Panasonic **INSTRUCTION MANUAL**

Magnetic Displacement Sensor

High Accuracy Eddy Current Type Displacement Sensor

GP-A Series

CME-GPA(01) No.0031-88V

Thank you very much for using our products. Please read this Instruction Manual carefully and thoroughly for the correct and optimum use of this product. Kindly keep this manual in a convenient place for quick reference.

WARNING

- Never use this product as a sensing device for personnel protection.
- In case of using sensing devices for personnel protection, use products which meet laws and standards, such as OSHA, ANSI or IEC etc., for personnel protection applicable in each region or country.

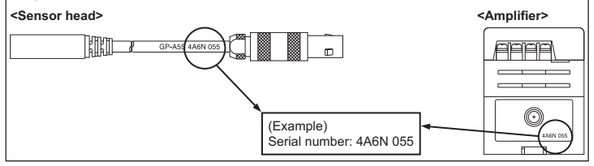
1 SPECIFICATIONS

Item \ Type		For 1mm sensing	For 2mm sensing		For 5mm sensing	For 3mm sensing
		Non-threaded type sensor head	Non-threaded type sensor head	Threaded type sensor head	Threaded type sensor head	Front sensing type sensor head
	Set model No. (Note 1)	**GP-A5S(I)**	**GP-A8S(I)**	**GP-A10M(I)**	**GP-A12ML(I)**	**GP-A14F(I)**
Sensing range		0 to 1mm	0 to 2mm		0 to 5mm	0 to 3mm
Standard sensing object		Iron sheet 8×8×t1mm	Iron sheet 12×12×t1mm		Iron sheet 30×30×t1mm	Iron sheet 15×15×t1mm
Supply voltage		24V DC±10% Ripple P-P 10% or less				
Current consumption		150mA or less				
Analog output (Analog voltage output / Analog current output)		Analog voltage ・Output voltage: 0 to 5V ・Output impedance: 100Ω approx.			Analog current ・Output current: 4 to 20mA ・Load resistance: 0 to 350Ω	
	Response frequency	1.6kHz (-3dB)				
	Resolution	0.04% F.S.				
	Linearity	Within ±0.5% F.S.				
Alarm output		NPN open-collector transistor ・Maximum sink current: 100mA ・Applied voltage: 30V DC or less (between alarm output and 0V) ・Residual voltage: 1.6V or less (at 100mA sink current) 0.4V or less (at 16mA sink current)				
	Output operation	Turns ON when the sensor head connection is improper or the sensor head cable is disconnected				
	Short-circuit protection	—				
External zero-adjustment input		Input condition: Non-voltage contact or NPN open-collector transistor input Signal condition: Low ... 0 to 1V (duration 30ms or more) High ... 5 to 30V, or open Operation: Low ... External zero-adjustment setting High ... External zero-adjustment ineffective				
Zero-adjustment setting method		Push button setting / External input setting				
Power indicator		Green LED (lights up when the power is ON)				
Over indicator		Orange LED (lights up when sensing range is exceeded)				
Alarm indicator		Yellow LED (lights up when alarm output is ON)				
Adjustment functions		① Shift adjustment (by push-buttons) ② Span adjustment (by 14-turn adjuster)				
Temperature characteristics (Note 2)	Sensor head	0.5μm/℃	0.6μm/℃ (1μm/℃ for **GP-A8SI** and **GP-A10MI**)		1.5μm/℃ (2.5μm/℃ for **GP-A12MLI**)	0.9μm/℃ (1.5μm/℃ for **GP-A14FI**)
	Amplifier	0.4μm/℃	0.8μm/℃		2.0μm/℃	1.2μm/℃
Protection	Sensor head	IP67 (IEC), IP67g (JEM)				
	Amplifier	—				
Ambient temperature	Sensor head	-10 to +55℃, Storage: -20 to +70℃				
	Amplifier	0 to +50℃ (No dew condensation), Storage: 0 to +50℃				
Ambient humidity		35 to 85% RH, Storage: 35 to 85% RH				
Material	Sensor head	Enclosure: Stainless steel (SUS303) Sensing part: Polyalylate	Enclosure: Stainless steel (SUS303) Sensing part: ABS		Enclosure: Brass (Nickel plated) Sensing part: Nylon	Enclosure: Stainless steel (SUS303) Sensing part: ABS
	Amplifier	Enclosure: ABS				
Cable (Note 3)	Sensor head	Connector attached high frequency coaxial cable, 3m long				
Cable length (Note 4)	Amplifier	Up to total 100m with 0.3mm², or more, cable				
Weight	Sensor head	40g approx.		50g approx. (Note 5)	45g approx. (Note 5)	50g approx.
	Amplifier	170g approx.				
Accessories		Adjusting screwdriver: 1 pc.		Nut: 2 pcs. Toothed lock washer: 1 pc. Adjusting screwdriver: 1 pc.		2 pcs. each of M3 countersunk head screws, spring washers, plain washers and M3 nuts Adjusting screwdriver: 1 pc.

