

Linear Magnetic Sensor Controller ZL1

Instruction Manual Ver 1.0

Thank you for purchasing this Koganei product.
Before using it, be sure to read this manual and make sure you use it correctly.
Keep this manual in a safe place for future reference.

⚠ DANGER Do not use this product for the purpose of accident prevention or for other safety assurance purposes. Using the product in any of the ways described above creates the risk of loss of human life.

1 Specifications

● Controller

Item	Model	ZL1
Power supply voltage		24 VDC ±10%
Consumption current		50 mA max. (Not including supply power to sensor.)
Sensor input supply power and voltage		5 VDC
Sensor input maximum input voltage		3.0 V
Switch output method		NPN open collector output, 5 points
Load voltage		30 VDC
Load current		50 mA max.
Switch output volume repeatability		±1% F.S. ±1 digit <small>Note</small>
Internal voltage drop		0.3 V MAX. (When I _c = 5 mA)
Response time		5 ms MAX.
Operation indicator light		Lights red when each switch output is on.
Value display		% display within effective measuring range (4 digits, 2-color display: red and green)
Analog output voltage range		1 ~ 5 VDC (1 KΩ output impedance)
Analog output repeatability		±1% of F.S (25°C ±5°C) <small>Note</small>
Insulation resistance		100 MΩ MIN. (500 VDC Megger, between case and lead wire terminal)
Withstand voltage		500 VAC (50/60 Hz) in 1 minute (between case and lead wire terminal)
Shock resistance		294.2 m/s ² (non repetitive)
Ambient temperature		0 to 50°C (non-condensation, non-freezing)
Storage temperature range		-10 to 70°C (non-condensation, non-freezing)
Mass		40 g

Note: This performance excludes the mechanical looseness of a cylinder with a fixed magnet (standalone performance). In the case of a movable type cylinder whose magnet is not fixed, the movable part and repeatability are degraded.

● Sensor head

Item	Model	ZLS1-□L
Power supply voltage		5 VDC ±5%
Consumption current		20 mA max.
Mounting methods		Embedded type
Operation indicator light		Red LED lights at optimal sensitivity position (Operation position can be changed by setting.)
Lead wire		Heat-resistant, oil-resistant vinyl sheath instrumentation cable φ2.9 0.15 mm ² 5 core With 6P connectors
Insulation resistance		100 MΩ MIN. (500 VDC Megger, between case and lead wire terminal)
Withstand voltage		500 VAC (50/60 Hz) in 1 minute (between case and lead wire terminal)
Shock resistance		294.2 m/s ² (non repetitive)
Protective structure		IP67
Vibration resistance		88.3 m/s ² (Double amplitude: 1.5 mm 10 ~ 55 Hz)
Ambient temperature		0 to 50°C (non-condensation, non-freezing)
Storage temperature range		-10 to 70°C (non-condensation, non-freezing)
Mass		20 g (When 1L lead wire length is 1000 mm.)

Connector number

● Sensor head

Connector side number	Signal name	Lead wire color
1	Sensor head voltage (+)	Sensor head brown lead
2	Sensor head voltage output A_IN	Sensor head white lead
3	Sensor head voltage output B_IN	Sensor head black lead
4	Indicator (LED) input	Sensor head red lead
5	GND	Sensor head blue lead
6	NC	Not connected

● Power supply

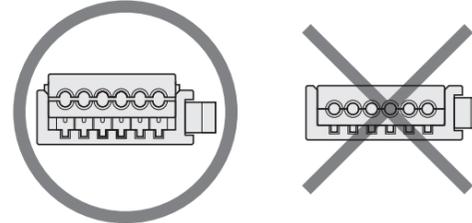
Pin No.	Signal name	Lead wire color
1	Power supply voltage input (24 V)	Brown
2	Analog output (1 ~ 5V)	Gray
3	Effective measuring range signal output (STAB)	Black
4	GND	Blue
5	Switch output OUT1	White
6	Switch output OUT2	Red
7	Switch output OUT3	Green
8	Switch output OUT4	Yellow

2 Installation

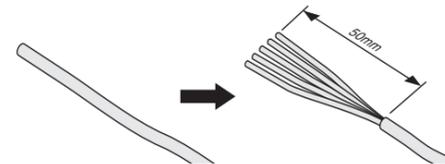
Sensor head and connector connection overview

The ZLS1-□ sensor head is provided to you with the mini plug wire mount plug connected to the sensor head unit. A special tool is required if you need to reconnect in order to adjust the length. Use the following procedure when reconnecting.

