KEYENCE

96M11843

Environment Resisting Type Built-in-amplifier Pressure Sensors

GP-M Series

Instruction Manual

Read this instruction manual before using the product in order to achieve maximum performance.
Keep this instruction manual in a safe place after reading it so that it can be used at any time.

■ Symbols

In this instruction manual, the following symbols will be used to so that important points can be understood at one glance.
Be sure to read these messages carefully.

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

Reference — It indicates tips for better understanding or useful information.

Safety Information for GP-M Series

WARNING	**1. Do not use this product for the purpose to protect a human body or a part of human body.** **2. This product is not intended for use as an explosion-proof product. Do not use this product in hazardous locations and/or potentially explosive atmospheres.** **3. The GP-M Series is not designed to sanitary specifications. Do not use the product for applications such as drinks, foods, or medical liquids.** **4. Do not use the GP-M Series for applications requiring safety measures, such as any nuclear, railroad, aircraft, vehicle, or playground equipment.**

CAUTION	**1. You must verify that the GP-M Series is operating correctly in terms of functionality and performance before the start and operation of the GP-M Series.** **2. We recommend that you take all the necessary safety measures to avoid any damage in the unlikely event of a problem occurring.** **3. Do not use the GP-M Series with corrosive liquids.**

NOTICE	**1. We cannot guarantee the functions and/or performance in the event that the product is used outside the standards of the specification, or if the product is modified.** **2. When using our product in combination with another product, based on such factors as conditions of use and surrounding environment, sometimes functions and performance may not be fully realized. In such a case, use after adequate examination.**

Precautions on Regulations and Standards

■ CE Marking

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

- **EMC Directive (2004/108/EC)**

• Applicable standards EMI: EN61326-1, Class A
EMS: EN61326-1

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.

■ CSA Certificate

GP-M Series complies with the following CSA and UL standards and has been certified by CSA.

- Applicable standard CAN/CSA C22.2 No.61010-1
  UL61010-1

Be sure to consider the following specifications when using this product as a product certified by CSA.

- Overvoltage category: 1
- Use this product under pollution degree 2.
- Use this product at the altitude of 2000 m or less.
- Indoor use only.
- Use CSA/UL certified power supply that provides Class 2 output as defined in the CEC (Canadian Electrical Code) and NEC (National Electrical Code), or CSA/ULcertified power supply that has been evaluated as a Limited Power Source as defined in CAN/CSA-C22.2 No. 60950-1/UL60950-1.
- Do not use the GP-M Series for poizonous fluid.

■ Caution when handling

⚠ CAUTION	**1. When detecting the temperature of the fluid, the housing of the product will be hot, and there is the danger of a burn injury. Do not touch the metal housing while the product is in operation.** **2. The screw part of the main unit is sharp, take care to avoid injury.**
NOTICE	**1. Do not drop or hit the device, and avoid any other large shock to the device.** **2. Do not use a sharply pointed object to press the setting keys.** **3. If the detection portion is pushed with sharp thing, damage may occur to the detection surface. Also, for devices where the measuring range is low, the detection portion is thin and easy to break. Touch as little as possible.**

■ Precautions for wiring

⚠ CAUTION	1. Do not modify or disassemble unnecessarily. It may cause electric shock or improper operation. 2. Do not work on the wiring with bare hands. Even if the power is OFF, electric charge may remain and cause electric shock. 3. Do not work on the pipe work or wiring with wet hands. It may cause electric shock. 4. When wiring, confirm the pin position. 5. Use the GP-M Series within the rated range. The GP-M Series is a sensor that uses a DC (direct current) power source. Do not apply alternating current or other power supplies. Do not use a load that exceeds the allowable limit.

NOTICE	1. Use an insulated stabilizing supply for the power supply. 2. Do not pull strongly on the cable. 3. Ensure that the cable tip is not submersed in water during wiring work. 4. Isolate the cable from power supply lines or power lines. 5. Isolate the cable as far as possible from any source of noise.

■ Other precautions

NOTICE	1. The power ON reset time for the GP-M Series is 2 seconds after power is turned on. Do not use outputs from the sensor during this period. 2. Initial drift may occur after supplying power to the GP-M Series. To detect a minute difference in the pressure, let the GP-M Series warm up for approximately 15 to 30 minutes. 3. Do not bring a strong magnet or magnetic field close to the main body of the GP-M Series.

NOTICE	**4. Do not remove the seal of the air hole of the GP-M001/M010/M025. It will no longer be waterproof.** **5. When condensation occurs, it may become impossible to make measurements, or, damage may occur. Take measures such as the following to prevent condensation.** **• Ensure that the ambient temperature is the same or lower than the fluid temperature.** **• Remove moisture via air conditioning** **• Separate the sensor 30 cm or more from the cooling pipes using the connector pipe.** **6. When conducting maintenance, use a soft brush so as not to damage items such as the detection surface or the O-Ring.** **7. When replacing the O-Ring, clean all of the debris from the surface that will be in contact with the O-Ring.**

Checking the Packed Items

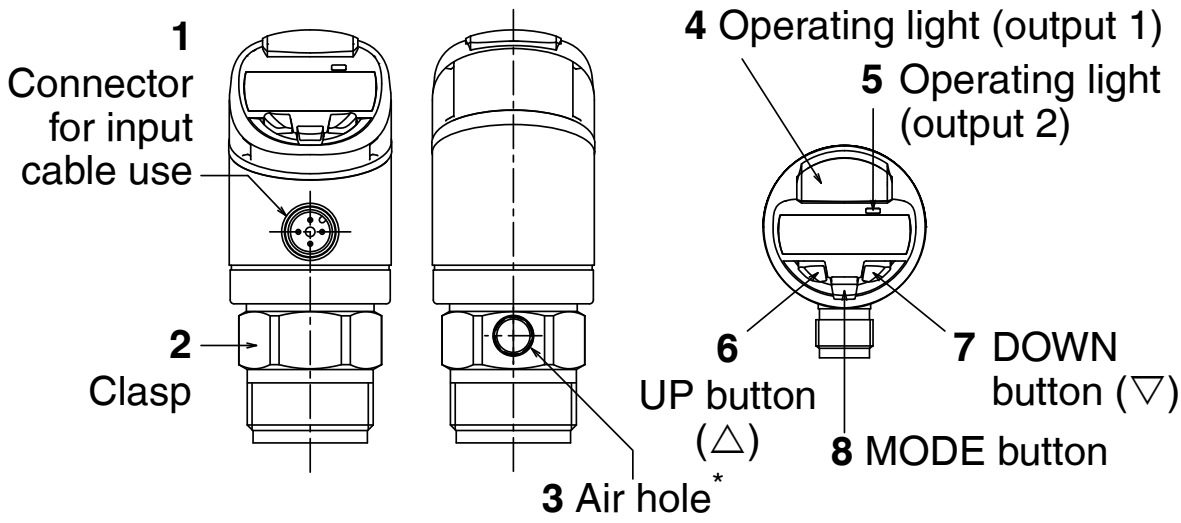
GP-M001/M010/M025

Sensor x 1
Instruction manual x 1
O-Ring x 1 (OP-87287)

