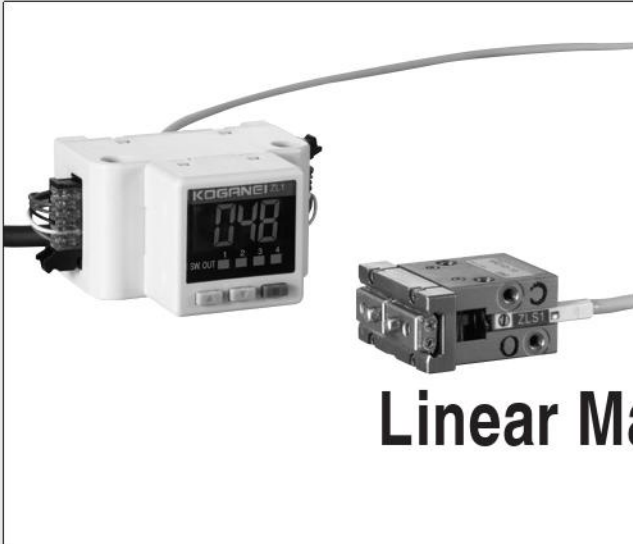


KOGANEI

Actuators



Linear Magnetic Sensor Controller

INDEX

RoHS directive compliant products

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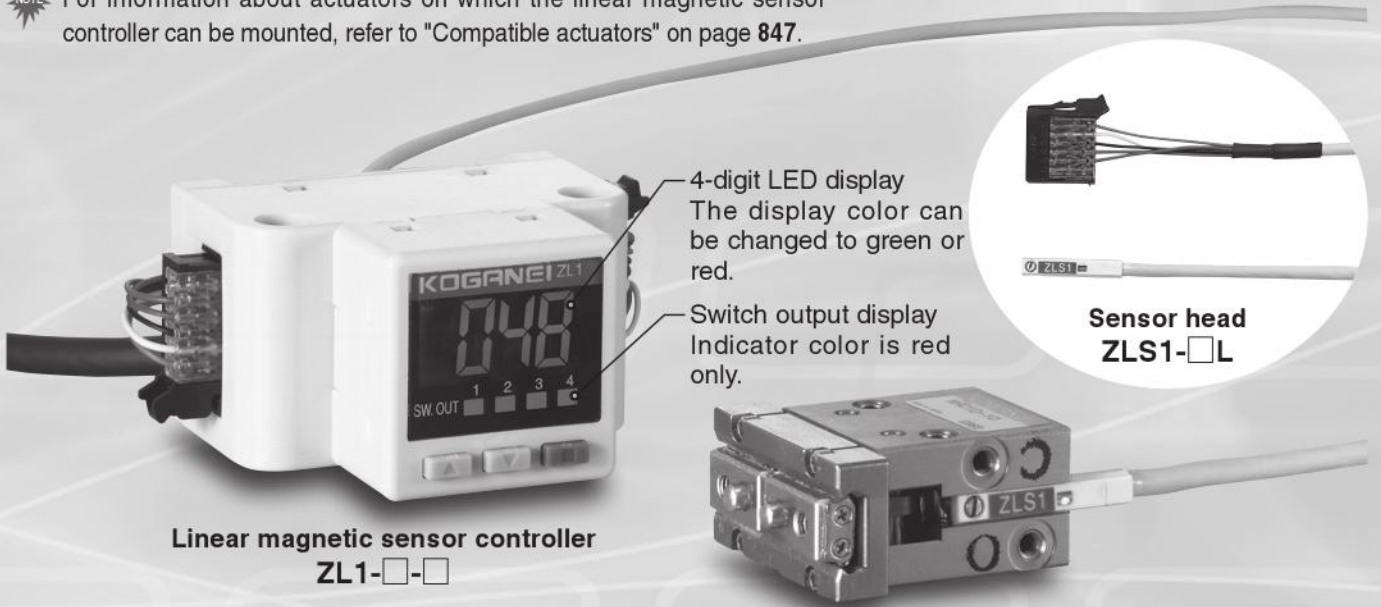
 **CAUTION** Before use, be sure to read the safety precautions at the front of the general personal catalog.

Linear Magnetic Sensor Controller

Senses the linear position of the cylinder within the specified range.

- Exchange with control devices is possible due to standard equipment for analog output (1 to 5 VDC).
- Switch output is possible in four places. Simple position detection is possible.
- Since the sensor head is the same shape as the ZE sensor switch, it is compatible with actuators equipped with the ZE sensor switch.

NOTE For information about actuators on which the linear magnetic sensor controller can be mounted, refer to "Compatible actuators" on page 847.