- Be sure to use the mount plug and the special tool shown below when reconnecting.
6P mini clamp wire mount plug Model: **ZL-6M**
Special tool Model: **1729940-1**
Tyco Electronics Japan G.K.
- Check to make sure that the connector cover (lead wire inlet) is sitting above the body of the connector. Note that a connector whose cover is even with the body of the connector cannot be used.

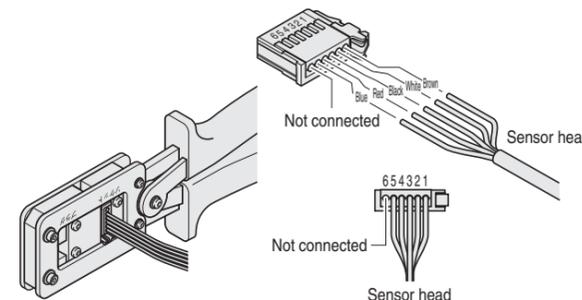


- Cut the sensor head cable to the required length.
Strip the outer covering of the cable, 50 mm from the end, to expose the lead wires. Do not strip the insulation from the individual lead wires at this time.



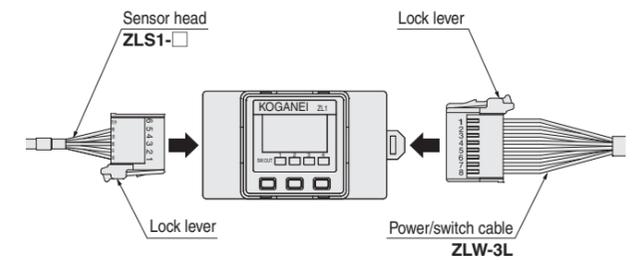
- Insert the lead wires into the connector cover holes in accordance with the information in the table below. Check to make sure the lead wires are fully inserted (wire goes in about 9 mm) as far as they will go by viewing the semi-transparent top cover of the connector.
Note that supplying power while connections are incorrect will damage the sensor head and controller.

Connector side number	Signal name	Lead wire color
1	Sensor head voltage (+)	Sensor head brown lead
2	Sensor head voltage output A_IN	Sensor head white lead
3	Sensor head voltage output B_IN	Sensor head black lead
4	Indicator (LED) input	Sensor head red lead
5	GND	Sensor head blue lead
6	NC	Not connected



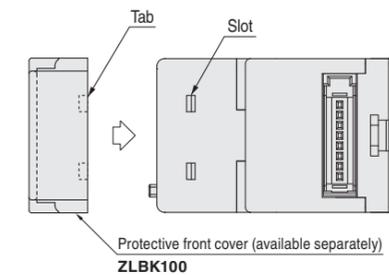
- Taking care not to allow the lead wires to come out of the connector, use the special tool (don't try to use any other tool) to squeeze the cover and body of the connector until the cover is pressed into the body. Connection is complete when the cover is even with the connector body.
- Double check to make sure that wiring is correct.

Attaching and detaching of the sensor head and power/switch cables

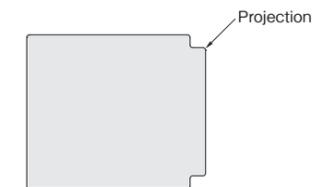


To attach the sensor head and the power/switch cables, position the lock levers as shown in the illustration above, and then insert until they lock into place with the controller side connectors. To disconnect, press the lock lever down as far as it will go as you pull the connector to unplug it. At this time, take care not to apply undue force to the lead wires.