GP-M100/M250/M400

Sensor x 1
Instruction manual x 1
O-Ring set x 1 (OP-87288)

Name and Function of Each Part

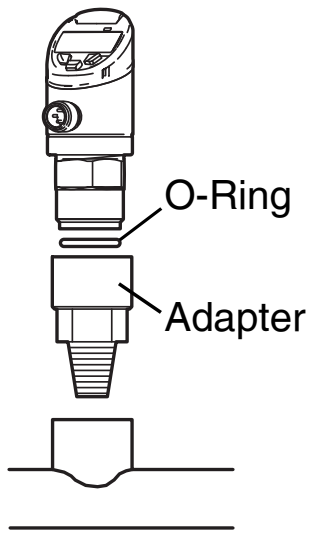


* Only for the GP-M001/M010/M025

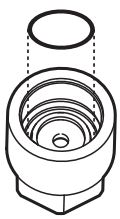
Piping/Installation

■ Piping

- Use the adapter for matching with the diameter of the piping.
- When using a replacement adapter, attach the O-Ring included with the Main Unit to the groove of the G3/4 female screw part. (Refer to the diagram below)

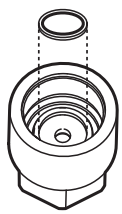


GP-M001/M010/M025



Adapter

GP-M100/M250/M400



Adapter

- Inquire to us when connecting the pipes directly using the GP-M Series with a G3/4 female screw.
- The body may be rotated horizontally to 330°. When rotating, hold the clasp in place with something such as a wrench.

■ Precautions when installing

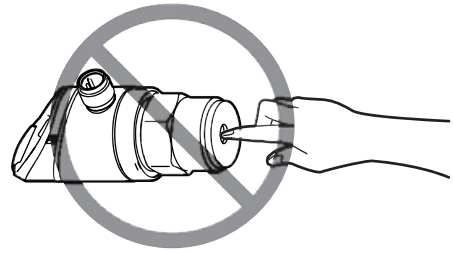
● Attaching the coupling

The recommended tightening torque when installing the adapter to the main body of the sensor is 20 N•m. It is recommended to apply grease to the G3/4 screw part in order to avoid scorching.

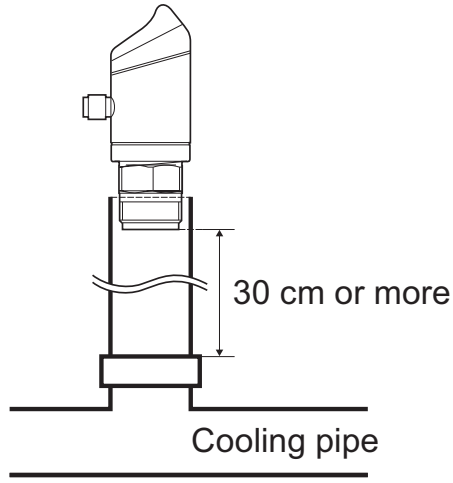
● Grounding of metal parts

The metal parts of the main body, the internal circuits 0 V are insulated.

● Other precautions



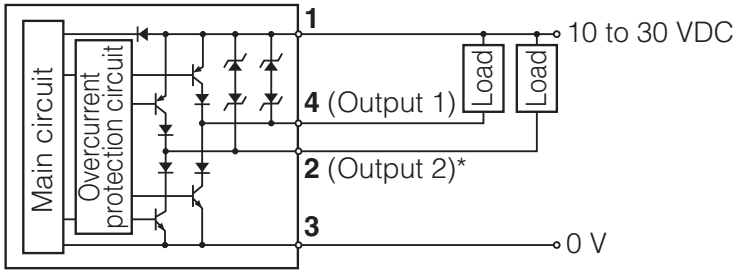
- Regardless of whether the power of the device is ON or OFF, do not touch the main part of the pressure detector, if the if the pressure detector is touched, damage may occur due to static electricity.
- If using a non-conductive liquid such as oil, and plastic piping are used, the risk of an offset change will become greater. In such a case, it is recommended to ground the metal housing.
- In the case that noise causes malfunction, grounding the metal housing may improve performance.
- After installation, conduct an atmospheric correction by making the applied pressure the same as regular room pressure. (Refer to page 10)
- When there is condensation, separate the sensor from cooling pipe by at least 30 cm using the connecting pipe.



Wiring, Output Diagram

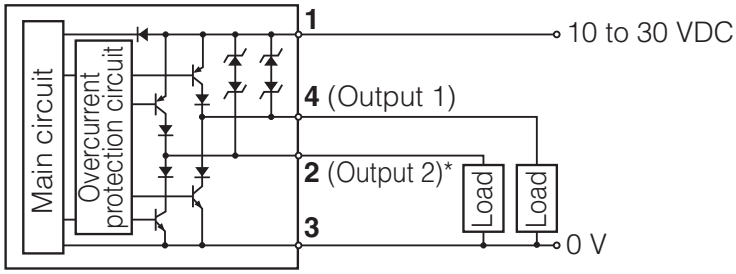
■ Output diagram

● When choosing an NPN output



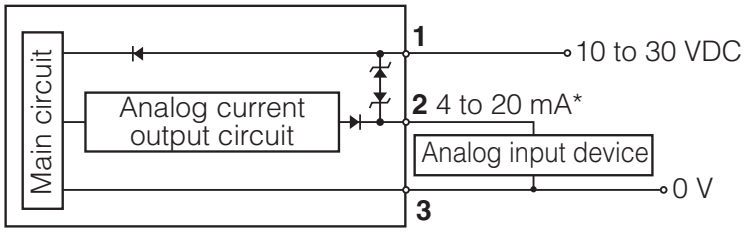
* When choosing the function of output 2 out (control output) only.