Notes: 1) Set model Nos. having the suffix 'I' are different frequency type.
2) These values are for a range which is 20 to 60% of the maximum sensing distance.
3) The length of the sensor head cable cannot be changed.
4) The given weight of the threaded type sensor head is the value including the nuts and the toothed lock washer.
5) Take care that the output voltage is reduced due to the resistance of the wiring cable.

2 CAUTIONS

Make sure that the sensor head and the amplifier which have the same production serial number (7 digit) are used in combination. Since adjustment is done before shipment, if items with different production serial numbers are combined, the sensing characteristics will deteriorate even if they have the same model Nos.



- Make sure that the power supply is off while wiring.
- Take care that wrong wiring will damage the sensor.
- Verify that the supply voltage variation is within the rating.
- If power is supplied from a commercial switching regulator, ensure that the frame ground (F.G.) terminal of the power supply is connected to an actual ground.
- In case noise generating equipment (switching regulator, inverter motor, etc.) is used in the vicinity of this product, connect the frame ground (F.G.) terminal of the equipment to an actual ground.
- Do not run the wires together with high-voltage lines or power lines or put them in the same raceway. This can cause malfunction due to induction.
- Do not use during the initial transient time (0.5 sec.) after the power supply is switched on.
- The length of the sensor head cable cannot be changed.
- Make sure that stress by forcible bend or pulling is not applied directly to the sensor cable joint.
- The alarm output is not incorporated with a short-circuit protection circuit. Do not connect it directly to a power supply or a capacitive load.
- Do not use the sensor at places having intense vibrations, as this can cause malfunction.
- Take care that the product does not come in direct contact with water, oil, grease, organic solvents, such as, thinner etc., strong acid or alkaline.
- Make sure that the sensing end is not covered with metal dust, scrap or spatter. It will result in malfunction.
- For stable sensing, carry out the adjustments 30 min., or more, after the power supply is switched on.

3 MOUNTING

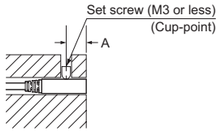
- Make sure that the sensor head and the amplifier which have the same production serial number (7 digit) are used in combination.
- The length of the sensor head cable cannot be changed.

● Mounting sensor head

・ The tightening torque should be under the values given below.

Mounting with set screw [GP-A5S(I), GP-A8S(I) only]

・ Make sure to use an M3, or smaller, set screw having a cup-point.



Model No.	Set screw position A (mm)	Tightening torque
GP-A5S(I)	5 or more	0.44N·m
GP-A8S(I)		0.58N·m

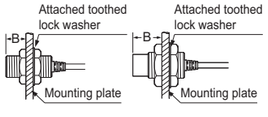
Note: Do not apply excess torque.

Mounting with nut [GP-A10M(I), GP-A12ML(I) only]

・ Mount such that the nuts do not protrude from the threaded portion.

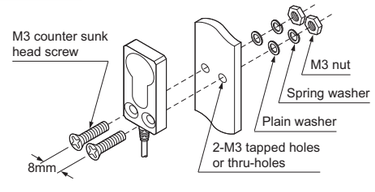
<Threaded type>

GP-A10M(I) **GP-A12ML(I)**



Model No.	B part (mm)	Tightening torque
GP-A10M(I)	7 or more	9.8N·m
GP-A12ML(I)	14 or more	20N·m

Mounting GP-A14F(I)



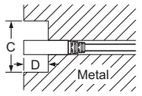
● Distance from surrounding metal

・ As metal around the sensor may affect the sensing performance, pay attention to the following points.

<Embedding of the sensor in metal>

・ Since the analog output may change if the sensor is completely embedded in metal, keep the minimum distance specified in the table below.

