connection, are implemented, these do not protect against all incorrect wiring. Incorrect wiring can result in malfunction, failure, or damage to the sensor. Check the instruction manual for line colors and terminal numbers in order to ensure correct wiring.
- b) Ensure that wires are properly insulated.  
Check that wires do not come into contact with other circuits, that no ground faults occur, and that the insulator between terminals is not defective.  
Otherwise, overcurrent may flow into the sensor, causing damage.



## CAUTION

- a) Observe the following items when wiring:
- When using a switching regulator for the power supply, ground the F.G. (frame ground).
  - Avoid using in the transient state, 1s after power is turned ON.
  - Take special care to prevent load short-circuits or incorrect wiring.  
The protective circuit is activated.
  - M12 connector pins are arranged as shown in lower figure.  
Take special care to prevent incorrect wiring.



**Connector pin array  
(body side)**

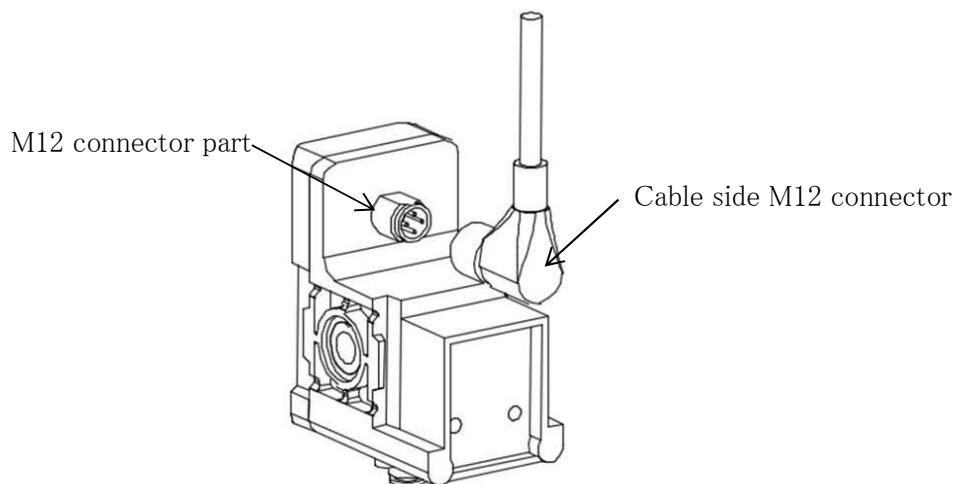
Pin No.	Lead wire color	Applications
1	Brown	Power supply +
2	White	Output 2
3	Blue	Power supply -
4	Black	Output 1 (C/Q*1)

\*1: For IO-Link compatible options

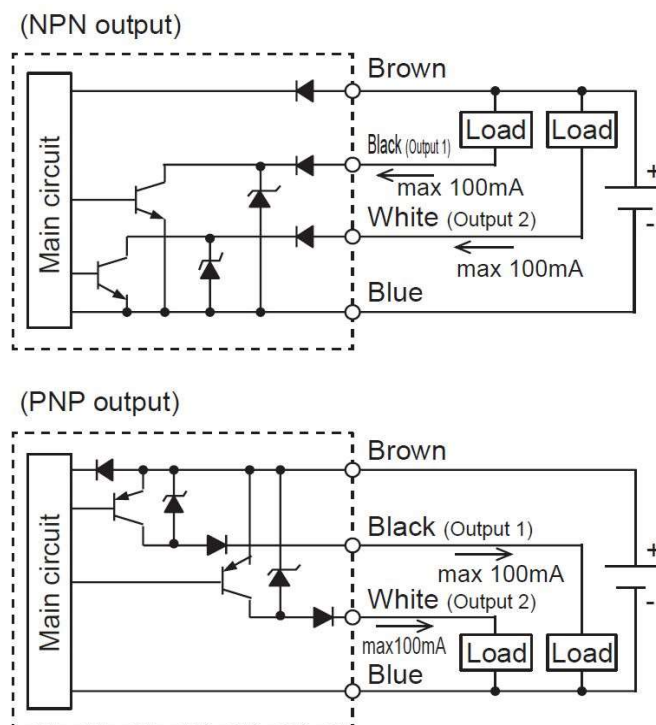
- When using a load with a large rush current, such as a motor, the protection circuit will activate. In this case, use a relay.
  - If there is a device (motor, welder) that generates a large surge near this product, insert a surge suppressor, such as a varistor, at the source of the surge.
  - If this product's lead wire is wired with the drive cable or power cable, it is affected by surge and noise deteriorating or damaging the sensor element in the switch. Use separate wiring.
- b) Keep unused wires from coming into contact with other wires.
- c) Do not apply load to the cable. It may cause breakage or breakage.  
Also, Use cable ties to fix the cable in place.
- d) Do not bind the sensor cable together with AC power wiring.

## 2 INSTALLATION

- (1) Connect the cable side connector to the M12 connector part of the product.  
 Turn the knurled portion of the cable side connector clockwise.  
 Connection is completed when the knurled part got out. Please check whether there is looseness.



- (2) NPN output type and PNP output type are available.  
 Wire the switch based on the output as shown in lower figure.  
 Use the load current of 100 mA or less.



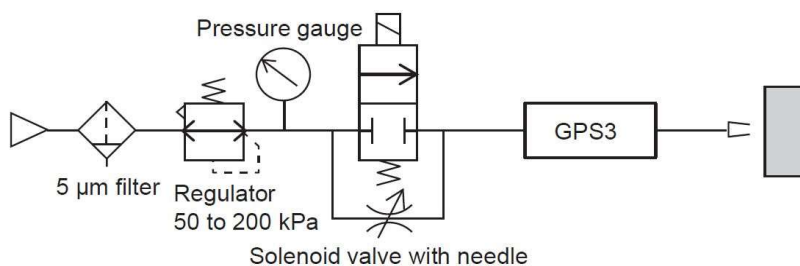
## 3. PROPER OPERATION

### 3. 1 Important safety instructions



#### WARNING

- a) Use the product in the range of conditions specified for the product.  
Contact CKD when using the product outside specifications or for special applications. Use of the product outside the specifications range may result in insufficient performance, and its safety cannot be guaranteed.
- b) This product is for industrial use. Must not be used in components or circuits for medical equipment or components that involve human lives.
- c) Confirm before use that the product will withstand the working environment.
  - This product cannot be used in environments where functional obstacles could occur.
  - The main material of this product is resin.  
Do not use in atmospheres where corrosive gases are generated.  
Such environments include high temperatures, chemical atmospheres, where chemical liquids, vibration, moisture, water dripping, coolant, or gas is present; where ozone is generated; chemical plants, semiconductor pre-processing, outdoors, etc.
  - Compressed air quality must satisfy JIS 1.4.1, "oilless clean dry air."
- d) This product cannot be used to display the absolute distance from the reference surface to the workpiece. It is a pressure sensor for calculating the detection output and displaying a reference value (dimensionless number).  
Refer to the characteristics data in the technical data for information about the relationship between reference value and distance.
- e) Check that the piping load or torque above 10 N · m is not applied to the body or piping sections.
- f) Working fluid must be clean air from which solids, water and oil have been sufficiently removed using a dryer, filter and oil mist filter. Never supply oiled air.
  - This product has a small orifice, so to prevent the entry of foreign matter, use an air filter for clean air (5 μm or less) with the recommended circuit shown below.



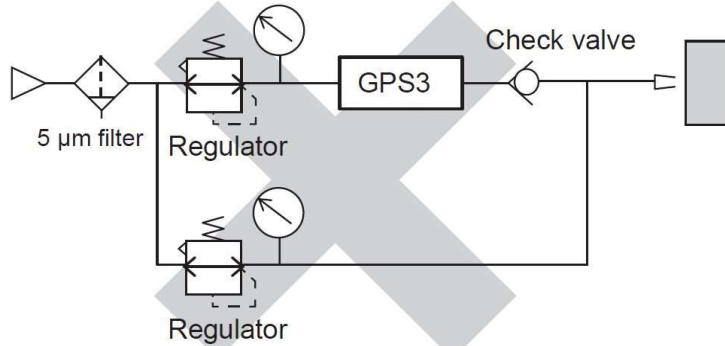
**Recommended circuit**

## **WARNING**

g) Do not use the following air circuits when blowing air from the detection nozzle.

•Circuit with check valve

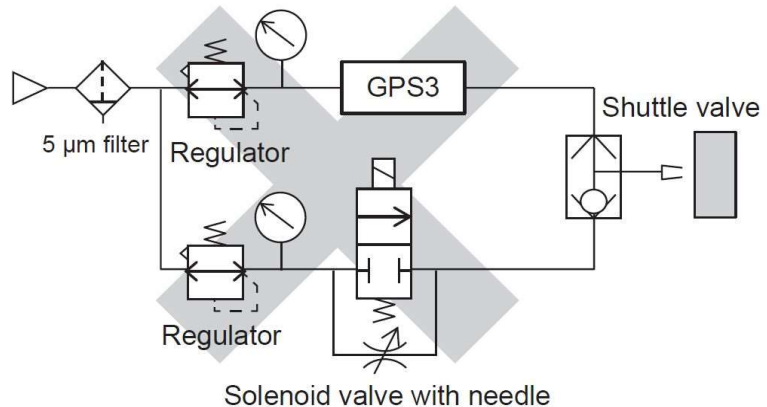
The check valve acts as exhaust resistance, and limits the adjustable range.



•Circuit with shuttle valve and 2-way valve

Residual pressure in the OUT side of the 2-way valve prevents correct detection.

Even if a 3-way valve is used, the shuttle valve may vibrate excessively.



## **CAUTION**

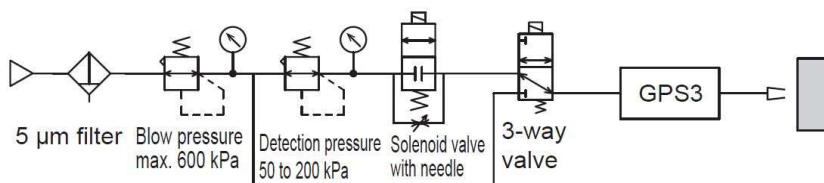
a) The entry of compressor oil and tarry substances may obstruct the flow of air and result in problems. Regularly inspect the compressor and discharge drainage.

b) Keep the air flow constant so coolant and oil do not flow back from the detection nozzle, or use a solenoid valve with needle and let in a small amount of air from the bypass as shown in the recommended circuit.

The solenoid valve with needle is shipped with the needle nut temporarily tightened. To prevent the nut from loosening or falling off during use, please tighten the nut yourself before use.

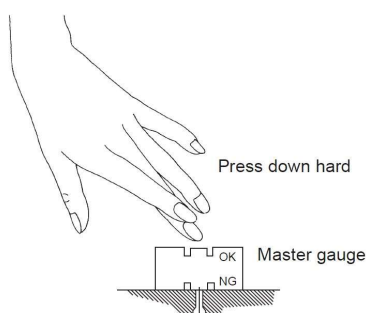
## CAUTION

- c) Swarf and grinder chips, etc., could clog the nozzle. Switch the supply pressure (max. 600 kPa) when transporting the workpiece during machining processes to prevent the detection nozzle from becoming clogged.