● When choosing a PNP output



* When choosing the function of output 2 out (control output) only.

■ Analog output diagram



* When Choosing AnLG of the Function of Output 2 only.

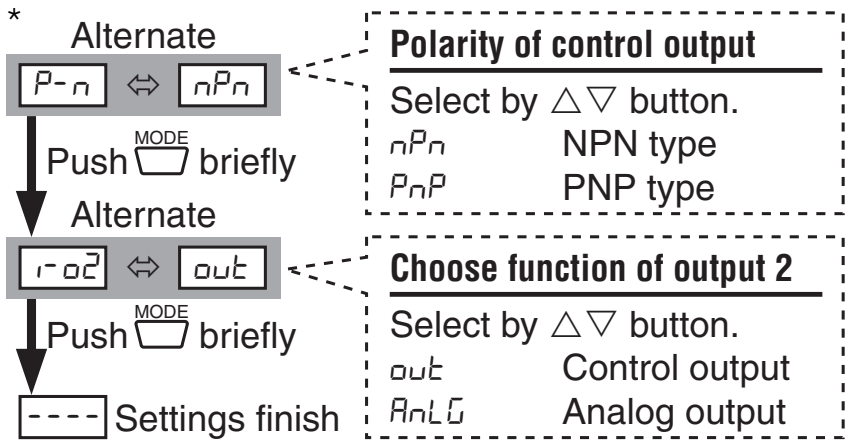
■ Pin

■ M12 Connector Cable (Optional) Pin Position

1	Brown
2	White
3	Blue
4	Black

Initial Settings at the Time of Delivery

When turning the power ON for the first time after delivery, set the initial settings according to the outline below.



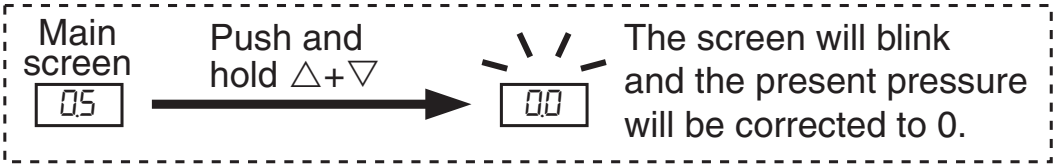
* On this screen, press the ▽ button 5 times while pressing and holding the MODE button to move to the unit switch screen "Unit". By using △▽ the unit can be selected from PSI, bAr, kGF, kPA*1, and MPA*2.
*1 Except GP-M100/M250/M400 *2 Except GP-M001

Reference Pushing MODE while pushing △ briefly will return you to the previous screen.

Atmospheric Pressure Correction

Function for correcting the measurement value to 0 due to problems such as long term use.

Correct the atmospheric pressure



- Always correct the atmospheric pressure by making the applied pressure the same as regular room pressure.
- The air pressure correction is effective within a range of ±10 of F.S. If it is executed outside of that range, "----" is displayed and no correction will occur.

- The atmospheric pressure correction will be reflected on the analog output.

Key Lock

Function for preventing operation error.

Activate/Deactivate Key Lock

From the main screen, press and hold the MODE button and the △ button (or the ▽ button) simultaneously.
If "Loc" is displayed while blinking, the Key Lock is enabled. With the same operation it can be disabled ("unL" will be displayed while blinking).

Reference

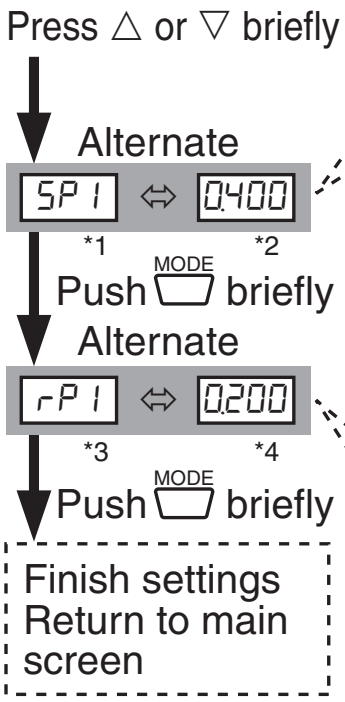
- If the Key Lock is enabled, the setting value change (the detail settings from pressing and holding the MODE button) is not available. ("Loc" will display as blinking")
- If "PASS" is set to a value other than "0000 (initial value)" via the extended function (page 16), when the Key Lock is disabled a password will be requested. (Refer to below)

Disabling the Key Lock with Password

1. **From the main screen press and hold the MODE button simultaneously with the △ button (or the ▽ button).**
   "PASS" and a number value alternately is displayed.
2. **Select a password with the △▽ and press the MODE button to select.**
   If the correct password is entered:
   "unL" will appear as a blinking display, and Key Lock will be disabled.
   If an incorrect password is entered:
   "ErP" will appear as a blinking display, Key Lock will not be disabled, and the screen will return to the main screen.

Changing the Setting Value of Output 1

Change the setting value of output 1. The changing of setting values of output 2 is done by pressing and holding the MODE button. (Refer to page 15)



Switch-on point 1

Select using the △▽ buttons.
Setting range: 1% of F.S. to 100% of F.S.
(Details on page 17)

*1. The detection mode of the Output 1 is displayed as "FH 1" when in window mode.
*2. If it is not used for 4 seconds it will return to the main screen.

Switch-off point 1

Select using the △▽ buttons.
Setting range: 0% of F.S. to (Switch-on point) -1% of F.S.
(Details on page 17)

*3. The detection mode of the Output 1 is displayed as "FL 1" when in window mode.
*4. If it is not used for 4 seconds it will return to the main screen.

Display Pressure Unit/Hold Display

Display Pressure Unit

If the MODE button is pressed briefly on the main screen, the pressure unit will display.
If it is not used for 2 seconds it will return to the main screen.