Attaching the protective front cover



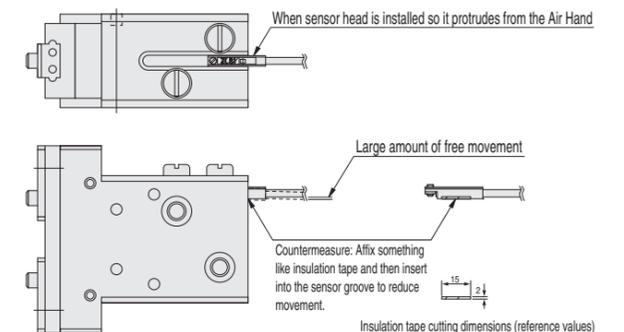
Attach the protective front cover so the tabs inside the cover enter the slots on the Linear Magnetic Sensor Controller.



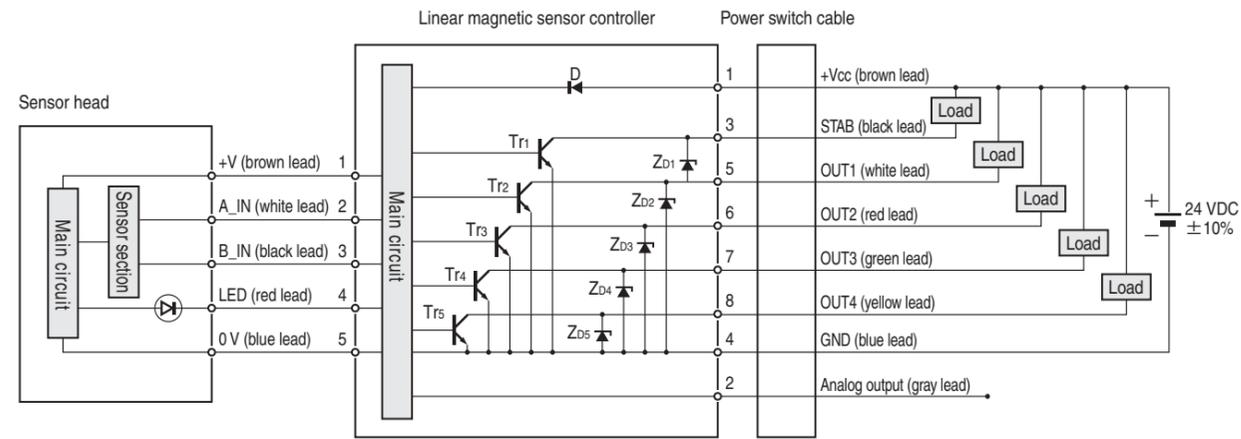
* To remove the protective front cover, hook your finger on the projection on one side of the cover and remove it.

Sensor head installation precautions

- After inserting the sensor head into the Air Hand or cylinder switch mounting groove (depending on which you are using) and move the sensor head to the suitable position, secure it in place with the fixing screw. Use a tightening torque of 0.2 N·m or less.
- For information about the sensor head insertion direction, see the "Sensor switch mounting method" for the Air Hand or cylinder you are using.
- When the sensor head is installed in a position that causes it to protrude from the Air Hand or cylinder body you are using, the sensor head will move by the amount of the gap with the sensor groove, which will cause deterioration of sensing precision. Affix insulating tape or some other suitable material to the lower part of the sensor head (as shown in the illustration below) in order to reduce the gap.



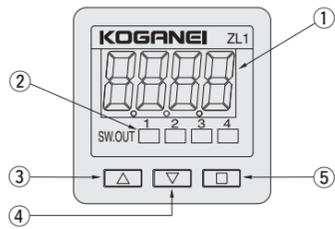
3 Inner Circuit Diagrams



Note: Note that extending the cable can cause a drop in voltage due to cable resistance.