(When using high pressure, GPS3 will display "Er1" or "-H-" and the outputs will turn OFF)

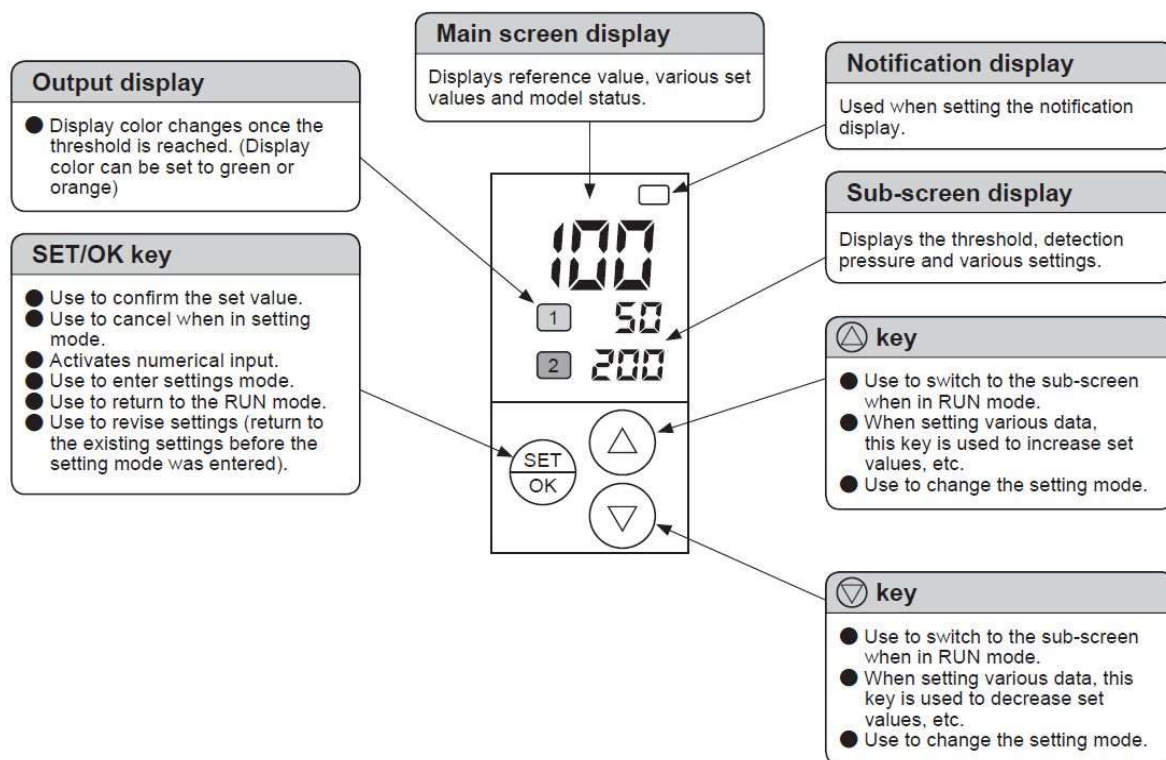
- d) Select an output format (NPN, PNP) matching the input unit of the programmable controller being used.
- e) Operation may be disabled if a capacitance load such as an AC/DC buzzer is connected to the load. A protection circuit is provided to prevent damage from incorrect wiring or overcurrent. A relay must be used when connecting a capacitance load.
- f) Using the master gauge and gap gauge
- Be careful not to be dangerous as it will be adjusted while operating the machine. Adjustment is 1) gauge set, 2) machine operation, 3) adjustment of this product, a total of 3 people are required.
  - Clearance cannot be set unless the master gauge or gap gauge is accurately pressed against the detection nozzle.



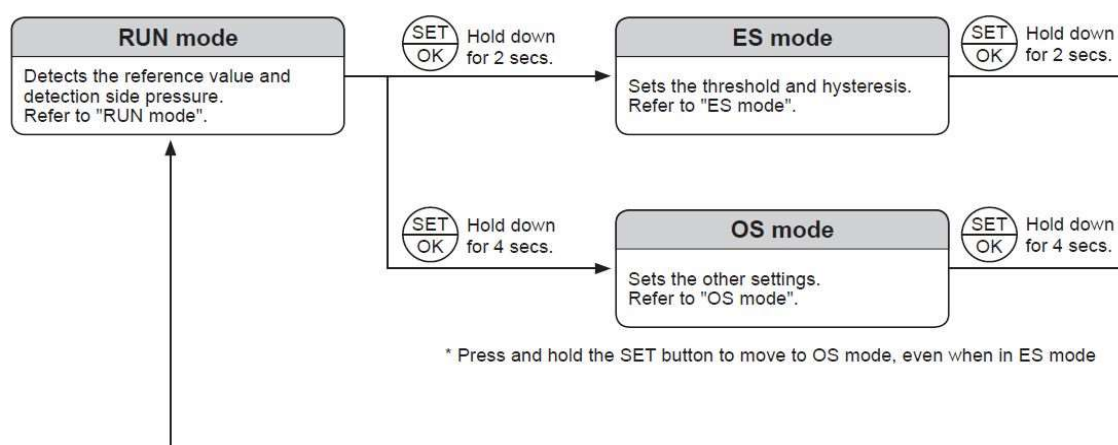
- g) One detection nozzle can be used for one of these product units.
- h) Immediately after work is started, the coolant from the nozzle may accumulate in the pipe and cause the sensor to turn ON for a short time. Wait for coolant to be discharged by the detection air before starting the machine.
- i) If the nozzle becomes blocked, remove the pipe on this product's side and blow out stuck foreign matter with an air gun. If foreign matter cannot be removed, poke a needle, etc., through the detection nozzle on the end.
- j) If the output setting value is changed, control system devices could operate unintentionally.  
Stop devices before changing settings.
- k) Ensure proper operation through periodic inspections.

## 4. OPERATION

### 4. 1 Names and functions of display / operation section



### 4. 2 Setting



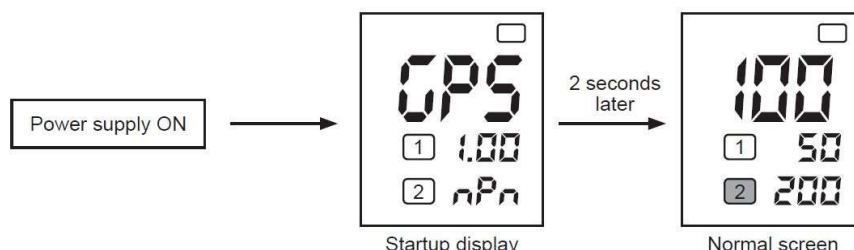


### 4. 3 RUN mode (normal operation)

- RUN mode is the regular display and output operation mode which succeeds the startup display when the power is turned on.

#### 4. 3. 1 Startup display

The following startup display appears when the power is turned on.

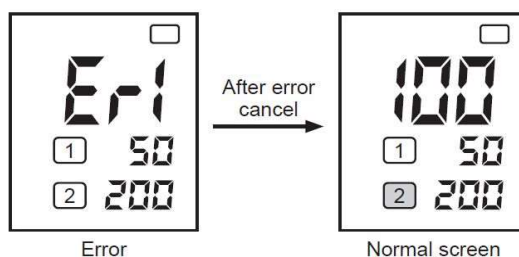


#### 4. 3. 2 Normal screen

Screen	Display		Display color
	GPS3-E (short range)	GPS3 (wide range)	
Main screen	10 to 200 FF (over display range upper limit) -FF (under display range lower limit)	20 to 500 FF (over display range upper limit) -FF (under display range lower limit)	Green display
Sub screen	Threshold (CH1/2): 10 to 200, no display Detection pressure kPa: 0 to 220 bar: 0 to 2.20 (export model option only) psi: 0 to 31.9 (export model option only) Output display: ON/OFF (IO-Link compatible option only)	Threshold (CH1/2): 20 to 500, no display Detection pressure kPa: 0 to 220 bar: 0 to 2.20 (export model option only) psi: 0 to 31.9 (export model option only) Output display: ON/OFF (IO-Link compatible option only)	Green display
CH1/2 output display	ON		2-color (green/orange) display * Freely configurable
Notification display	Blinking or OFF * Freely configurable (factory default setting: OFF)		Orange display

#### 4. 3. 3 Detecting abnormalities

At error detection, the main screen displays an error code indicating the content of the abnormality.  
(Error code display remains until the error is canceled.)



Error display	Content	Countermeasures
Er1	Sensor signal error (*1) (damage/disconnection/over pressure (more than 250 kPa)/P2≥P1 x 1.1)	Displayed when there is a disconnection or the sensor signal exceeds the full scale. Return supply pressure to within the rated pressure range.
Er2	Outside setting range (0-point calibration)	Turn the supply pressure OFF and conduct 0-point calibration at atmospheric pressure.
Er3	Outside setting range (various settings)	Configure within each setting range.
Er4	PIN entry error	Enter the configured PIN.
Er7	Temperature sensor error (*1)	Use within the operating temperature range (0 to 50°C).
Er8	Overcurrent (contact output) (*1)	Ensure the output current is 100 mA or less.
Er9	Memory error (ROM/RAM/EEPROM)	Contact CKD for details.
-H- (blinking)	Supply pressure is above 220 kPa (*1)	Lower the supply pressure to within the rated pressure range.
-L- (blinking)	Supply pressure is below 45 kPa (*1)	Raise the supply pressure to within the rated pressure range.
FF	Above display range upper limit	GPS3-E: Above 200, GPS3: above 500 Detect distance within the reference value display range.
-FF	Below display range lower limit	GPS3-E: Below 10, GPS3: below 20 Detect distance within the reference value display range.

(\*1: Output is OFF. Automatic recovery when back within specification range.)

## 4 OPERATION

### 4. 3. 4 Initializing

With the power supply OFF, press SET +  $\triangle$  +  $\nabla$  buttons simultaneously and turn the power ON.

Note 1) When initializing, make a note in advance of any of the current settings you wish to preserve.

Note 2) Display OFF at shipping (option code: T) products will switch to display ON when initialized.

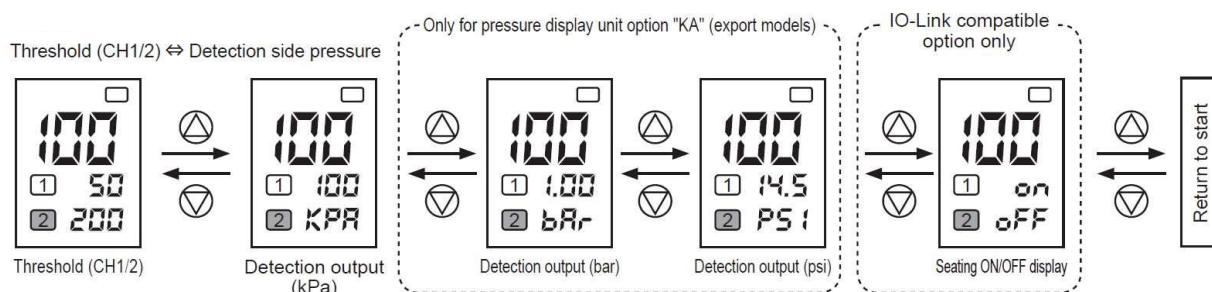
### 4. 4 Easy setting (in RUN mode)

- Frequently used settings can be configured during regular operation.

#### 4. 4. 1 Sub screen selection

- $\triangle$  or  $\nabla$  can be used to switch to the sub screen.