Non-threaded type sensor head, threaded type sensor head



Model No.	C (mm)	D (mm)
GP-A5S(I)	ϕ18	4
GP-A8S(I)		
GP-A10M(I)		7
GP-A12ML(I)	ϕ50	14

Front sensing type sensor head

・ **GP-A14F(I)** can be used by being completely embedded in metal. However, the surrounding metal should not protrude beyond the sensing face.

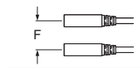
● Mutual interference

・ If several sensor heads are mounted together, since the specifications may not be met, keep the minimum separation distance given below.

Non-threaded type sensor head, threaded type sensor head

<Face to face mounting>

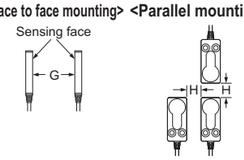
<Parallel mounting>



Model No.	Condition	E (mm)	F (mm)
GP-A5S(I)	Between 'I' type and non-'I' type	18	11
	Between two 'I' types or two non-'I' types	50	36
GP-A8S(I) **GP-A10M(I)**	Between 'I' type and non-'I' type	22	11
	Between two 'I' types or two non-'I' types	60	38
GP-A12ML(I)	Between 'I' type and non-'I' type	24	14
	Between two 'I' types or two non-'I' types	210	130

Front sensing type sensor head

<Face to face mounting> **<Parallel mounting>**



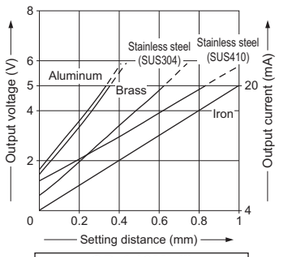
Model No.	Condition	G (mm)	H (mm)
GP-A14F(I)	Between 'I' type and non-'I' type	14	0
	Between two 'I' types or two non-'I' types	68	30

Notes: 1) **'I'** type is different frequency type.
2) If the required resolution is lower than the specification (0.04% F.S.), it is possible to bring the sensor heads nearer than the separation distance given in the table above. For further details, please contact our office.

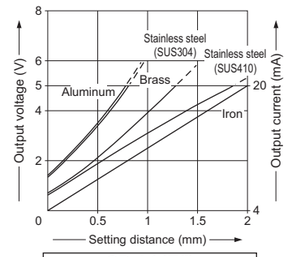
● Dependence of output characteristics on material (typical)

・ Take care that, depending upon the material of the sensing object, the output differs as shown in the figures below.

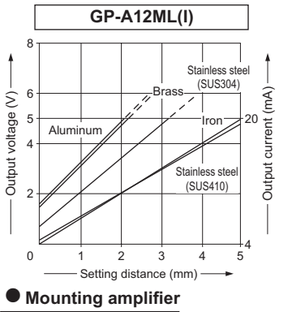
GP-A5S(I)



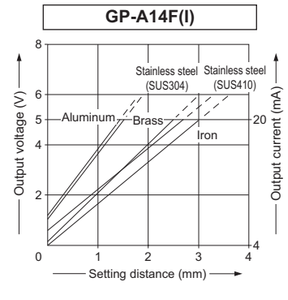
GP-A8S(I), GP-A10M(I)



GP-A12ML(I)



GP-A14F(I)

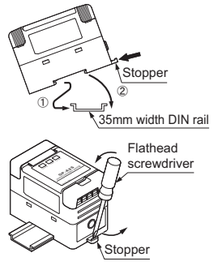


● Mounting amplifier

Mounting on DIN rail

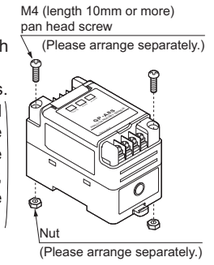
① With the stopper pressed in the direction of the arrow (it locks), fit the front portion of the amplifier mounting section on the 35mm width DIN rail.
(Lightly press the grooved section of the)
② stopper downwards when pressing the stopper in.

* Press and fit the rear portion of the amplifier mounting section on the 35mm width DIN rail. To remove, insert a flathead screwdriver into the stopper and pull out.



Mounting with screws

・ Use two commercially available M4 (length 10mm or more) pan head screws.
The tightening torque should be 1.2N·m or less.
(Please arrange the pan head screws and nuts separately. The mounting holes for the screws can be accessed by removing the terminal cover. To remove the terminal cover, insert a flathead screwdriver into the groove of the terminal cover and lift up.)