Signal D : Power supply reverse-polarity protection diode
 ZD1 ~ ZD5 : Surge voltage absorption zener diode
 Tr1 ~ Tr5 : NPN output transistors

4 Nomenclature and functions



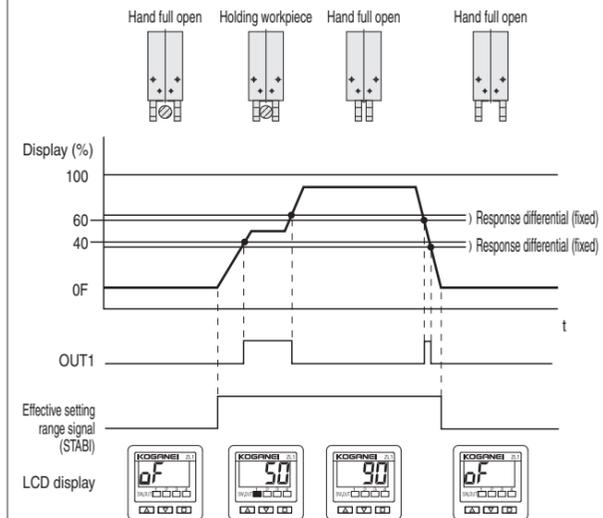
No.	Name	Description
①	Display	Shows effective measuring range %, setting details, error indicators.
②	Switch output indicators.	Light when switch output is ON (CH1 ~ CH4).
③	UP key (Δ).	Use to increase a setting value.
④	DOWN key (∇).	Use to decrease a setting value.
⑤	MODE key (\square).	Use when configuring settings.

5 Output mode

Window comparator mode

The ON range of each output can be set within the effective measuring range (sensor head ON range). Response differential is fixed (2% F.S).

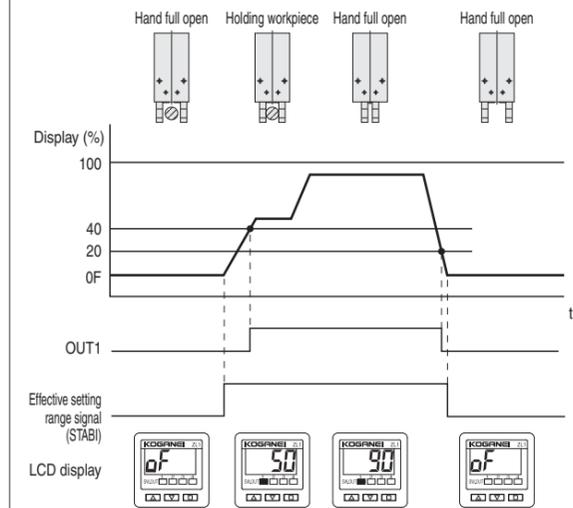
When the controller setting and sensor head setting positions are as shown below.
 OUT1 Threshold value setting Upper limit: 60 Lower limit: 40
 Display when hand is full open: 90



Hysteresis mode

The ON position and OFF position each output can be set within the effective measuring range (sensor head ON range).

When the controller setting and sensor head setting positions are as shown below.
 OUT1 Threshold value setting Upper limit: 40 Lower limit: 20
 Display when hand is full open: 90



CAUTION: When the effective measuring range signal is OFF (outside the measuring range), OUT also becomes OFF.

6 Setting

CAUTION

1. Incorrect wiring of the sensor head or power/switch cable will damage both the controller and the sensor head. Be sure to double-check and make sure that wiring is correct before supplying power.
2. Parameters that are set are recorded into flash memory and retained there. Note that flash memory has a limited service life. The guaranteed number of rewrites is 10,000.