When option "KA" is selected, detection side pressure unit can be switched to bar, psi display and when "L" is selected, seating ON / OFF display can be switched.

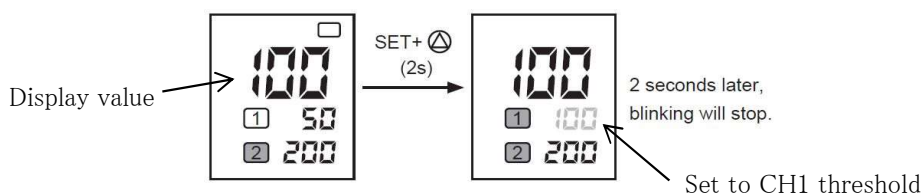


#### 4. 4. 2 CH1 auto threshold setting

- Display value can be set to the threshold of CH1.

Press and hold SET +  $\triangle$  (2 seconds or more) to set the current displayed value to the CH1 threshold.

Note) Er3 will be displayed on the sub screen if this is outside the configurable range.

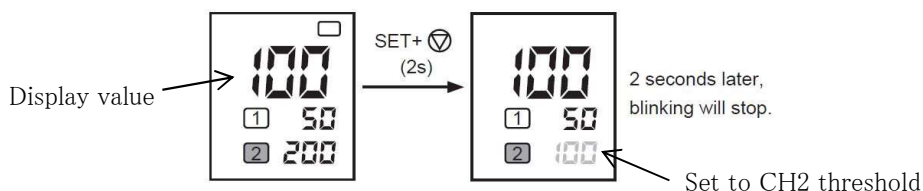


#### 4. 4. 3 CH2 auto threshold setting

- Display value can be set to the threshold of CH2.

Press and hold SET +  $\nabla$  (2 seconds or more) to set the current displayed value to the CH1 threshold.

Note) Er3 will be displayed on the sub screen if this is outside the configurable range.





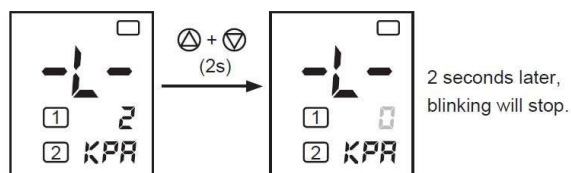
#### 4. 4. 4 0-point calibration

△ + ▽ (2 seconds or more) to set the detection side pressure 0-point calibration.

0-point drift can be calibrated.

Set the supply pressure to OFF before making this setting.

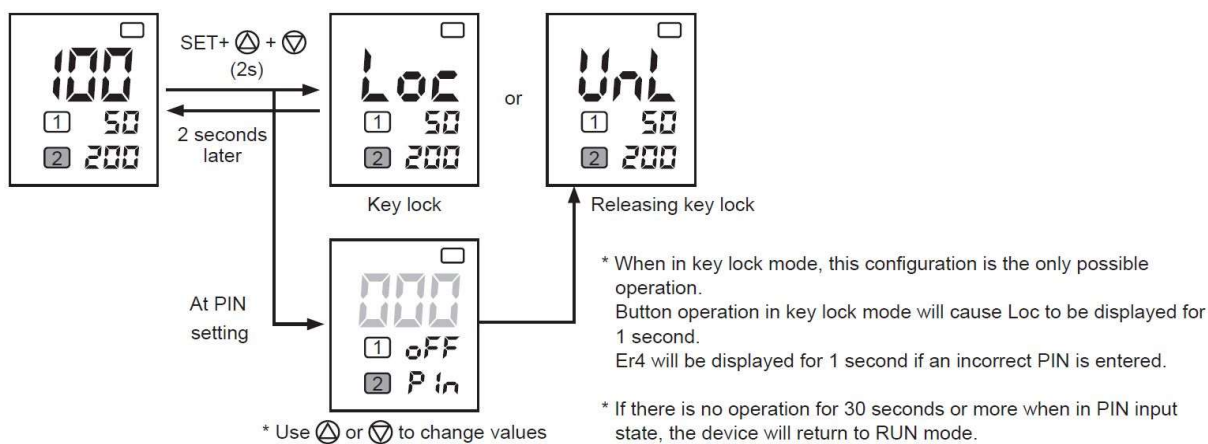
Note) Er2 will be displayed on the main screen if this is outside the configurable range.



#### 4. 4. 5 Key lock

Press and hold SET+ △ + ▽ (2 seconds or more) to configure key lock and release settings.

Take care during button operation to ensure that each setting is not modified incorrectly.



## 4 OPERATION

### 4. 5 ES mode

- Sets the threshold and hysteresis.

Regular operation is halted when entering ES mode.

Note) Outputs retain their status as of when the mode was entered.

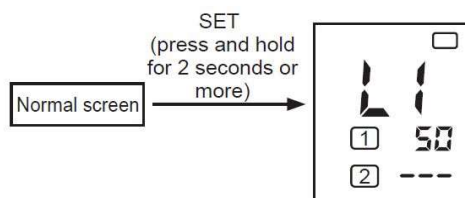
#### (1) ES mode list

Display	Setting items	Content
L1	CH1 threshold	CH1 threshold setting
H1	CH1 hysteresis	CH1 hysteresis setting
L2	CH2 threshold	CH2 threshold setting
H2	CH2 hysteresis	CH2 hysteresis setting

#### (2) Moving to ES mode

Press and hold SET (2 seconds or more) to move from the normal screen to ES mode.

After moving to ES mode, use  $\Delta$  or  $\nabla$  to switch among setting items.

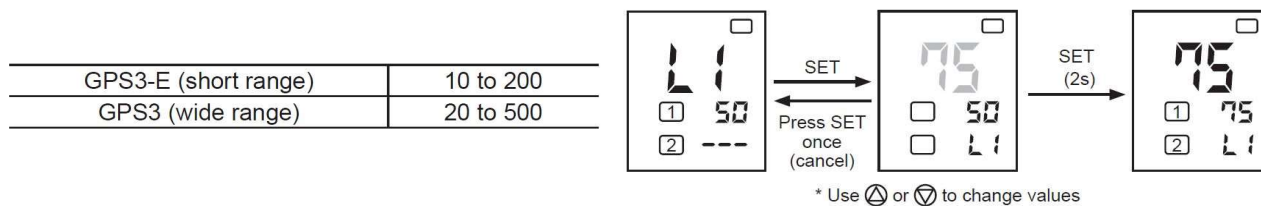


#### (3) Returning to the normal screen

Press and hold SET (2 seconds or more) to move to RUN mode.

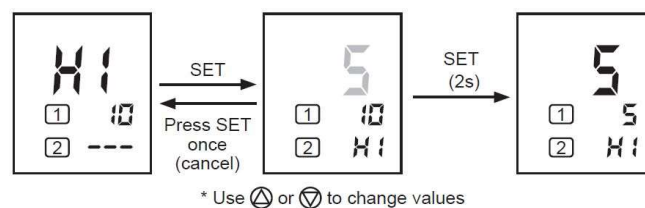
#### 4. 5. 1 CH1 threshold setting (Factory default: 50)

CH1 threshold should be set to no display or to a value in the table below.



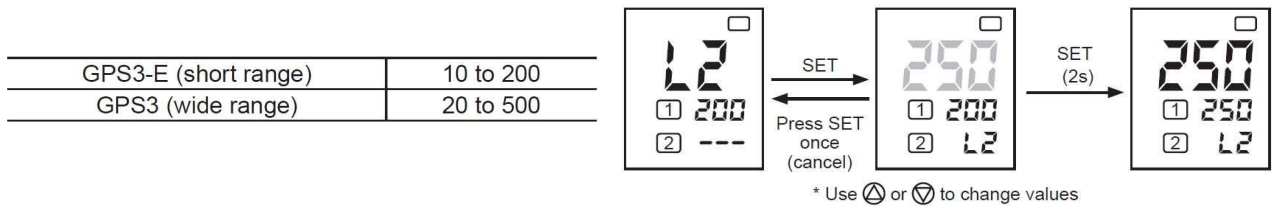
#### 4. 5. 2 Setting CH1 hysteresis (Factory default: 10)

CH1 hysteresis can be set from 1 to 20.



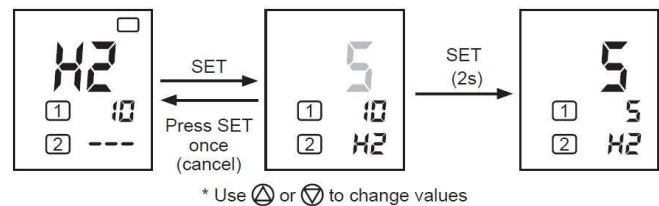
4. 5. 3 CH2 threshold setting (Factory default: 50)

CH2 threshold should be set to no display or to a value in the table below.



4. 5. 4 Setting CH2 hysteresis (Factory default: 10)

CH2 hysteresis can be set from 1 to 20.



4. 6 OS mode

- Sets other settings.

Regular operation is halted when entering OS mode.

Note) Outputs retain their status as of when the mode was entered.

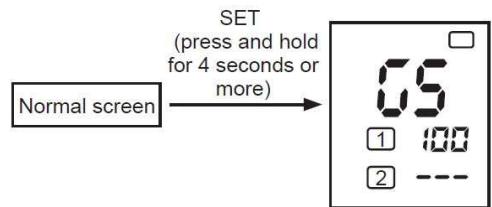
(1) OS mode list

Display	Setting items	Content
GS	Actual measurement calibration	Setting to match the master gauge clearance and the reference value
Cor	Display color	Setting of CH1/2 ON/OFF display colors
Por	Screen non-display	Setting of main/sub screen non-display
Inf	Notification display	Setting of orifice nozzle blockage notification display
Pin	PIN	Setting of PIN

(2) Moving to OS mode

Press and hold SET (4 seconds or more) to move from the normal screen to OS mode.

After moving to OS mode, use Δ or ∇ to switch among setting items.



(3) Returning to the normal screen

Press and hold SET (2 seconds or more) to move to RUN mode.

# 4 OPERATION

## 4. 6. 1 Actual measurement calibration

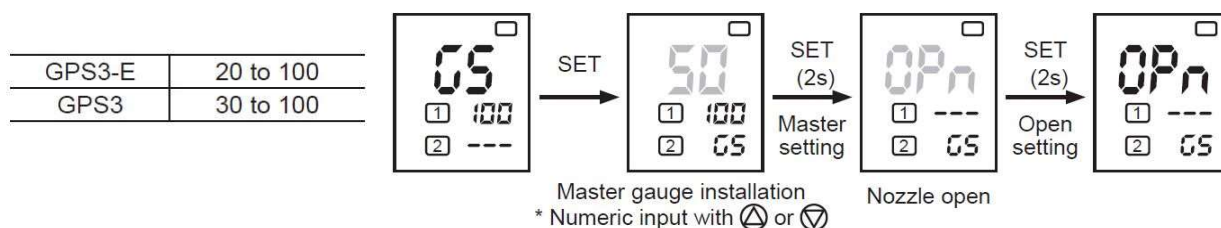
Displays the newly converted reference value based on the master setting and open setting pressure.

Setting order [1] → [2]

Note) The threshold must be reconfigured after conducting actual measurement calibration.

### [1] Master setting:

After installing the reference master gauge, enter the reference value numerically and record the pressure with the master gauge installed.