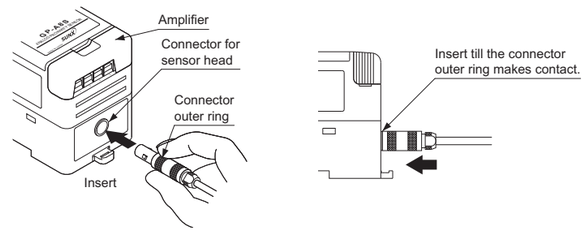


Notes: 1) If two, or more, amplifiers are mounted together, make sure to leave a gap of at least 10mm between them.
2) If the amplifier is installed in a control box, etc., ensure proper ventilation.

4 CONNECTION

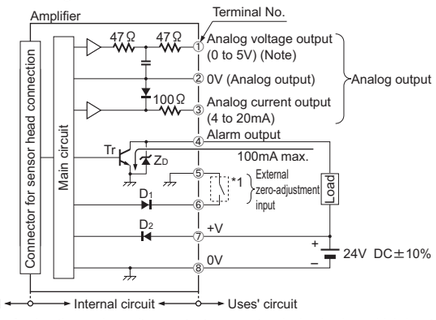
● Connection of sensor head and amplifier

・ Hold the sensor head's connector by the outer ring and insert it into the connector provided on the amplifier for sensor head connection. Insert till you hear a click sound.



* To remove the sensor head, hold its connector by the outer ring and pull it straight out.
(Do not pull by holding the cable, as this can result in cable disconnection.)

● I/O circuit diagram

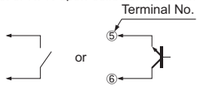


Note: In case of using the analog voltage output, connect a device having a high input impedance. Also, take care that the output voltage is reduced due to the resistance of the wiring cable.

Symbols ... D1 : Input protection diode
D2 : Reverse supply polarity protection diode
ZD : Surge absorption zener diode
Tr : NPN output transistor

*1

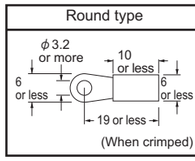
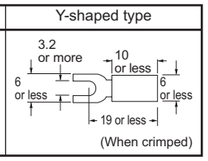
Non-voltage contact or NPN open-collector transistor



Low (0 to 1V) (duration 30ms or more): External zero-adjustment setting
High (5 to 30V, or open): External zero-adjustment ineffective

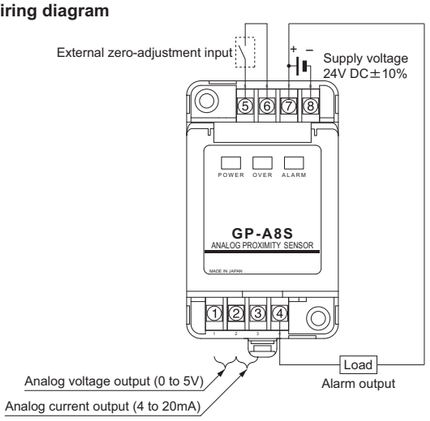
● Dimensions of suitable crimp terminal

(Unit: mm)

Round type	Y-shaped type
	
(When crimped)	(When crimped)

Note: Please use crimp terminals which have insulation sleeves.
Recommended crimp terminal: Type 1.25 - 3.0

● **Wiring diagram**



Note: After the wiring, make sure to fit the terminal covers. The terminal cover having a concave depression at the top should be fitted on the side having terminal Nos. 1 to 4.

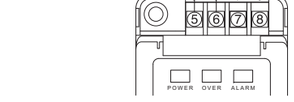
5 ALARM OUTPUT

- Alarm signal is output when the sensor head connection is improper of the sensor head cable is disconnected.
  [Alarm indicator (yellow) lights up when alarm output is ON.]
- The alarm output is not incorporated with a short-circuit protection circuit. Do not connect it directly to a power supply or a capacitive load.

6 EXTERNAL ZERO-ADJUSTMENT INPUT

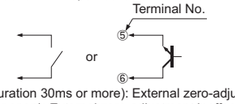
The external zero-adjustment input should be applied 30 min., or more, after the power supply is switched on.

- Zero-adjustment can be remotely done by an external input by using the zero-adjustment input terminals (terminal Nos. 5 and 6).
- If the external zero-adjustment input terminals (terminal Nos. 5 and 6) are short-circuited for 30ms, or more, the analog voltage output and the analog current output are forcibly set to 0V and 4mA, respectively.