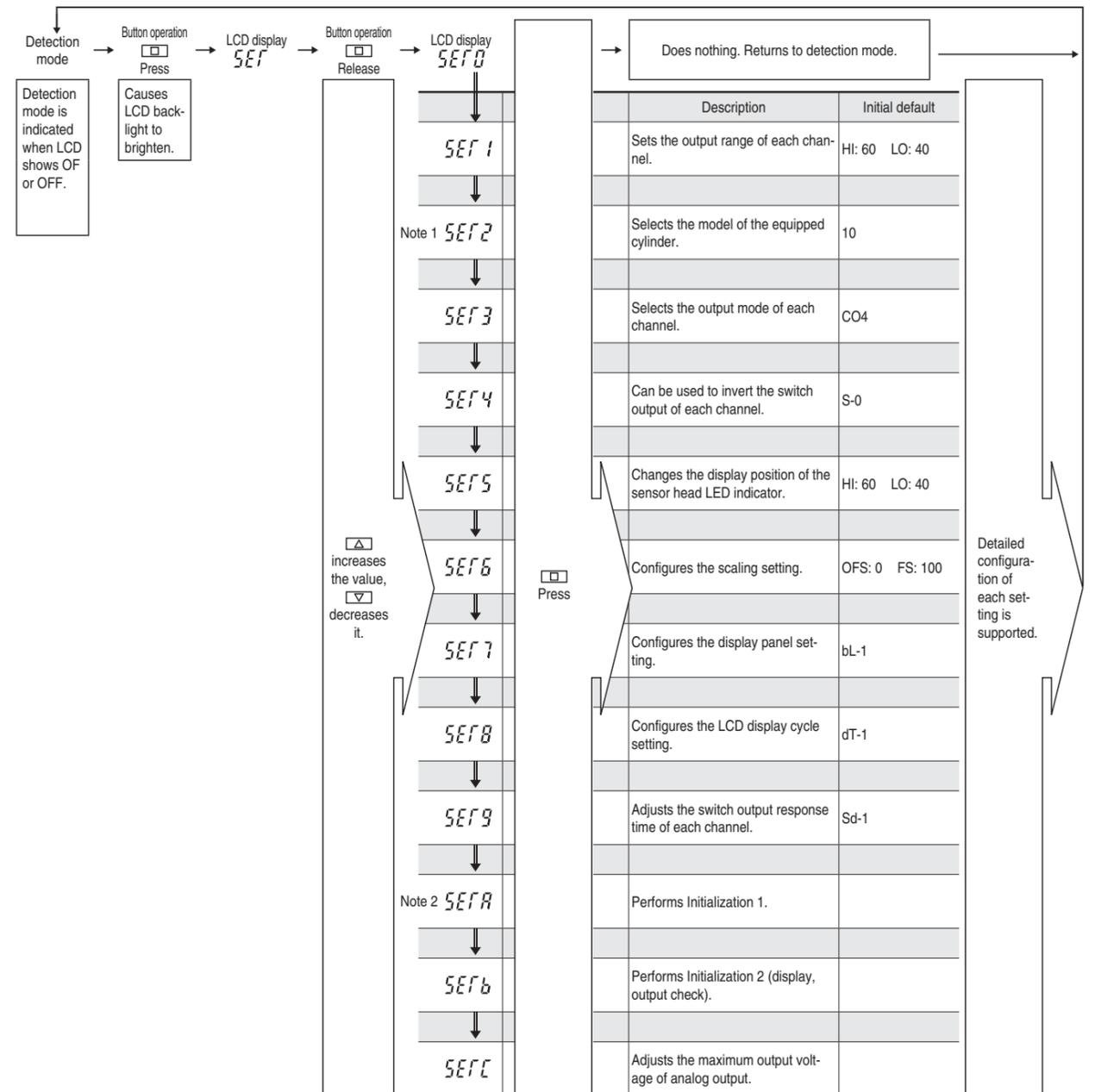
Getting ready to configure settings

- Connect the sensor head and power/switch cable to the controller. (Refer to "Attaching and detaching of the sensor head and power/switch cables" on page 2).

Configuring settings

General flow

First specify the cylinder model that is equipped (SET2), and then configure the other settings (as shown below). You also can use the procedure below to modify settings.



Note 1: Always be sure to configure the equipped cylinder model setting. Failure to do so creates the risk of malfunction.

Note 2: Note that initialization (SETA, SETB) initializes all settings, so any settings you have configured are lost.

Threshold value setting (SET1)

Use this setting to set threshold values for each channel.

	Window comparator	Hysteresis
Upper limit (L2)	ON/OFF positions	ON position
Lower limit (L1)	ON/OFF positions	OFF position

Procedure	Button operation	Display after operation	Indicator	Backlight	Remarks
1		SEF1		Green	Set the output range of each OUT.
2	[]	(Initial default: 60)	OUT flashing	Red	Set the upper limit value for indicator flashing.
3	[]			↓	Change the setting value as required.
4	[]	(Initial default: 40)		Green	Set the lower limit value for indicator flashing.
5	[]			↓	Change the setting value as required.
6	[]	(Initial default: 60)	OUT flashing	Red	OUT2, OUT3: Repeat steps 2 through 5. OUT4: Return to detection mode.