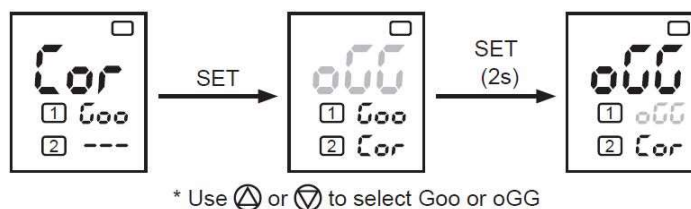
### [2] Open setting:

Record the pressure with the nozzle open.

Note) Fully open the nozzle when using this setting.

## 4. 6. 2 Setting of display color (Factory default: Goo)

Sets the CH1/2 ON/OFF display colors.



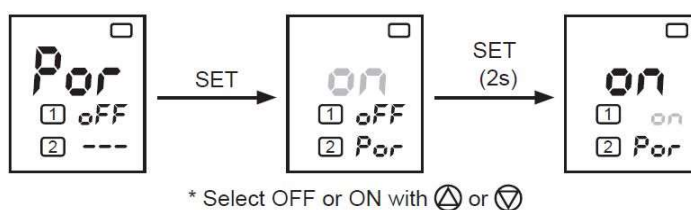
Setting contents	Display color		
	No output	CH1:ON	CH2:ON
Goo	green	orange	orange
oGG	orange	green	green

## 4. 6. 3 Setting of screen non-display (Factory default: OFF)

Sets the main/sub screen non-display settings.

Non-display for all except output display and notification display.

(With this setting ON and 3 minutes without key operation)



#### 4. 6. 4 Setting of notification display (Factory default: OFF)

- You can set the indication of a blockage in the detector air flow path.

Configure the variation in detection side pressure (%) required to activate this function.

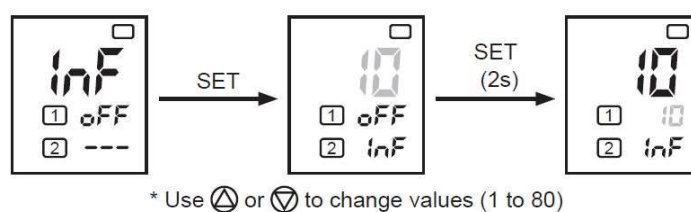
- If the detection side pressure exceeds the set ratio:  
→ Display blinks slowly (nozzle may be blocked). (Note1)
- If the detection side pressure falls below the set ratio:  
→ Display blinks rapidly (internal orifice may be blocked)

Note1) If blinking with no workpiece present.

(Blinking also occurs during regular contact due to the detection structure)

Set the supply pressure to ON and set the nozzle to the open state.

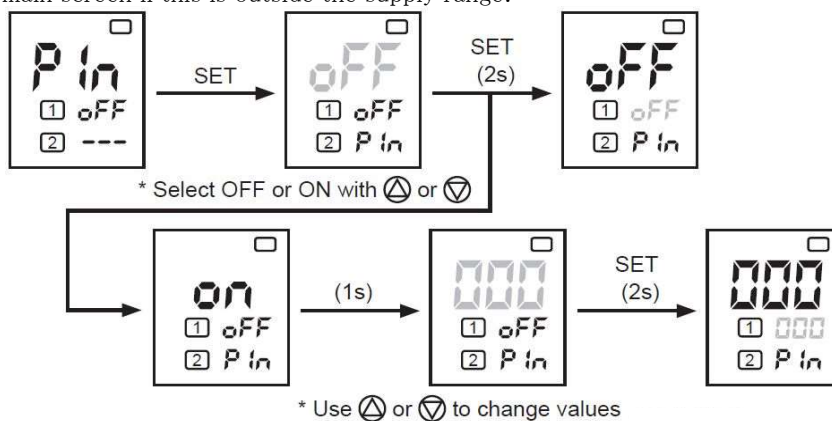
Note2) Er3 will be displayed on the main screen if this is outside the supply range.



#### 4. 6. 5 Setting of PIN (Factory default: OFF)

Sets the PIN (000 to 999) required to release the key lock.

Note) Er3 will be displayed on the main screen if this is outside the supply range.



## 4

### OPERATION

#### 4. 7 IO-Link parameter specification

When selecting IO-Link communication compatible option, please use IO-Link compatible control equipment (PLC etc.) and IO-Link master.

For the parameter specification of IO-Link, refer to the next section.

IODD file can be downloaded from the CKD website (<https://www.ckd.co.jp/>).

##### 4. 7. 1 General

Descriptions	Details
Communication protocol	IO-Link
Communication protocol version	V1.1
Transmission bit rate	COM2 (38.4kbps)
Port	Class A
Process data length (input)	4 byte
Process data length (output)	0 byte
Minimum cycle time	5 ms
Data storage	1 kbyte
SIO mode support	Yes
Device ID	See the section 4.7.2 ① Identification

#### 4. 7. 2 On demand data

##### ①Identification

Vendor ID: 855 (Dec) / 0x357 (Hex)

Device ID: See table below

Device ID (Dec)	Device ID (Hex)	Model Number
2166785	0x211001	GPS3-L
2166786	0x211002	GPS3-L-KA
2166787	0x211003	GPS3-EL
2166788	0x211004	GPS3-EL-KA

Index (Hex)	Sub Index	Item	Value (Dec)	Access ※1	Length	Format
0x0010	0	Vendor Name	CKD Corporation	R	15byte	String
0x0011	0	Vendor Text	<a href="https://www.ckd.co.jp/">https://www.ckd.co.jp/</a>	R	22byte	String
0x0012	0	Product Name	GPS3-EL-T-KA ※2	R	Max40byte	String
0x0013	0	Product ID	GPS3-EL-KA ※2	R	Max12byte	String
0x0014	0	Product Text	Digital Gap Switch, 0.02mm to 0.15mm ※2	R	Max64byte	String
0x0015	0	Serial Number	8301 ※2	R	4byte	String
0x0016	0	Hardware Version	A01 ※2	R	3byte	String
0x0017	0	Firmware Version	2.03 ※2	R	4byte	String
0x0018	0	Application Specific Tag	***	R/W	32byte	String

※1. R: Read only, R/W: Read/Write

※2. Reference example (GPS3-EL-KA Type)



# 4 OPERATION

## ②Parameter and commands

### Common Specifications

Index (Hex)	Sub Index	Item	Value (Dec)	Access ※1	Length	Format	DS ※2
0x0002	0	System Command	See the table below	W	1byte	UInteger8	-
0x000C	0	Device Access Locks	0x0000: Unlocked 0x0002: Data storage locked	R/W	2byte	Record	●
0x0020	0	Error Count	0	R	2byte	UInteger16	-
0x0024	0	Device Status	0	R	1byte	UInteger8	-
0x0025	0	Detailed Devices Status	See the Section 4.7.5 Diagnosis	R	24byte	ArrayT of 3OctetString	-

※1 R: Read only, W: Write only, R/W: Read/Write

※2 [ ● ] means that the value of the Index is saved in Data Storage.

### System Command

Value (Hex)	Command	Description
0x82	Restore Factory Settings	Set every parameters to Factory Settings.
0xA0	CH1 Auto Threshold Setting	Set the current display value as CH1 threshold
0xA1	CH2 Auto Threshold Setting	Set the current display value as CH2 threshold
0xA3	0-Point Correction	Recalibrate the 0-pt. (Value the detection display)
0xA4	Master Setting	Records the pressure at the time of the master gauge installation with Master Value Setting
0xA5	Open Setting	Records the pressure when nozzle is opened with Master Value Setting



## Individual Specifications

Index (Hex)	Sub Index	Item	Value (Dec ) ※3	Access ※1	Length	Format	DS ※2
0x0040	0	Sub Screen Selection	0:Threshold 1:kPa 2:bar ※4 3:psi ※4 4:ON/OFF Display (contact output display)	R/W	1byte	UInteger8	●
0x0044	0	Key Lock	0:OFF 1:ON	R/W	1byte	UInteger8	●
0x0045	0	Key Lock Status	0:Unlock 1:Lock 2:PIN Lock	R	1byte	UInteger8	●
0x0050	0	CH1 Threshold Setting	0:OFF 20~500 (50) ※5 10~200 (50) ※6	R/W	2byte	UInteger16	●
0x0051	0	CH1 Hysteresis Setting	1~20 (10)	R/W	1byte	UInteger8	●
0x0054	0	CH2 Threshold Setting	0:OFF 20~500 (50) ※5 10~200 (50) ※6	R/W	2byte	UInteger16	●
0x0055	0	CH2 Hysteresis Setting	1~20 (10)	R/W	1byte	UInteger8	●
0x0060	0	Master Value Setting	30~100 (50) ※5 20~100 (50) ※6	R/W	2byte	UInteger16	-
0x0064	0	Setting of Display Color	0:Goo 1:oGG	R/W	1byte	UInteger8	●
0x0065	0	Setting of Screen Non-Display	0:OFF 1:ON	R/W	1byte	UInteger8	●
0x0068	0	Setting of Announce Level (%)	1~80 (50)	R/W	1byte	UInteger8	-
0x0069	0	Setting of Announce	0:Announce OFF 1:Announce ON	R/W	1byte	UInteger8	-
0x006C	0	Key Lock PIN Enable	0:OFF 1:ON	R/W	1byte	UInteger8	●
0x006D	0	Set The PIN	000~999	R/W	2byte	UInteger16	●

※1 R: Read only, W: Write only, R/W: Read/Write

※2 [ ● ] means that the value of the Index is saved in Data Storage.

※3    area: Factory Settings

※4 This value is able to be set only in option "KA"

※5 This value is able to be set only in model number of GPS3-L-□

※6 This value is able to be set only in model number of GPS3-EL-□

# 4 OPERATION

## 4. 7. 3 Process data IN

Bit	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
	MSB															LSB
Data name	Ref. value															
Data range	20 to 500 ※1 10 to 200 ※2															
Format	UInteger16															

※1 This value is able to be set only in model number of GPS3-L-□

※2 This value is able to be set only in model number of GPS3-EL-□

Bit	15	14	13	12	11	10	9	8
Data name	Error	Warning	Alert display output (interior orifice may be clogged)	Alert display output (nozzle may be clogged)	Below display range lower limit	Beyond display range upper limit	Control output CH2	Control output CH1
Data range	True/False							
Format	Boolean							

Bit	7	6	5	4	3	2	1	0
Data name	Detection pressure value ※3							
Data range	-5~250 ※5							
Format	Integer8							

※3 For products in which the pressure value can be confirmed on the detection side, "V2.0" is stamped on the top right of the product nameplate. (Since Bit 0 to 7 is not used for products without the above printing, the pressure value cannot be confirmed.)

※4 IODD files can be downloaded from the CKD website. Depending on whether ※3 is printed above, the applicable IODD file will be different. Please apply the correct ver. IODD file to take advantage of the product features.

If you apply the IODD file ver.2 to a product that cannot confirm the pressure value on the detector side (that is, a product that does not use Bit 0 to 7), the process data value will be "0" and the display value on IODD will be "123kPa" (a fixed value), but it is not the actual value.

Also, if IODD file (ver.1) is applied to a product that uses Bit 0 to 7 on the side where the pressure value is detected, the IODD value will not be displayed as there is no field to display the value.

※5 The display value on the IODD (unit: kPa).