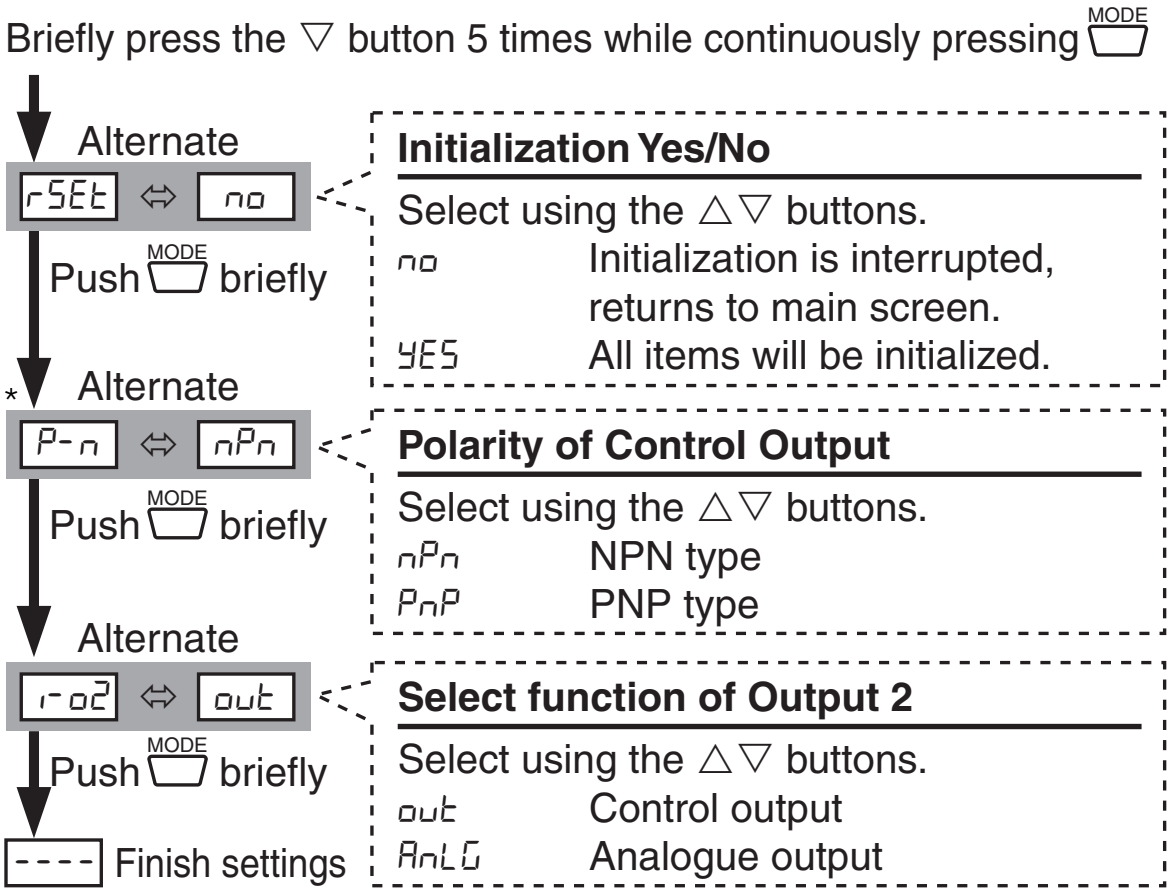
Display Peak and Bottom Hold

If the MODE button + the △ (▽) button are pressed briefly on the main screen, the peak (bottom) hold value will display.
("P_H" ("b_H") and hold value will blink alternately.)

Reference

- Peak (bottom) hold value will be stored into EEPROM every 45 seconds.
- If the △ and ▽ buttons are pressed and held simultaneously on the peak (bottom) hold screen, the peak (bottom) hold value of the initial reset will be cleared.
- To return to the previous screen, press the MODE button briefly.

Initial Reset (Initialization)



* On this screen, press the ▽ button 5 times while pressing and holding the MODE button to move to the unit switch screen "Unit". By using △▽ the unit can be selected from PSI, bAr, kGF, kPA*1, and MPA*2.

*1 Except GP-M100/M250/M400 *2 Except GP-M001

If anything other than the default value is selected, and when MODE is pressed briefly on the P-n screen, the unit switch screen will appear.

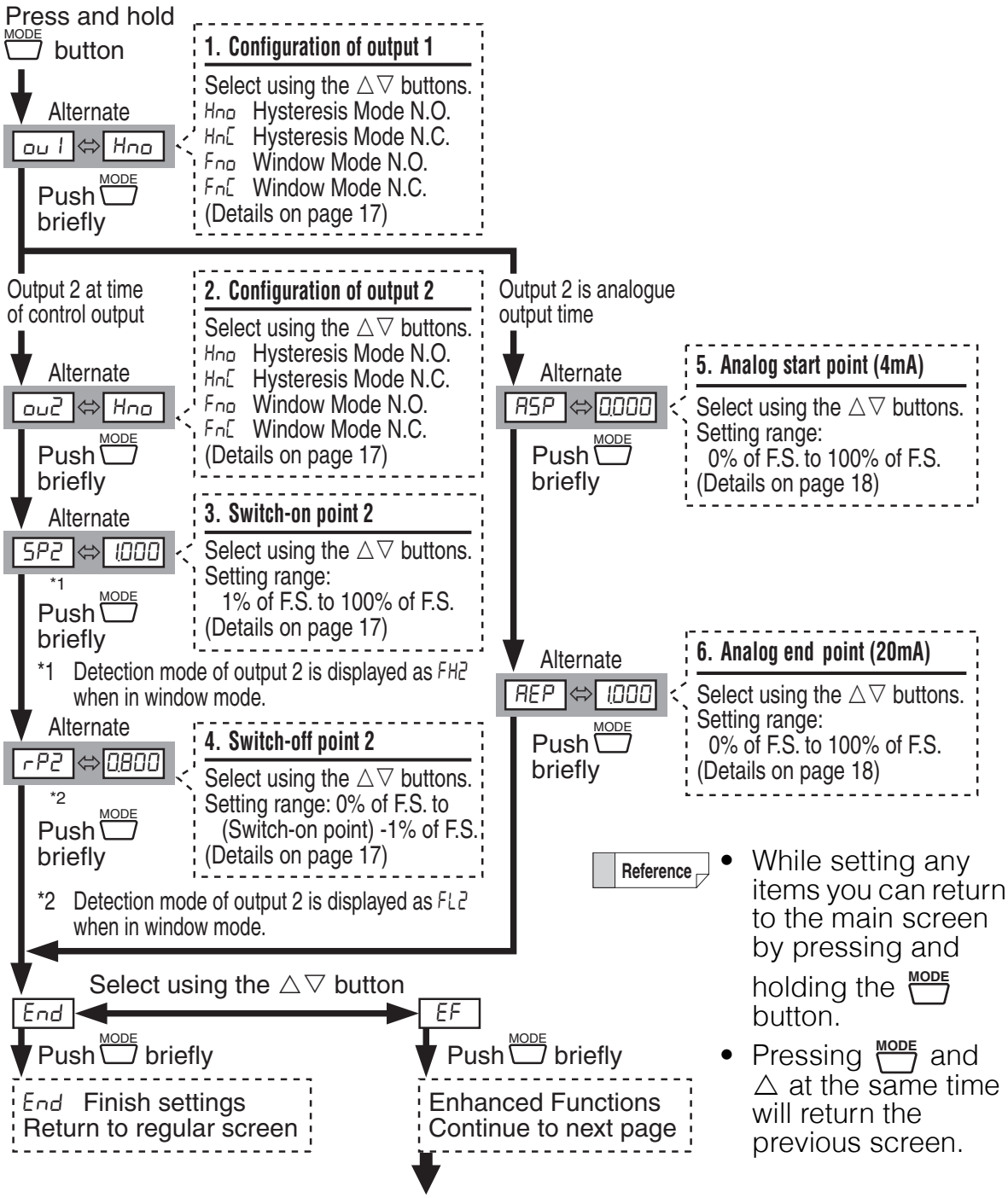
Reference Pressing MODE and △ at the same time will return to the previous screen.