*1

Non-voltage contact or NPN open-collector transistor

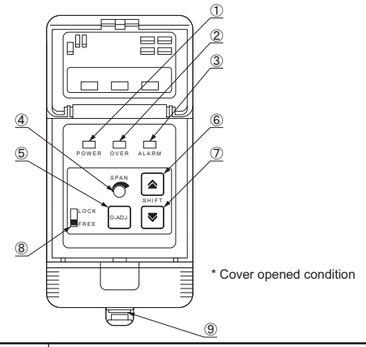


Low (0 to 1V) (duration 30ms or more): External zero-adjustment setting
High (5 to 30V, or open): External zero-adjustment ineffective

- The external zero-adjustment input operation is independent of the state of the 'button operation effective / ineffective selection switch'.
  However, since the external zero-adjustment setting is not stored in the EEPROM (memory), it is canceled when the power supply is switched off. In case it is desired to store the setting in the EEPROM, set the button operation effective / ineffective selection switch' once to the 'FREE' side and again to the 'LOCK' side, before switching off the power supply.

Note: If the power supply is switched on with the external zero-adjustment input terminals (terminal Nos. 5 and 6) short-circuited, since zero-adjustment gets done in the transient state of the power supply switching on, stable sensing is not possible.
Further, ensure to apply the zero-adjustment input 30 min., or more, after the power supply is switched on.

7 FUNCTIONAL DESCRIPTION



* Cover opened condition

	Description	Function	
①	Power indicator (Green)	Lights up when the power is ON.	
②	Over indicator (Orange)	Lights up when the sensing range is exceeded.	
③	Alarm indicator (Yellow)	Lights up when the sensor head connection is improper or the sensor head cable is disconnected.	
④	Span adjuster	Analog output's output voltage range and output current range can be adjusted. It is a 14-turn potentiometer.	
⑤	Zero-adjustment button	The zero-point of the analog output can be set. Further, if it is pressed continuously for 3 sec., or more, the zero-point value can be erased.	
⑥	Shift-up button	Analog output's offset value can be increased.	If both the buttons are pressed simultaneously for 3 sec., or more, the set value can be erased.
⑦	Shift-down button	Analog output's offset value can be decreased.	
⑧	Button operation effective / ineffective selection switch	If it is set to the 'LOCK' side, the operation of the zero-adjustment button, the shift-up button and the shift-down button is ineffective. Set it to the 'FREE' side during adjustment, and to the 'LOCK' side during sensing. The values of zero-point setting and shift adjustment are stored in an EEPROM (memory) whenever the switch is changed from the 'FREE' side to the 'LOCK' side.	
⑨	Connector for sensor head	It is the connector for sensor head connection.	

8 ADJUSTMENT

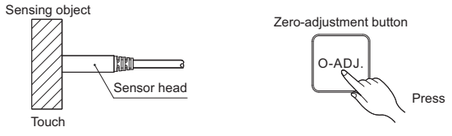
- This product is delivered after being adjusted with the standard sensing object. However, since there are slight differences due to the sensing object being used, carry out the adjustment as per the following procedure, using a voltmeter or ammeter, oscilloscope, etc.

- Make sure to carry out the adjustment 30 min., or more, after the power supply is switched on.
- Since the analog voltage output and the analog current output get adjusted simultaneously, it is not possible to adjust them individually.

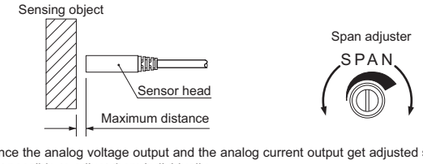
① Switch on the power supply after confirming that proper connection has been made to the external device to which **GP-A** is to be connected.
② Start the adjustment 30 min., or more, after switching on the power supply.
③ Open the cover on the top of the amplifier and set the 'button operation effective / ineffective selection switch' to the 'FREE' side.

Button operation effective / ineffective selection switch

④ Touching the sensor head to the sensing object, press the 'zero-adjustment button' and set the zero-point. At this time, the analog voltage output and the analog current output are forcibly set to 0V and 4mA, respectively.



⑤ Set the sensor head at the maximum distance [**GP-A5S**(**I**): 1mm, **GP-A8S**(**I**) and **GP-A10M**(**I**): 2mm, **GP-A12ML**(**I**): 5mm, **GP-A14F**(**I**): 3mm] from the sensing object. Now, adjust the analog voltage output +5V or the analog current output to 20mA by turning the span adjuster with the accessory adjusting screwdriver.