Refer to the following for details on the relationship between the process data and the pressure value on the detection side.

Relationship between Process data and Detection pressure

Process data(Bit0~7)		-128~+127
Detection pressure	kPa	-5~250
	bar	-0.05~2.5
	psi	-0.7~36.3

Detection pressure (kPa)=Process data (Bit0~7) value + 123

Detection pressure (bar)=(Process data (Bit0~7) value + 123) / 100

Detection pressure (psi)=(Process data (Bit0~7) value + 123) / 6.895

#### 4. 7. 4 Observation

Index (Hex)	Sub Index	Item	Value (Dec)	Access ※1	Length	Format
0x0041	0	Detection Output (kPa)	0~220	R	2byte	UInteger16
0x0042 ※2	0	Detection Output (bar)	0~220 (0.00~2.20bar)	R	2byte	UInteger16
0x0043 ※2	0	Detection Output (psi)	0~319 (00.0~31.9psi)	R	2byte	UInteger16
0x007A	0	Temperature	0~50	R	1byte	UInteger8
0x0405	0	Operating Time (h)	0~4.29 Billion	R	4byte	UInteger32

※1 R: Read only

※2 This value is able to be set only in option "KA"

#### 4. 7. 5 Diagnosis

Event Code (Hex)	Type	Device Status	Cause	Treatment method
0x4000	Error	Out of specification	Temperature sensor error	Use within the operating temperature range. (0 to 50 °C)
0x4210	Warning	Failure	Device Temperature Over-Run	Lower the temperature of the device.
0x5000	Error	Failure	Memory Trouble (ROM・RAM・EEPROM)	Contact CKD for details.
0x5111	Warning	Out of specification	Power Supply Voltage Descent (18V below)	Make power supply voltage the specifications range.
0x7710	Error	Failure	Overcurrent (contact output)	Ensure the output current is 100 mA or less.
0x8021	Error	Function check	Communication Setting Error	Communicate and setting after finishing hand-operated operation.
0x8C20	Error	Failure	Disconnection / Sensor Signal Exceeds the Full-scale	Return supply pressure to within the rated pressure range.
0x8D00	Error	Failure	Supply pressure is above 220 kPa	Lower the supply pressure to within the rated pressure range.
0x8D01	Error	Failure	Supply pressure is below 45 kPa	Raise the supply pressure to within the rated pressure range.

## 5. MAINTENANCE

### 5. 1 Periodic inspection

#### (1) Daily inspection

- Before operating the product, confirm proper operation.
- Before using this product, it is operating correctly, please perform the operation confirmation.

#### (2) Periodic inspection

- To operate the product in its optimal operating state, carry out the periodic inspection normally once every six months.
- Check that no leak occurs in the piping.

### 5. 2 Disassembly and reassembly



#### **WARNING**

- a) Before disassembling or cleaning the orifice, turn the power OFF, stop the supply of compressed air and make sure that there is no residual pressure.
- b) Do not disassemble the product as it will affect performance.



#### **CAUTION**

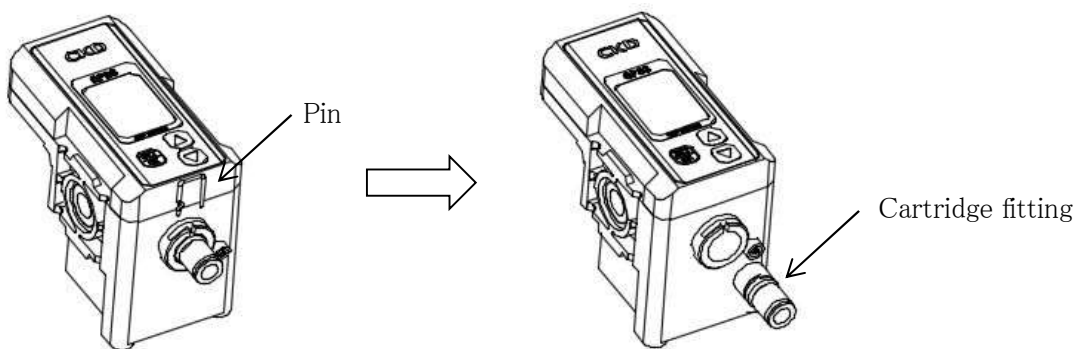
Read instructions and precautions enclosed with the product before starting use or disassembly.

#### 5. 2. 1 Orifice cleaning

It is possible to clean foreign matter accumulated in the internal orifice.

##### ■ Disassembly procedure

- 1) Please remove the pin from the product body with a thin tool such as a flathead screwdriver.
- 2) Pull the cartridge fitting and pull it out from the product body.

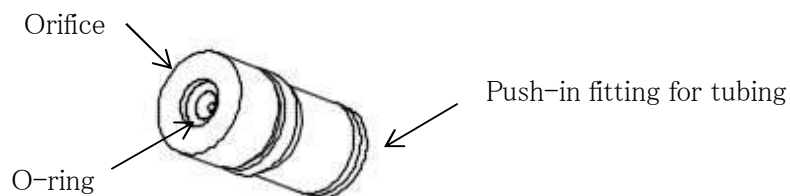


■ Cleaning procedure

- 1) Remove the O-ring from the cartridge fitting.
- 2) Please clean the orifice section of the cartridge fitting.

Note) Wipe off the internal orifice with air blow or a soft cloth.

If the orifice is scratched, it will not be able to detect normally.



■ Assembly procedure

- 1) Fit the O-ring into the orifice section.
- 2) Insert the cartridge fitting into the product body.
- 3) Please insert the pin all the way from the front of the product.

Note) After disassembly / cleaning, please re-set threshold value.

## 6. TROUBLE SHOOTING

Trouble symptom	Major Causes	Remedies
Output does not turn ON	Supply pressure error	Supply rated pressure. (50 kPa to 200 kPa)
	Setting is not correct	Perform setting correctly.
	Air leakage	Connect piping correctly and eliminate any air leakage.
Output stays ON (Does not turn OFF)	Setting is not correct	Perform setting correctly.
	Clogged piping	Apply pressure lower than the withstand pressure to eliminate the cause of clogging of piping.
The indicator LED operates correctly. Output does not turn ON	Incorrect wiring	Connect wires correctly.
	Selected product is not correct	Check if the output specification (NPN / PNP) is correct.



## 7. PRODUCT SPECIFICATIONS

### 7. 1 Product specifications

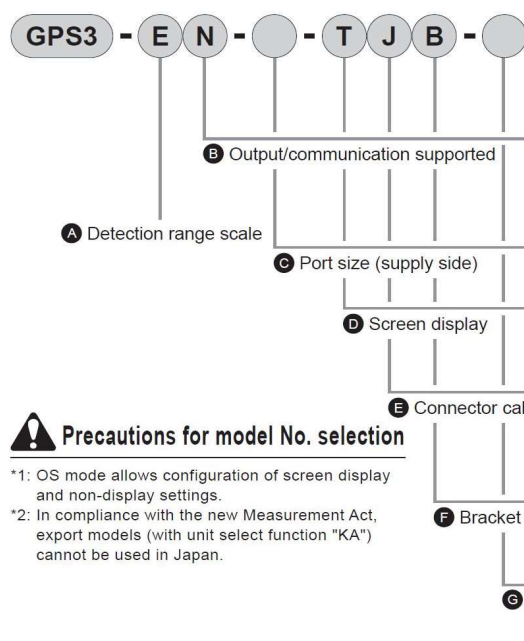
Descriptions	Short range GPS3-E	Wide range GPS3
Working fluid	Compressed clean air (after 5 μm filter, lubrication not possible)	
Working pressure	kPa 50 to 200	
Proof pressure	kPa 600	
Detection range	mm 0.02 to 0.15	0.03 to 0.4
Reference value display range	10 to 200 (display unit 1)	20 to 500 (display unit 1)
Repeatability	mm ±0.01	±0.01 (detection range min to 0.1)
Hysteresis	Variable (reference value variable from 1 in increments of 1. Factory default 10)	
Temperature characteristics (base temperature +25°C)	0.015	0.030 mm or less (detection distance min to 0.3 mm) 0.1 mm or less (detection distance 0.3 to 0.4 mm)
Detection nozzle	Single hole nozzle φ1.5	
Power supply voltage	V 24 DC ±10% (18 to 30 DC) *1, ripple P-P 10% or less (with reverse connection protection)	
Current consumption	mA 25 or less (35 or less) *1	
Output/communication supported	2-point output (NPN, PNP open collector)*2	
Output rating	30 VDC, 100 mA or less	
Internal voltage drop	V 2 or less (using 100 mA)	
Short-circuit protection circuit	Equipped	
Display	Reference value, thresholds (2-point), output status indicators (2-point), detection side pressure, blockage indication	
Insulation resistance	No failure after 1 minute of 1,000 VAC application	
Withstand voltage	10 MΩ and over at 500 VDC megger	
Ambient temperature	°C 0 to 50 (no freezing or condensation)	
Degree of protection	IP67 equivalent	
Port size	Supply port: Rc1/8, detection port: push-in fitting φ6	
Wiring	M12 connector, 4-pin	
Weight	g 128 (excluding cable)	
Air consumption	L/min Less than 9	Less than 22

\*1: Values in ( ) are when communication support option L is selected

\*2: Refer to page 15 for communication specifications.

### 7. 2 How to order

#### ●Discrete



Code	Content
<b>A Detection range scale</b>	
Blank	0.03 to 0.4
E	0.02 to 0.15
<b>B Output/communication supported</b>	
N	NPN open collector (2-point)
P	PNP open collector (2-point)
L	IO-Link communication
<b>C Port size (supply side)</b>	
Blank	Rc1/8
<b>D Screen display</b> *1	
Blank	Displayed (factory default)
T	Non-displayed (factory default)
<b>E Connector cable</b>	
Blank	5 m connector cable attached (One side elbow)
D	5 m connector cable attached (Both sides elbows/straight)
J	Without connector cable
<b>F Bracket</b>	
Blank	Without bracket
B	With bracket
<b>G Pressure display unit</b> *2	
Blank	SI units only (domestic model)
KA	With unit switching function (export model)

# 7 PRODUCT SPECIFICATIONS

## ● Manifold

MGPS3 - 2 E N - - T J B -

A Station No.

B Detection range scale

C Output style

D Port size (supply side)

E Screen display

F Connector cable

G Bracket

H Pressure display unit

### ! Precautions for model No. selection

\*1: OS mode allows configuration of screen display and non-display settings.

\*2: In compliance with the new Measurement Act, export models (with unit select function "KA") cannot be used in Japan.

Code	Content
<b>A Station No.</b>	
2	2 stations
3	3 stations
4	4 stations
5	5 stations
6	6 stations
<b>B Detection range scale</b>	
Blank	0.03 to 0.4
E	0.02 to 0.15
<b>C Output style</b>	
N	NPN open collector (2-point)
P	PNP open collector (2-point)
L	IO-Link communication
<b>D Port size (supply side)</b>	
Blank	Rc1/8
<b>E Screen display</b> *1	
Blank	Displayed (factory default)
T	Non-displayed (factory default)
<b>F Connector cable</b>	
Blank	5 m connector cable attached (One side elbow)
D	5 m connector cable attached (both sides elbows/straight)
J	Without connector cable
<b>G Bracket</b>	
Blank	Without bracket
B	With bracket
<b>H Pressure display unit</b> *2	
Blank	SI units only (domestic model)
KA	With unit switching function (export model)

## ● Unit

### How to order

UGPS3 - 2 E N R - - T J -

A Station No.