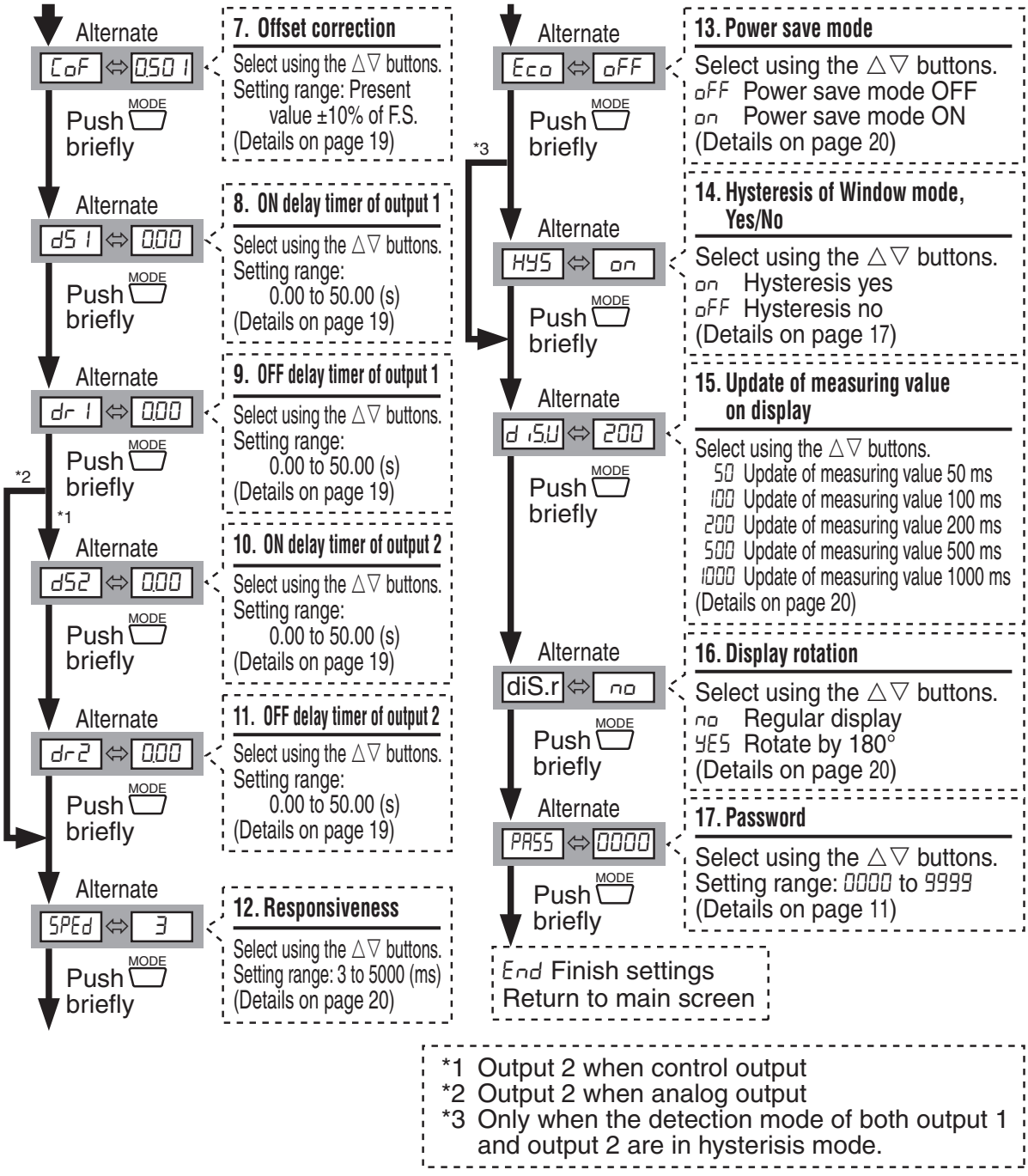
Initialization Value List

Item	Default value (by model)					
Model	GP-M 001	GP-M 010	GP-M 025	GP-M 100	GP-M 250	GP-M 400
Unit	kPa	MPa				
SP1/FH1 (Switch-on point 1)	40.0	0.400	1.000	4.00	10.00	16.00
rP1/FL1 (Switch-off point 1)	20.0	0.200	0.500	2.00	5.00	8.00
SP2/FH2 (Switch-on point 2)	100.0	1.000	2.500	10.00	25.00	40.00
rP2/FL2 (Switch-off point 2)	80.0	0.800	2.000	8.00	20.00	32.00
ASP (Analog start point (4 mA))	-100.0	0.000	0.000	0.00	0.00	0.00
AEP (Analog end point (20 mA))	100.0	1.000	2.500	10.00	25.00	40.00

Item	Default value (for all models)
ou1 (detection mode of output 1)	Hno
ou2 (detection mode of output 2)	Hno
CoF (offset correction)	No correction
dS1/dr1/dS2/dr2 (direct timer)	0.00 (s)
SPEd (responsiveness)	3 (ms)
Eco (power-save mode)	oFF
HYS (presence of hysterisis when in window mode)	on
diS.U (display renew cycle)	200 (ms)
diS.r (display inversion)	no
PASS (password)	0000

Settings of Each Setting Function





Reference

- While setting any items you can return to the main screen by pressing and holding the MODE button.
- Pressing MODE and △ at the same time will return the previous screen.