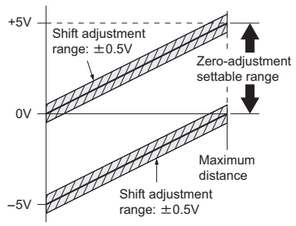


Note: Since the analog voltage output and the analog current output get adjusted simultaneously, it is not possible to adjust them individually.

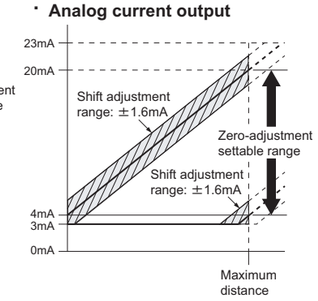
⑥ Once again, touch the sensor head to the sensing object, and confirm that the analog voltage output and the analog current output are 0V and 4mA, respectively. In case they are not, repeat the adjustment from step ④.
⑦ The following shift adjustment and span adjustment can be done if required.

Shift adjustment range

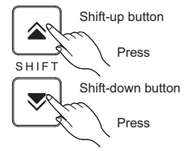
・ **Analog voltage output**



・ **Analog current output**



・ Using the 'shift-up button' and the 'shift-down button', it is possible to adjust the offset value for the analog voltage output by ±0.5V and that for the analog current output by ±1.6mA.

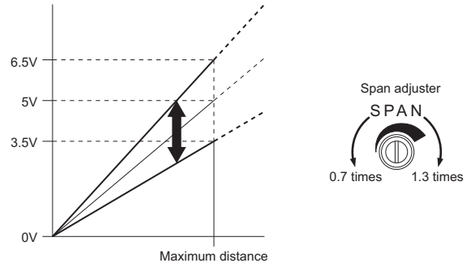


・ As long as the sensing object is within the sensing range, the analog voltage output and the analog current output can be adjusted to 0V and 4mA, respectively, with the 'zero-adjustment button'.

Note: The analog current output is limited to a lower limit of 3mA and an upper limit of 23mA by a control circuit.

Span adjustment range

・ The output span (slope) can be adjusted with the span adjuster over a range of 0.7 to 1.3 times that for the standard sensing object.



Note: Since the span adjustment can be done irrespective of the 'button operation effective / ineffective selection switch' position, do not operate the span adjuster after the adjustment.

⑧ After the adjustment, make sure to set the 'button operation effective / ineffective selection switch' to the 'LOCK' side.

Button operation effective / ineffective selection switch

The values of zero-point setting and shift adjustment get stored in an EEPROM when the switch is set to the 'LOCK' side. The values stored in the EEPROM are not erased even when the power supply is switched off.
However, kindly note that the EEPROM has a life span and its guaranteed life is 100,000 write operation cycles.

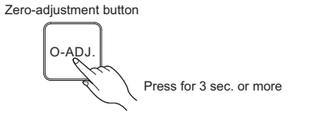
Notes: 1) The set values are not stored in the EEPROM if the power supply is switched off when the switch is on the 'FREE' side.
2) If the switch is set to the 'LOCK' side before adjustment, the set values cannot be changed.

⑨ Close the cover on top of the amplifier.

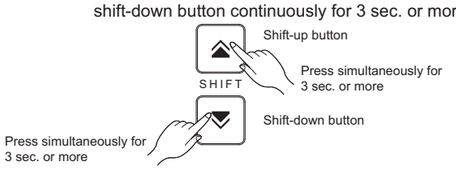
● Follow the procedure given below to cancel a set value during adjustment.

During adjustment, if the switch is once set to the 'LOCK' side, the set value is stored in the EEPROM and it is not possible to cancel it. In this case, repeat the adjustment from step ③.

・ Zero-adjustment setting: Press the zero-adjustment button continuously for 3 sec. or more.



・ Shift adjustment: Simultaneously press the shift-up button and the shift-down button continuously for 3 sec. or more.



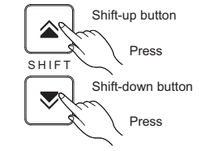
(Example) To shift the analog voltage output for a certain distance from 2.5V to 3V

(1) Set the sensor head at the desired distance from the sensing object.

(2) Set the 'button operation effective / ineffective selection switch' to the 'FREE' side.

Button operation effective / ineffective selection switch

(3) Adjust the analog voltage output to 3V by pressing the shift-up button.
If the analog voltage exceeds 3V, adjust it to 3V by pressing the shift-down button.



(4) Set the 'button operation effective / ineffective selection switch' to the 'LOCK' side.

Button operation effective / ineffective selection switch

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