B Detection range scale

C Output style

D Regulator/solenoid valve assembly position

E Port size (supply side)

F Screen display

G Connector cable

H Pressure display unit

### ! Precautions for model No. selection

\*1: The assembly uses regulator for R1000 low-pressure and solenoid valve with needle for GPS2-AB3X-2H-FL-DC24V. Left or right assembly position depends on whether the GPS3 display is on the left or right.

\*2: Port size for regulator and solenoid valve with needle. (The port size for single GPS3 units is Rc1/8)

\*3: OS mode allows configuration of screen display and non-display settings.

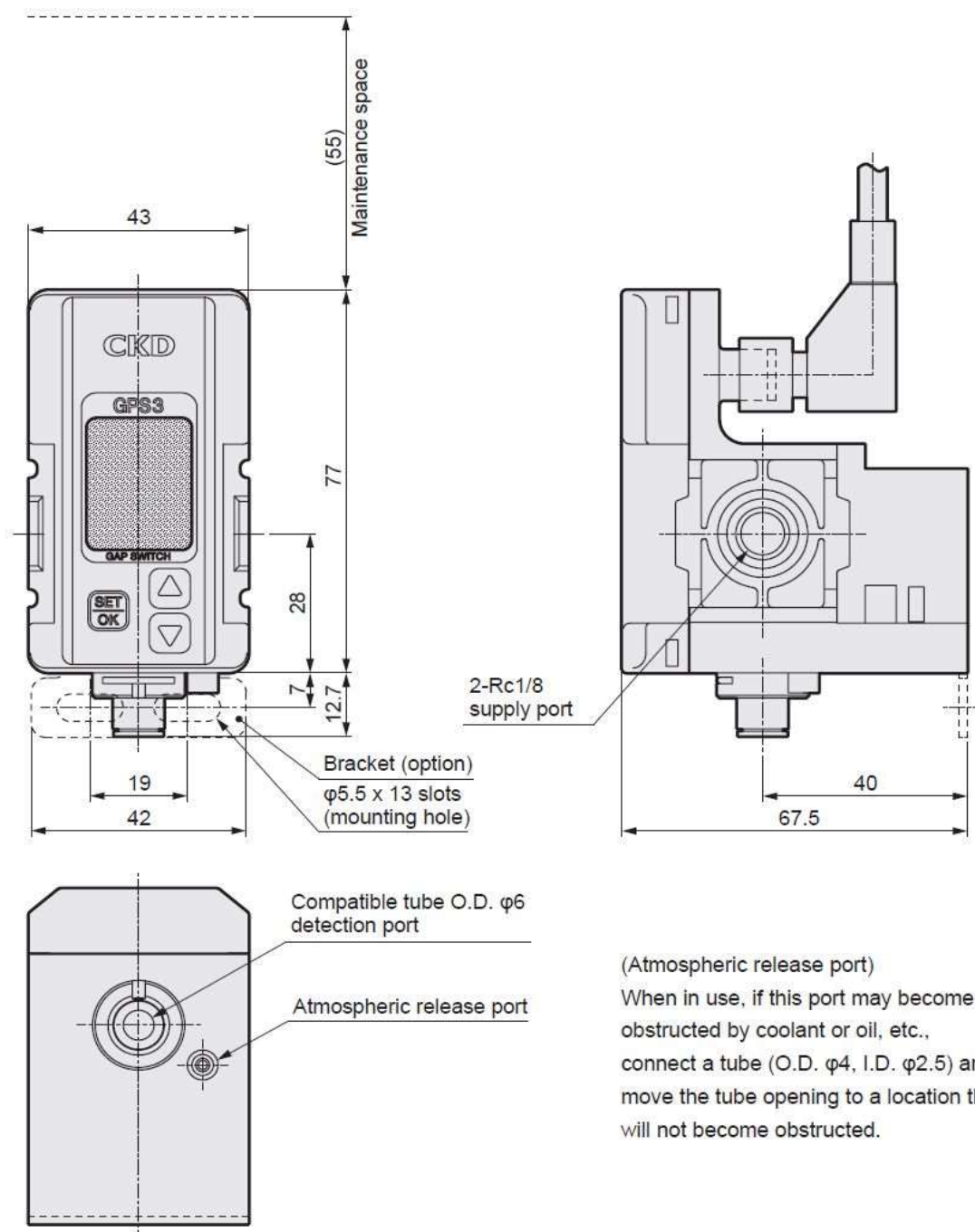
\*4: In compliance with the new Measurement Act, export models (with unit select function "KA") cannot be used in Japan.

Code	Content
<b>A Station No.</b>	
1	1 station
2	2 stations
3	3 stations
4	4 stations
5	5 stations
6	6 stations
<b>B Detection range scale</b>	
Blank	0.03 to 0.4
E	0.02 to 0.15
<b>C Output style</b>	
N	NPN open collector (2-point)
P	PNP open collector (2-point)
L	IO-Link communication
<b>D Regulator/solenoid valve assembly position</b> *1	
R	Right-side assembly (supply port on right)
L	Left-side assembly (supply port on left)
<b>E Port size (supply side)</b> *2	
Blank	Rc1/4
<b>F Screen display</b> *3	
Blank	Displayed (factory default)
T	Non-displayed (factory default)
<b>G Connector cable</b>	
Blank	5 m connector cable attached (One side elbow)
D	5 m connector cable attached (both sides elbows/straight)
J	Without connector cable
<b>H Pressure display unit</b> *4	
Blank	SI units only (domestic model)
KA	With unit switching function (export model)



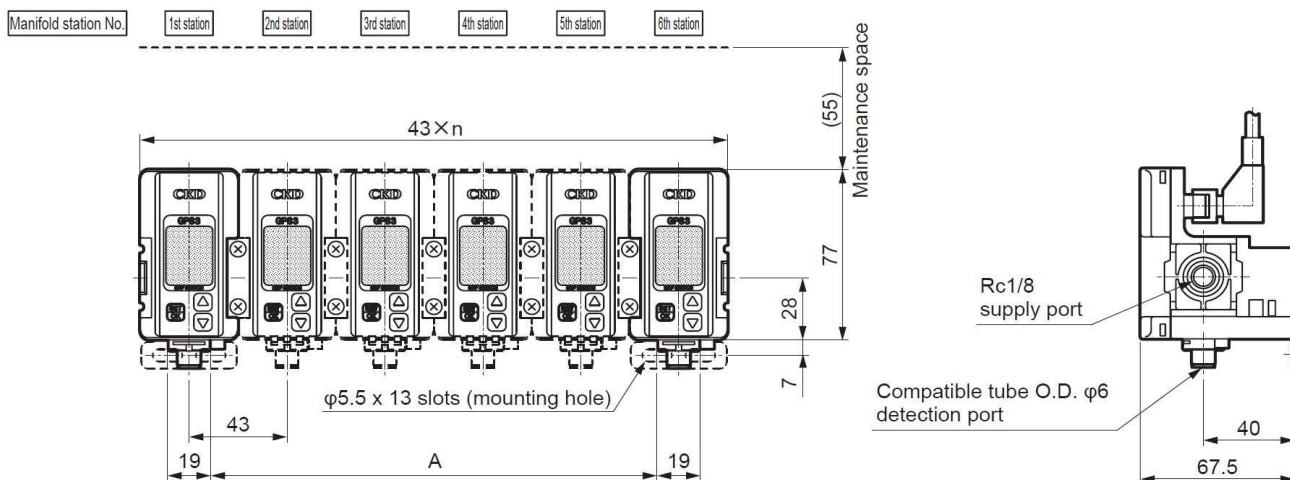
### 7. 3 Dimensions

● Discrete



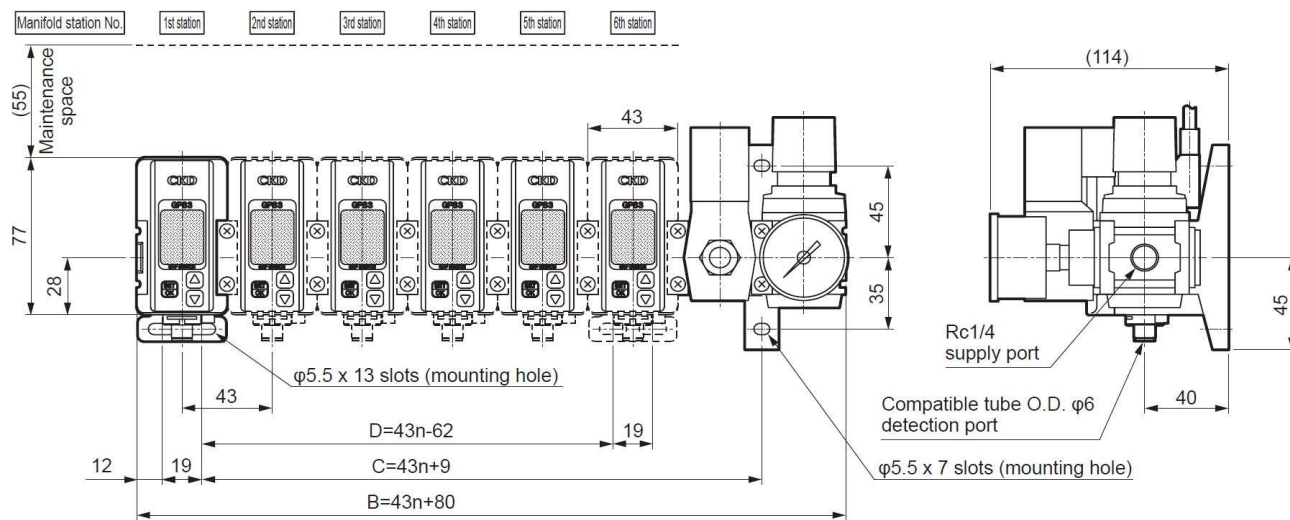
7  
PRODUCT  
SPECIFICATIONS

● Manifold



Dimension A	Station No. n				
	2	3	4	5	6
	24	67	110	153	196

● Unit



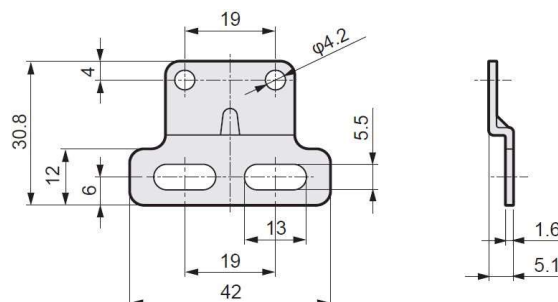
	Station No. n					
	1	2	3	4	5	6
Dimension B	123	166	209	252	295	338
Dimension C	52	95	138	181	224	267
Dimension D	-	-	67	110	153	196
Bracket set	1	1	2	2	2	2