Note 1: Input condition - Upper Limit (L2) > Lower Limit (L1) + 1
2: When the scaling setting is being used and the difference between its OFs and Fs values is 500 or greater, use the following for the threshold value setting input condition: Upper Limit (L2) > Lower Limit (L1) + 10.

Installed cylinder model setting (SET2)

Change this setting in accordance with the cylinder model that the cylinder head will be set into.

Procedure	Button operation	Display after operation	Remarks
1		SEF2	Selects the model of the equipped cylinder.
2	[]	RnLb	
3	[]	(Initial default: 10)	
4	[]		Change the model number of the equipped cylinder.
5	[]	of	After one second, returns to detection mode.

Applicable cylinder	Cylinder Bore	SET2 number	Applicable cylinder	Cylinder bore	SET2 number
NHC1D	All cylinders	10	MGA	All cylinders	20
NHL1D	All cylinders	10	TBDA	All cylinders	18
NHB PG(L)	All cylinders	10	ARS	All cylinders	16
NHB P(A)	All cylinders	10		6	13
NHB S	All cylinders	10	CDAS	8	14
NHBDSL(G)	All cylinders	10	SGDA	32	16
	6, 18	15		Other than above	15
AFDPG	8, 14	12	MS	6, 10	18
	12	16		16, 20	16

For information about other cylinders, contact Koganei.

Output mode setting (SET3)

Use this setting to set the output mode for each channel.

Procedure	Button operation	Display after operation	Remarks
1		SEF3	Set the output range of each OUT.
2	[]	CH1	Select the channel of each OUT.
3	[]	CH1~CH4	CH1: OUT1 CH2: OUT2 CH3: OUT3 CH4: OUT4
4	[]	EO4	Select the output mode.
5	[]	OFF~HFS	OFF : Output OFF EO4 : Window comparator mode HFS : Hysteresis mode (Note)
6	[]	CH*	Shows the channel number setting (1 second) Shows the channel mode setting (1 second)
7	[]	of	After one second, returns to detection mode.

Caution: Valid within the effective measuring range (operating range).

Switch output inversion setting (SET4)

This setting can be used to invert the switch output of each channel.

Procedure	Button operation	Display after operation	Remarks
1		SEF4	Set the contact type of each OUT.
2	[]	CH1	Select the channel of each OUT.
3	[]	CH1~CH4	CH1: OUT1 CH2: OUT2 CH3: OUT3 CH4: OUT4
4	[]	S-0	Select the contact type.
5	[]	S-0~S-1	S-0: Non-inversion (A contact) S-1: Inversion (B contact)
6	[]	CH*	Shows the channel number setting (1 second) Shows the channel mode setting (1 second)
7	[]	of	After one second, returns to detection mode.

LED display range setting (SET5)

This setting can be used to change the display position of the sensor head LED indicator.

Procedure	Button operation	Display after operation	Remarks
1		SEF5	
2	[]	Lo	Set the display lower limit value.
3	[]	(Initial default: 40)	
4	[]		Change the value as required.
5	[]	Hi	Set the display upper limit value.
6	[]	(Initial default: 60)	
7	[]		Change the value as required.
8	[]	of	After one second, returns to detection mode.

Scaling setting (SET6)

With this setting, a location between two points is specified and scaling is performed.

Procedure	Button operation	Display after operation	Remarks
1		SEF6	
2	[]	OFS	Move the cylinder to the lower limit value position.
3	[]	(Initial default: 0)	Set the scaling lower limit value.
4	[]		Change the value as required.
5	[]	FS	Move the cylinder to the upper limit value position.
6	[]	(Initial default: 100)	Set the scaling upper limit value.
7	[]		Change the value as required.
8	[]	of	After one second, returns to detection mode.