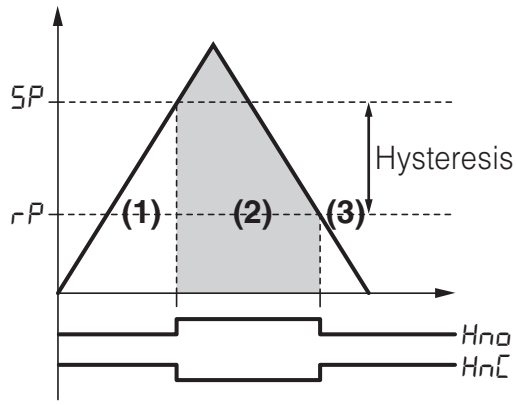
■ Detection mode and setting value

The GP-M Series has two types of detection modes which are described below.
When the selected function of output 2 is out (control output), the output 1 and output 2 can be set separately.

Hysteresis mode (Hno/HnC)

Considering SP-rP = hysteresis, it is the mode for changing the setting value when ON and when OFF.

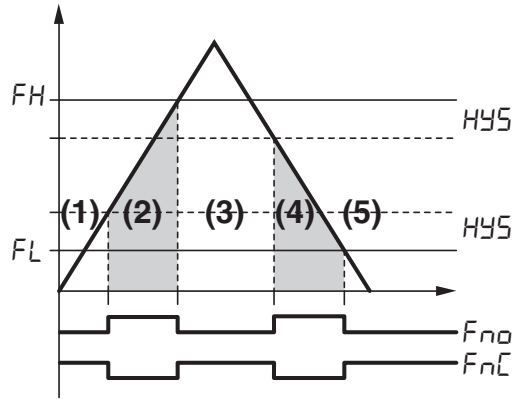
- When the output is OFF (right diagram 1), and the measured value becomes more SP than it will turn on (right diagram 2).
- When the output is ON, and the measuring value becomes less than rP, it will turn OFF (right diagram 3).



Window mode (Fno/FnC)

This mode determines whether the measured value is within or outside the area of FH to FL.

- If the detection value of the output OFF condition in the right diagram 1 is more than (FL + HYS) or less than FH, it will turn ON (right diagram2).
- From that condition the measured value is larger than FH (right diagram 3), or, less than FL, the right diagram will be OFF.
- If the measured value of the condition in the diagram on the right is less than (FH - HYS) or more than FL, it will be ON.



If HYS is fixed at 0.5% of F.S., the presence or absence of hysterisis can be selected by the extended function (page 16).

Reference The name of the setting values depending on the mode and output are as follows.

Output	Detection Mode	Switch on point	Switch off point
Output 1	when choosing hysteresis mode	SP1	rP1
Output 2		SP2*	rP2*
Output 1	when choosing window mode	FH1	FL1
Output 2		FH2*	FL2*

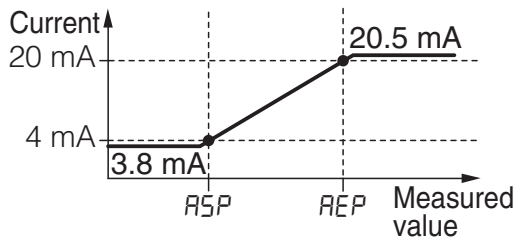
* Selection is possible when the selection function of output 2 (control output) is out.

■ Free range analog output

Set the pressure value for the respective free range analog start point and end point. The function of the output 2 can be selected at the time of AnLG (analogue output). ASP and AEP can be set freely within the measured range. Operation is as follows.

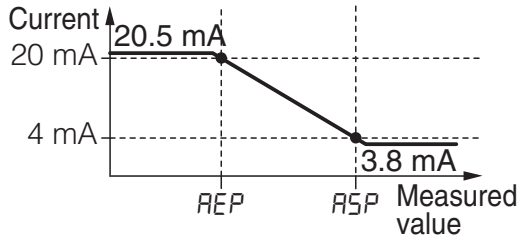
1. When ASP < AEP

- When ASP becomes AEP: 4 mA becomes 20 mA
- If the measurement value falls below ASP, output will be up to 3.8 mA
- If the measurement value rises above AEP, output will be up to 20.5 mA



2. When ASP > AEP

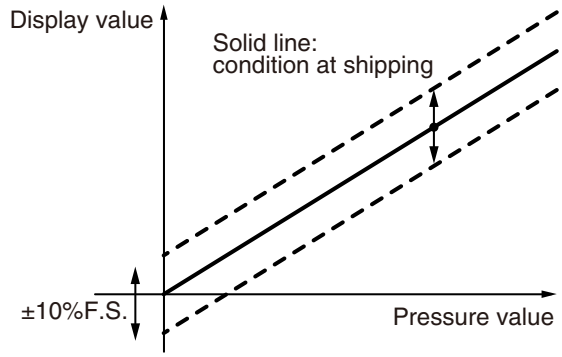
- When ASP becomes AEP: 4 mA becomes 20 mA
- If the measurement value falls below AEP, output will be up to 20.5 mA
- If the measurement value rises above ASP, output will be up to 3.8 mA



Reference When system error (Er5) occurs, 2 mA will be output.

■ Offset correction

Concerning the value at the time of shipping, there may be as much as ±10%F.S. offset correction. This activates in the case of a margin of error in the displayed pressure value and the actual pressure value.
The pressure value after the offset correction is displayed on the setting screen and can be adjusted with the △▽ buttons.



Reference

- Offset correction works in conjunction with “Atmospheric pressure correction”.
- If the △▽ buttons are pressed and held simultaneously on the offset correction screen, the offset correction value and the air pressure correction value will revert to the condition at shipping (no correction).