## 7. 4 Peripheral devices

### ● Bracket

**GPS3 - B**

Weight: 10g



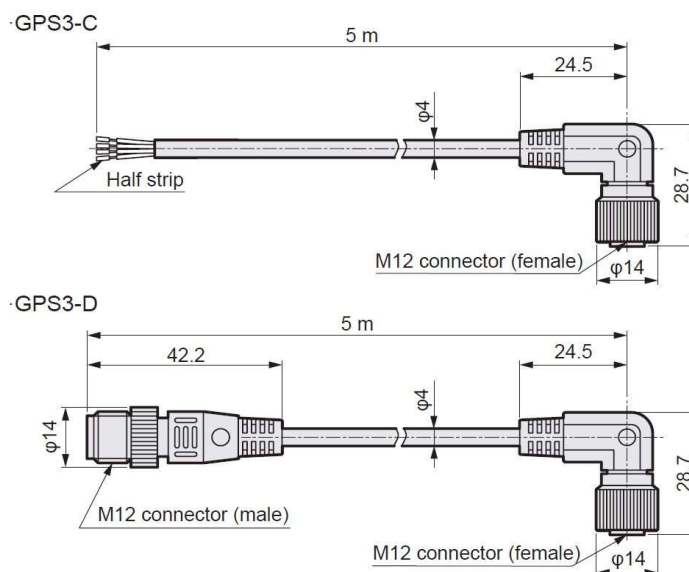
### ● Connector cable

**GPS3 - C**

Code	Content
C	Cable with 5 m connector (one side elbow)
D	Cable with 5 m connector (both sides elbows/straight)

GPS3-C: 148g

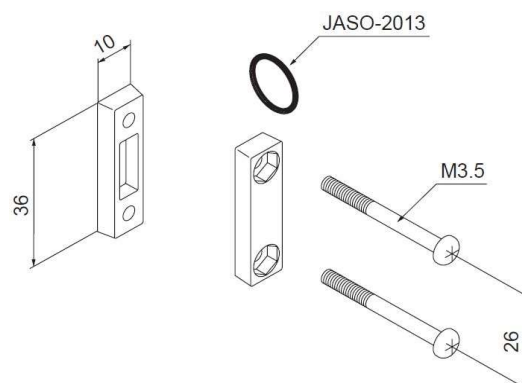
Weight: GPS3-D: 156g



### ● Joiner set

**C1000 - J100 - W**

Weight: 11g



● Gasket

**C1000 - GASKET**

The sales unit 5 pieces/set.

Used with a joiner when connecting GPS3 units together.

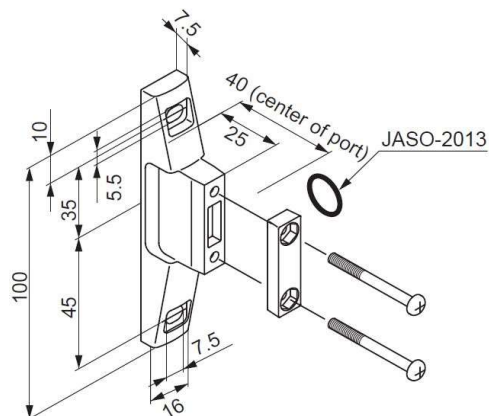


Gasket  
Material: NBR

● T type bracket set

**B110 -W**

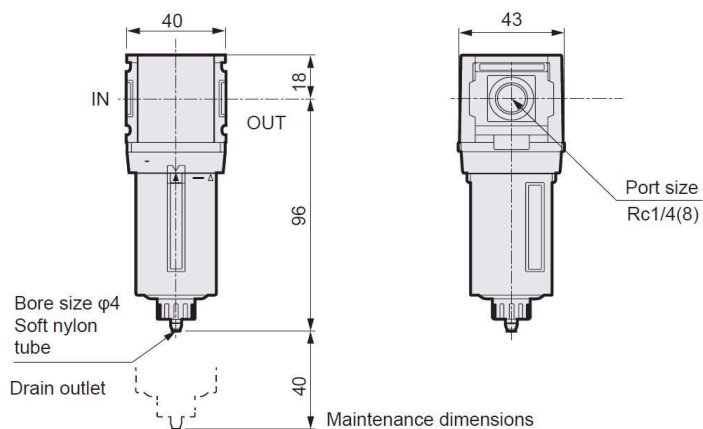
Weight : 24g



● Filter

**F1000 - 8 -W**

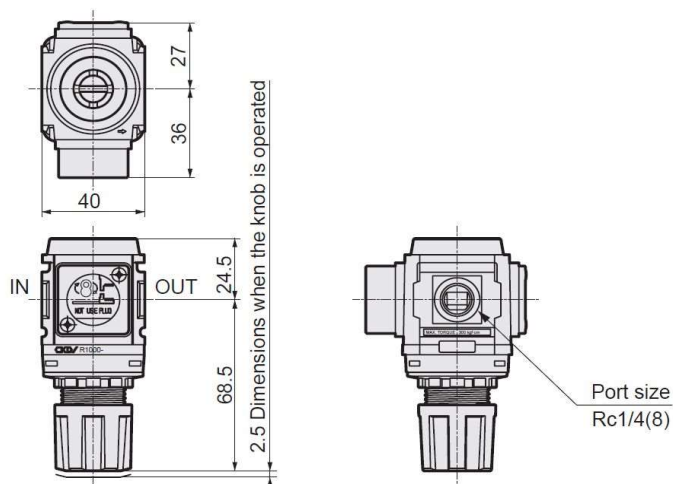
Weight : 87g



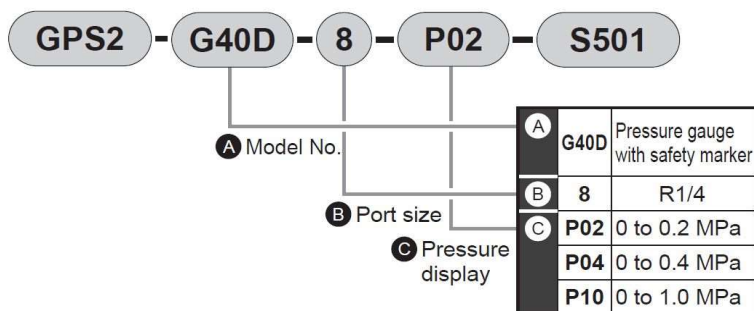
● Regulator

**R1000 - 8 -W-LT**

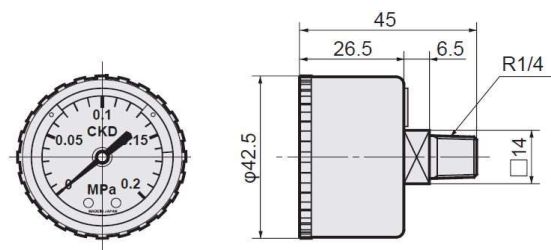
Weight : 150g



● Pressure gauge with safety mark

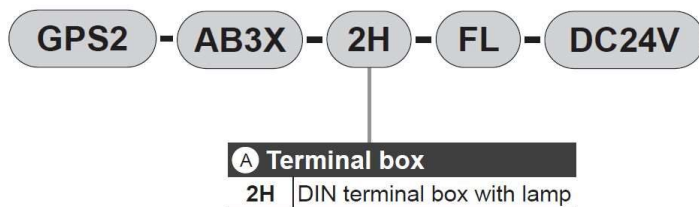


Weight: 85g

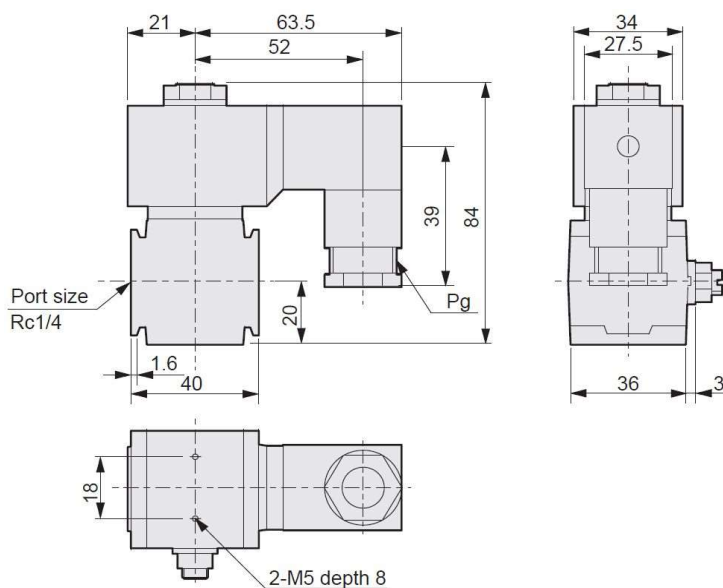


- \*1. Safety zone setting range: 0.03 to 0.2 MPa
- \*2. Safety zone setting maximum width: 0.09 MPa
- \*3. Gauge accuracy: JIS B 7505 former 3.0 grade
- \*4. Cover material: transparent nylon

● Solenoid valve with needle

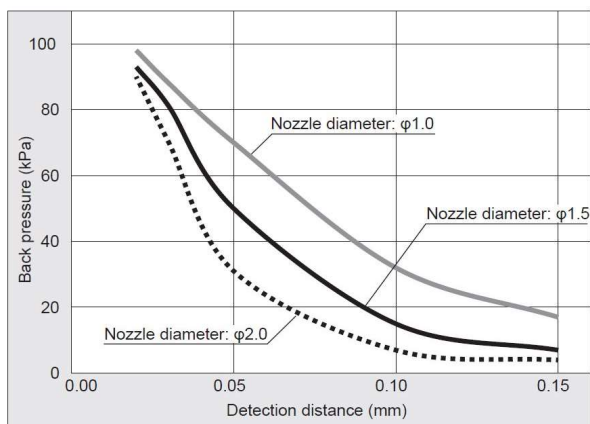


Weight: 280g



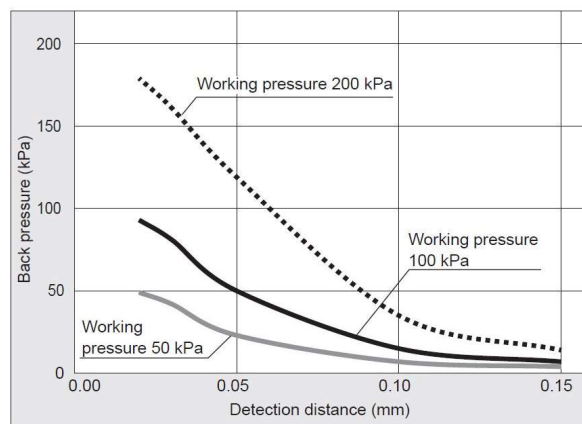
## 7. 5 Technical data

### 7. 5. 1 Characteristics data (short range)



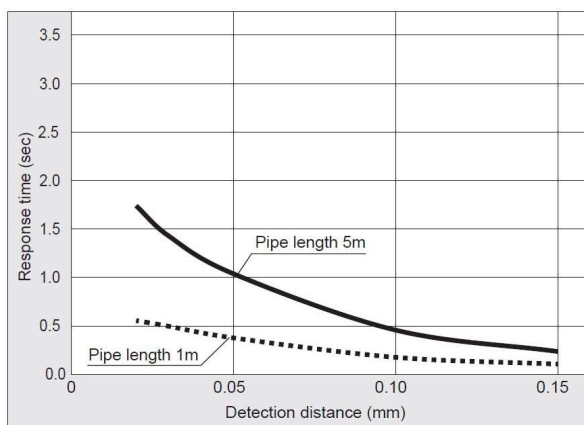
● Back pressure characteristic 1 - Differences in back pressure change due to detection nozzle diameter

• Type: GPS3-E • Bore size:  $\phi 6 \times \phi 4$  • Pipe length: 5 m  
• Supply pressure: 100 kPa