Input conditions

0<OFS<FS

OFS<FS<1000

The voltage differential between the OFS position and FS position must be at least 1 V.

If these conditions are not met, E-1 will appear on the display and the setting will be disregarded.

Note 1: After changing this setting, you will need to perform initialization in order to return to the original setting.
2: After the scaling setting is changed, all of the threshold values become Upper Limit (L2) = FS Lower Limit (L1) = OFS. Configure the initialization value settings as required after changing this setting.
3: After the scaling setting is changed, the threshold value setting range is OFS to FS.

Backlight display setting (SET7)

Use this setting to configure backlight color settings.

Procedure	Button operation	Display after operation	Remarks
1		SEF7	
2	[]	bl-1	Backlight setting
3	[]	bl-0~bl-4	
4	[]	of	After one second, returns to detection mode.

[Backlight color setting]
bl-0 Backlight OFF
bl-1 When switch output OFF: Green When switch output ON: Red
bl-2 When switch output OFF: Red When switch output ON: Green
bl-3 Always green
bl-4 Always red
* Linking to switch output links operation to which output channel 1.

LCD display cycle setting (SET8)

Use this setting to configure the display cycle of the LCD.

Procedure	Button operation	Display after operation	Remarks
1		SEF8	
2	[]	df-1	Sampling cycle setting
3	[]	df-1~df-3	
4	[]	of	After one second, returns to detection mode.

[LCD display cycle setting]

df-1 250 ms
df-2 500 ms
df-3 1000 ms

Switch output response time setting (SET9)

Use this setting to configure the response time for switch output.

Procedure	Button operation	Display after operation	Remarks
1		SEF9	
2	[]	sd-1	Output delay setting
3	[]	sd-1~sd-4	
4	[]	of	After one second, returns to detection mode.

[Switch output response time setting]

sd-1 5 ms Max
sd-2 ≒ 20 ms
sd-3 ≒ 100 ms
sd-4 ≒ 1000 ms

Initialization 1

This setting can be used to return settings to their initial default values.

Procedure	Button operation	Display after operation	Remarks
1	[]	SEF8	Performs initialization.
2	[]		Press all three at the same time. Or, while holding down [], press [] and then [].

Caution: Following this operation, all data will be initialized.
If you need any current settings, be sure to make a separate written copy of them before performing this operation.

Initialization 2 (display, output check)

This setting can be used to return settings to their initial default values. It also checks the display and output status at the same time.

Procedure	Button operation	Display after operation	Remarks
1		SEFb	Performs initialization. (Display check)
2	[]		Press all three at the same time. Or, while holding down [], press [] and then [].

Caution: This operation will cause all switch outputs to momentarily change to ON.
Following this operation, all data will be initialized. If you need any current settings, be sure to make a separate written copy of them before performing this operation.

Maximum output voltage of analog output adjustment (SETC)

Use this setting to adjust the maximum output voltage of analog output.

Procedure	Button operation	Display after operation	Remarks
1		SEFc	Adjust the maximum output voltage of analog output.
2	[]	SPRn	
3	[]	4095	Shows voltage output from analog output.
4	[]	Change value	Use a multimeter or other instrument to check the analog output voltage as you adjust the maximum output voltage.
5	[]	of	After one second, returns to detection mode.

Error Indicators

Indicator	Meaning	Required action
OFF	The sensor head of the selected channel is not connected or has been disconnected.	In the case of disconnection, turn off power and replace the sensor head.
E-1	Invalid scaling setting.	Reconfigure the scaling setting so it satisfies the required scaling conditions.
E-2	Over voltage being applied to sensor input.	After correcting for the source of the problem, hold down the MODE key for more than one second.
E-3 [n] (n: applicable channel)	Over voltage being applied to switch output.	

Revision History

Ver. 2.0
P.2 Sensor head installation precautions added.
P.3 Corrected internal circuitry diagram.
P.5 Added models to installed cylinder model setting.

● For other information, detailed specifications, and precautions, see the product catalog.
● For inquiries about the product, contact your nearest Koganei sales office or the Overseas Group noted below.