■ Delay timer

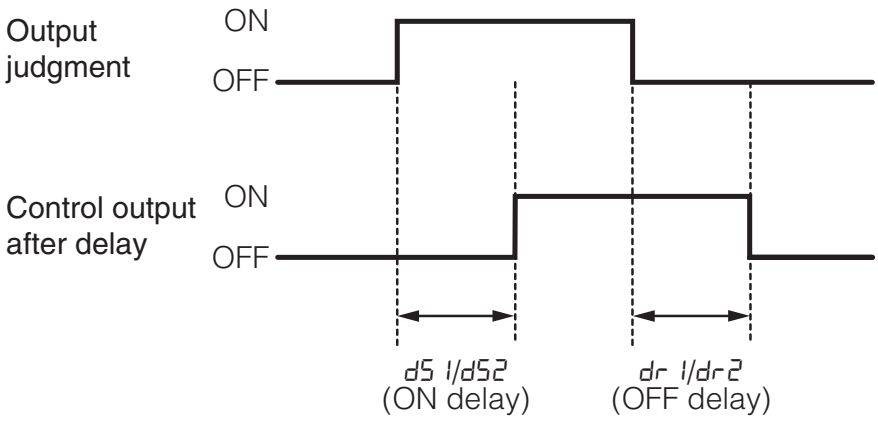
The delay timer can be set within the range of 0.00 to 50.00(s)
When the function selection of output 2 is out (control output) the delay timer for output 1 and output 2 can be set separately.

Setting item	Meaning
dS 1/dS2	Concerning the ON delay timer of output 1/output 2. When the judgment switches from OFF to ON, the set delay time will elapse.
dr 1/dr2	Concerning the OFF delay time of output 1/output 2. When the judgment switches from ON to OFF, the set delay time will elapse.

* The setting of the dS2, dr2 is possible when the function of output 2 is selected as out (control output).

Reference

Time chart



■ Responsiveness

The time until 100% response of the internal judgment value can be set from within the range of 3 to 5000 (ms).
The response time of the analog output (90% response) will be an additional 2 ms from this point.

■ Power Save Mode

When on is selected, if the key operation does not occur for 15 seconds (Power Save) will be displayed.
The "-"at the time of power save display will move from the left to the right, and the operation indicator will operate normally. To return the display status to normal, press any key. When there is an error, regardless of whether power save mode is on/oFF, the error will be displayed.

■ Display Renewal Cycle

Set the interval to renew the display contents. When a value is increased, only for that time the value will continue to be displayed the same. From after the renewal until the next renewal, the measurement value will be averaged so as to control fluctuations in the display value. However, there will be no influence on the control output and the analog output.

■ Display inversion

When no is selected: regular display
When YES is selected: The display will be inverted vertically 180°.

Error Display and Countermeasures

Error display	Cause	Measures
----	At the time of atmospheric pressure correction there is ±10% F.S. applied pressure.	Return the air to the room pressure, once again set the sensitivity setting.
ErC	There is too much current flowing through the control output.	Check the load, and return to the rated range.
oL	Outside possible display range (above)	Return to the rated pressure range.
uL	Outside possible display range (below)	Return to the rated pressure range.
ErP	An incorrect password was entered at the time of the Key Lock release.	Enter the correct password. If the password has been forgotten contact your nearest sales office.
ErE	Write/load to EEPROM error	Do an initial reset. If in that case the problem has not been fixed please contact us.
Er5	System error	Contact the nearest sales office.

Output Condition at the Time of Error.

Error display	Output judgment	Analog output
----	Regular operation	Regular operation
ErC	OFF	Regular operation
oL	Operation at the maximum possible display range	
uL	Operation at the minimum possible display range	
ErP	Regular operation	Regular operation
ErE	Regular operation	Regular operation
Er5	OFF	2 mA

Specifications (Differs by model type)

Model	GP-M 001	GP-M 010	GP-M 025	GP-M 100	GP-M 250	GP-M 400
Rated pressure	-100 to +100 kPa	-0.1 to +1 MPa	-0.1 to +2.5 MPa	0 to +10 MPa	0 to +25 MPa	0 to +40 MPa
Possible display range	-120.0 to +120.0 kPa	-0.210 to +1.110 MPa	-0.360 to +2.760 MPa	-1.00 to +11.00 MPa	-2.50 to +27.50 MPa	-4.00 to +44.00 MPa
Allowable pressure	400 kPa	4 MPa	10 MPa	30 MPa	50 MPa	50 MPa
Burst pressure	1.5 MPa	15 MPa	35 MPa	100 MPa	100 MPa	100 MPa
Display resolution	0.1 kPa	0.001 MPa		0.01 MPa		
Fluid type	Gas or liquid that will not corrode the liquid contact part			Liquid that will not corrode the liquid contact part		

Specifications (All model types are the same)

Type of pressure	Gage pressure
Precision[*1]	±1.0% of F.S. or less
Repeatability[*2]	±0.3% of F.S. or less
Temperature characteristics	±0.6% of F.S./10°C
Zero-cut pressure value	±0.5% of F.S.
Connection diameter	G3/4 (Changes to the R1/8 male, R1/4 male, R3/8 male, G1/4 female, NPT1/8 male, and NPT1/4 male option adapters are available.)
Box rotation angle	Maximum 330°

Medium temperature			-20 to +100°C (no freezing/condensation)[*3] [*6]
Rating	**Power supply voltage**		10-30 VDC, Ripple (P-P): 10% max, Class 2 or LPS
	Current consumption		50 mA or less (when 24 V: 32 mA or less, when 12 V: 48 mA or less. Excluding output)[*4]
Display method			4 column digital LED red/ Vertical inversion display possible
Operation display light			Operation indicator (output 1) (orange) Operation indicator (output 2) (orange)
Hysteresis			During hysteresis mode: variable (Difference between switch-on point and switch-off point is hysteresis) During window mode: fixed (0.5% of F.S.)
Response		**Control output**	Selectable from 3 to 5000 ms
		Analog output	As above + 2 ms (90% response)
Output	**Output 1 control output**		NPN/PNP open collector (Selectable) 30 V or less, Max. 250 mA Residual voltage for the Main Unit is 1 V or less, N.O./N.C. selectable
	Output 2 (replace-ment type)	**Control output**	
		Analog output	4-20 mA, maximum load resistance 500 Ω (When the electric voltage is more than 20 V)[*5]
Environmental resistance		**Ambient temperature**	-20 to +80°C (no freezing/condensation)[*6]
		Relative humidity	35 to 85% RH (no condensation)[*6]
		Vibration	IEC60068-2-6 20 G (10 to 2000 Hz In each direction of X, Y, Z for 2 hours)
		Shock	IEC60068-2-27 50 G (11 ms In each direction X, Y, Z 3 times)
		Enclosure protection	IP67

Material properties	**Wetted part**	Pressure port: SUSXM7/ Diaphragm pressure port: Al_2O_3/O-Ring: FKM
	Other parts	Housing metal portion: SUS304, SUS303 Housing plastic portion: PPSU Air hole*7: PTFE, nickel-plated brass.
Applicable cable		M12 connector 4 pin
Weight		App. 150 g

*1 This is the value when considering linearity + hysterisis + repeatability in a stable environment of 23°C.