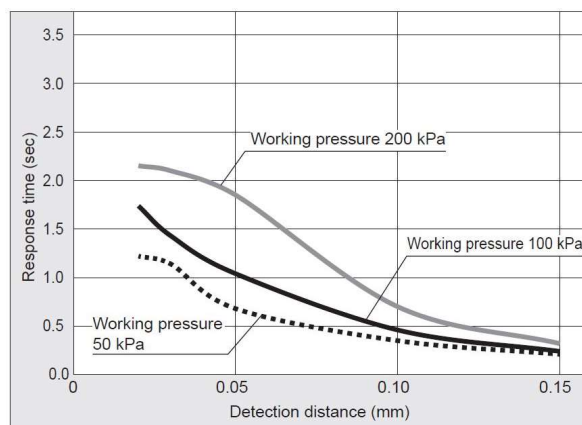
● Back pressure characteristic 2 - Differences in back pressure change due to working pressure

• Type: GPS3-E • Bore size:  $\phi 6 \times \phi 4$  • Pipe length: 5 m  
• Nozzle diameter:  $\phi 1.5$  (flat tip)



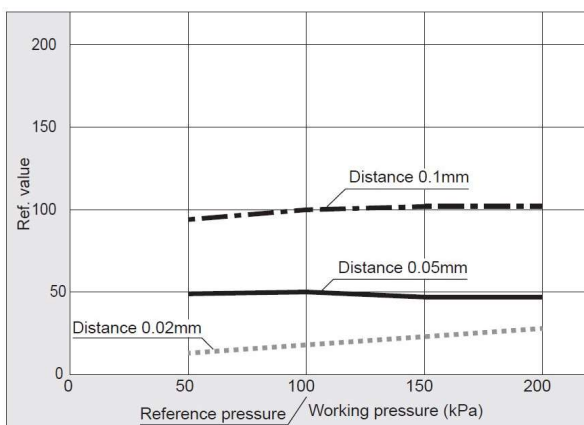
● Effect of pipe length on response time (OFF → ON)

• Type: GPS3-E • Bore size:  $\phi 6 \times \phi 4$   
• Supply pressure: 100 kPa • Nozzle diameter:  $\phi 1.5$  (flat tip)



● Effect of working pressure on response time (OFF → ON)

• Type: GPS3-E • Bore size:  $\phi 6 \times \phi 4$  • Pipe length: 5 m  
• Nozzle diameter:  $\phi 1.5$  (flat tip)



● Effect of working pressure change on reference value

• Type: GPS3-E • Bore size:  $\phi 6 \times \phi 4$  • Pipe length: 5 m  
• Nozzle diameter:  $\phi 1.5$  (flat tip)

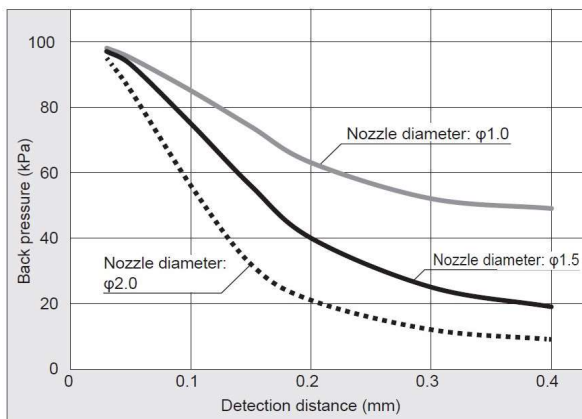


● Effect of pipe length change on reference value

• Type: GPS3-E • Bore size:  $\phi 6 \times \phi 4$  • Reference pipe length: 5 m  
• Supply pressure: 100 kPa • Nozzle diameter:  $\phi 1.5$  (flat tip)

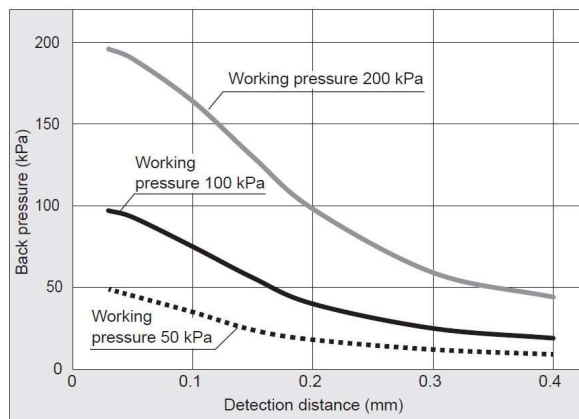


## 7. 5. 2 Characteristics data (wide range)



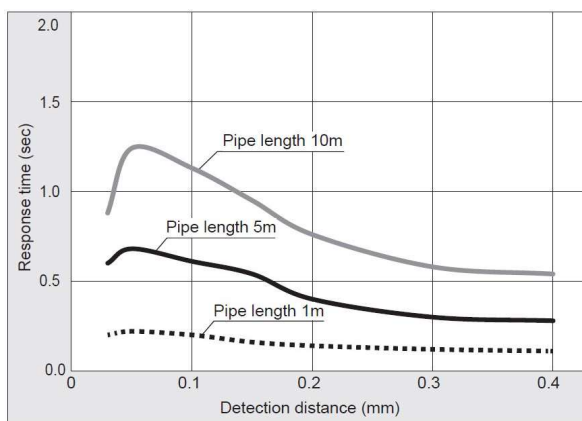
● Back pressure characteristic 1 - Differences in back pressure change due to detection nozzle diameter

- Type: GPS3 • Bore size:  $\phi 6 \times \phi 4$  • Pipe length: 5 m
- Supply pressure: 100 kPa



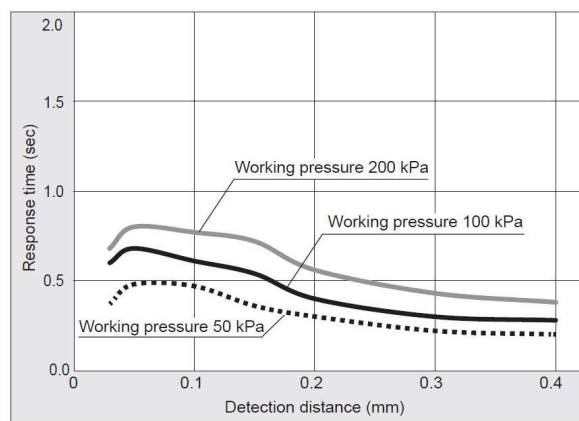
● Back pressure characteristic 2 - Differences in back pressure change due to working pressure

- Type: GPS3 • Bore size:  $\phi 6 \times \phi 4$  • Pipe length: 5 m
- Nozzle diameter:  $\phi 1.5$  (flat tip)



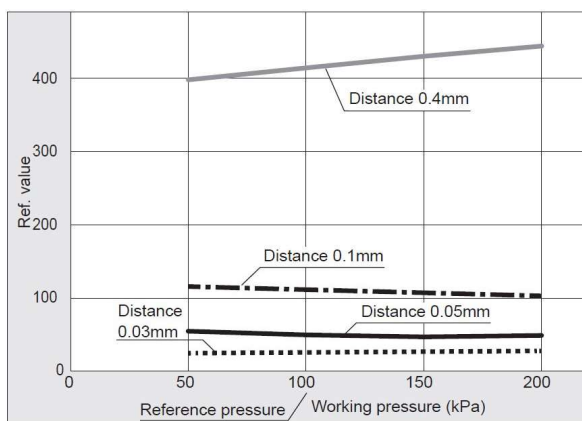
● Effect of pipe length on response time (OFF → ON)

- Type: GPS3 • Bore size:  $\phi 6 \times \phi 4$  • Supply pressure: 100 kPa
- Nozzle diameter:  $\phi 1.5$  (flat tip)
- (response time is measured at 80% distance of the threshold)



● Effect of working pressure on response time (OFF → ON)

- Type: GPS3 • Bore size:  $\phi 6 \times \phi 4$  • Pipe length: 5 m
- Nozzle diameter:  $\phi 1.5$  (flat tip)
- (response time is measured at 80% distance of the threshold)



● Effect of working pressure change on reference value

- Type: GPS3 • Bore size:  $\phi 6 \times \phi 4$  • Pipe length: 5 m
- Nozzle diameter:  $\phi 1.5$  (flat tip)

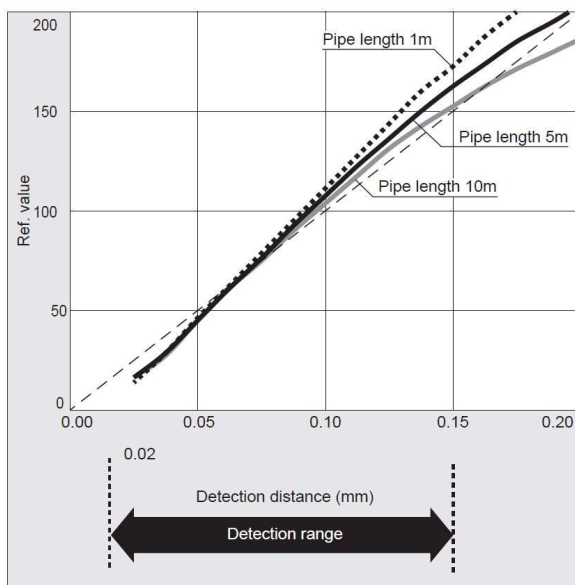


● Effect of pipe length change on reference value

- Type: GPS3 • Bore size:  $\phi 6 \times \phi 4$  • Reference pipe length: 5 m
- Supply pressure: 100 kPa • Nozzle diameter:  $\phi 1.5$  (flat tip)

### 7. 5. 3 Characteristics data

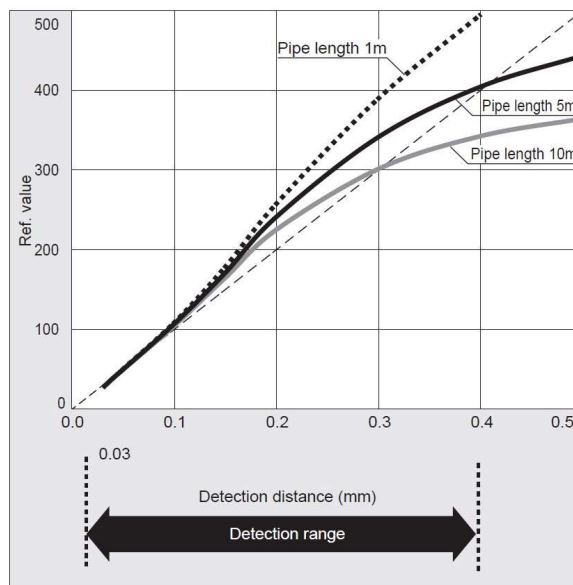
#### ● Short range



#### ● Relationship between detection distance and reference value

- Type: GPS3-E • Bore size:  $\phi 6 \times \phi 4$
- Supply pressure: 100 kPa • Nozzle diameter:  $\phi 1.5$  (flat tip)

#### ● Wide range



#### ● Relationship between detection distance and reference value

- Type: GPS3 • Bore size:  $\phi 6 \times \phi 4$
- Supply pressure: 100 kPa • Nozzle diameter:  $\phi 1.5$  (flat tip)
- Data using factory default settings (reference pipe length 5 m).