*2 The repeatability, based on consistent conditions, is the difference in the detection points at the time of fluctuations in the repetition.

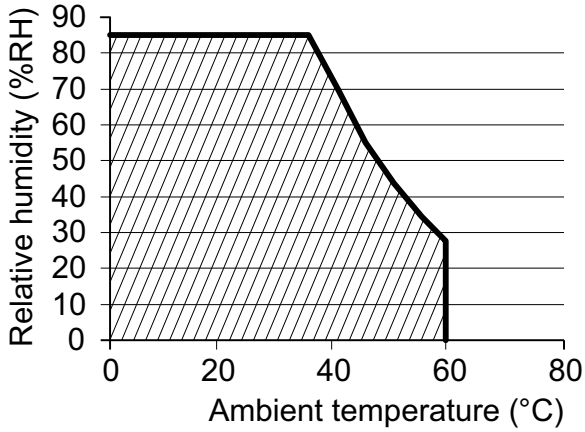
*3 When the temperature of the piping exceeds 80°C, do not connect the cable.

*4 Consumption current including output is 0.6 A and under.

*5 The maximum load resistance R will be the values below in response to the electric voltage E.
When 10-23V: R = (38 x (E-10) + 128) Ω
When 23-30V: R = 622 Ω

*6 Take measures such as the following to prevent condensation.
- Ensure that the ambient temperature is equal or lower than the fluid temperature.
- Dehumidify using an air-conditioner
- Separate the sensor from the cooling pipe by at least 30 cm using the connecting pipe.

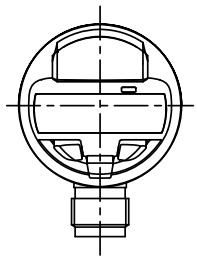
Also, it is recommended that ambient temperature and relative humidity should be within the range of the diagonal line depicted in the graph below.

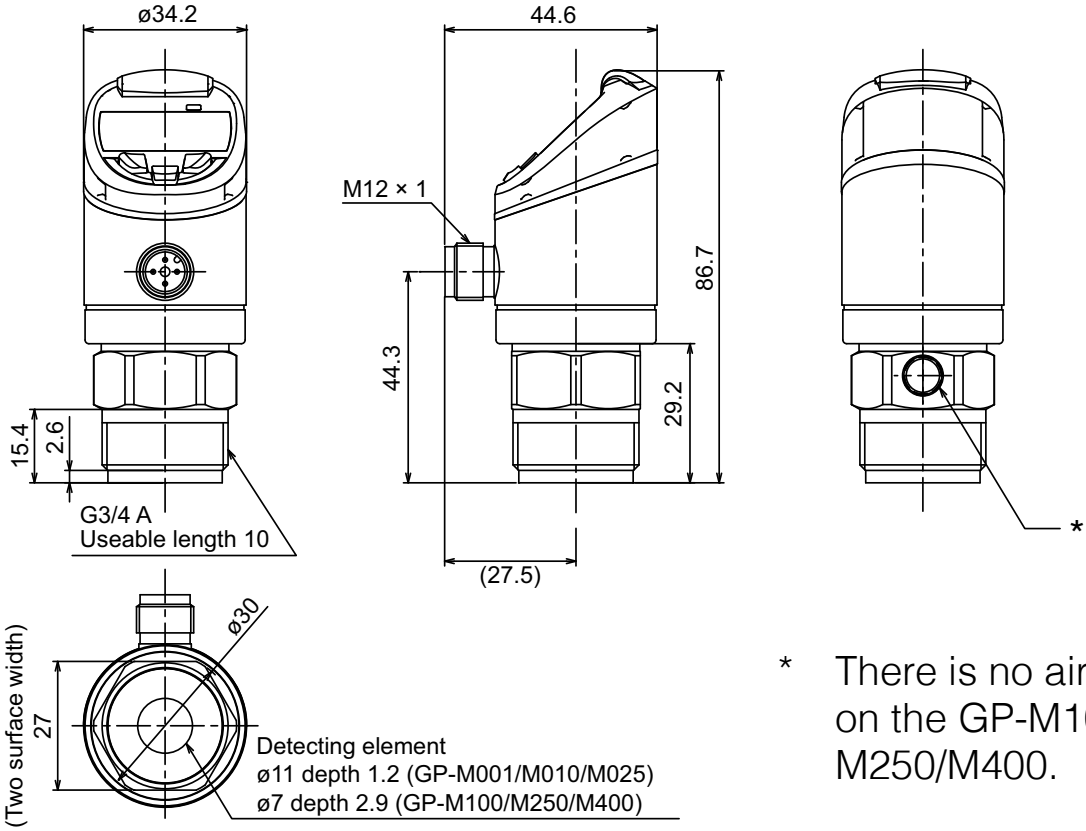


*7 Only for the GP-M001/M010/M025

Dimensions

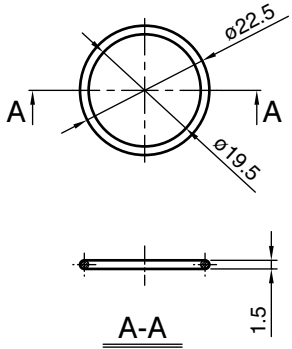
(Unit : mm)



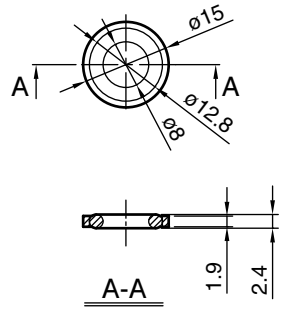


* There is no air hole on the GP-M100/ M250/M400.

O-ring
for GP-M001/M010/M025 use



O-ring set
for GP-M100/M250/M400 use



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KEYENCE CORPORATION

1-3-14, Higashi-Nakajima, Higashi-Yodogawa-ku,
Osaka, 533-8555, Japan
PHONE: +81-6-6379-2211

www.keyence.com

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