Linear magnetic sensor controller
ZL1-□-□

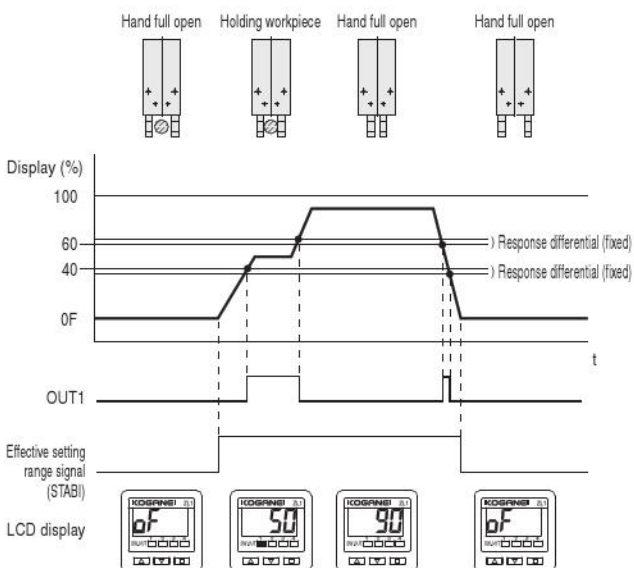
Sensor head
ZLS1-□L

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).

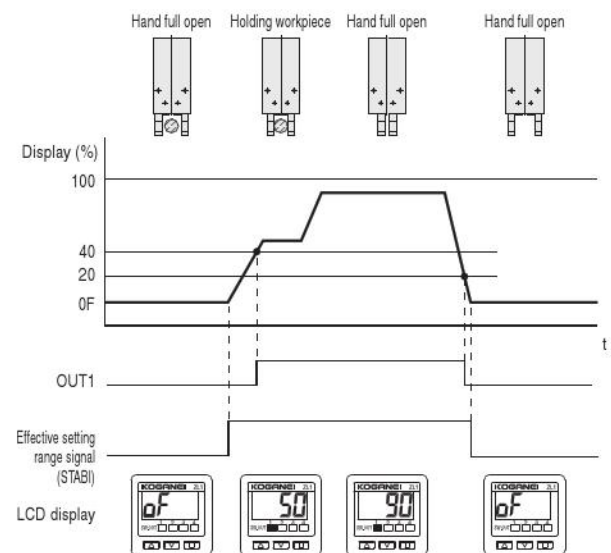
When the controller setting and sensor head setting positions are as shown below.
OUT1 Threshold value setting Upper limit: 60 Lower limit: 40
Display when hand is full open: 90



Hysteresis mode

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

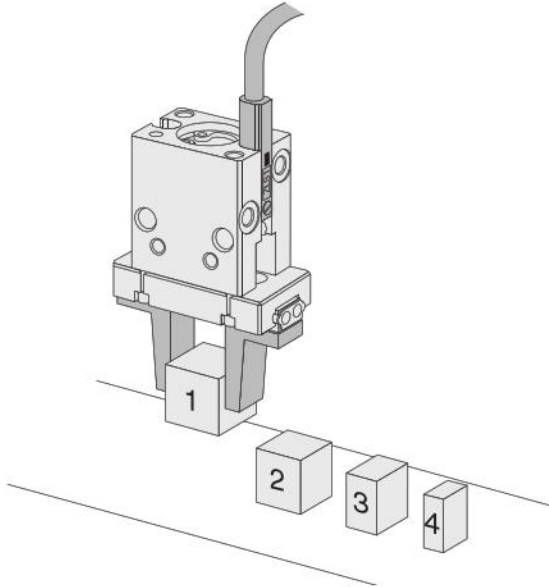
When the controller setting and sensor head setting positions are as shown below.
OUT1 Threshold value setting Upper limit: 40 Lower limit: 20
Display when hand is full open: 90



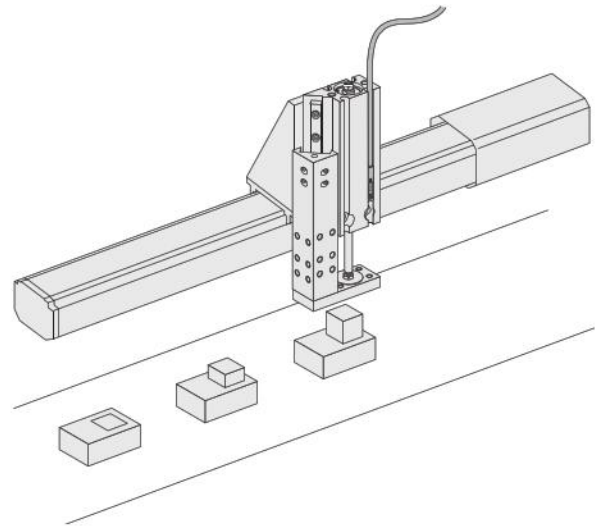
CAUTION: When the effective measuring range signal is OFF (outside the measuring range), OUT also becomes OFF.

Example of use

● Workpiece identification by 4-point switching output



● Height check for press-fit items



Compatible actuators

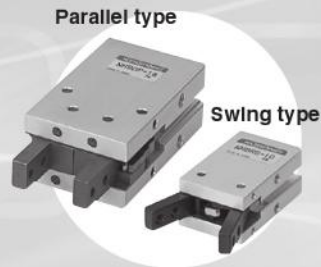
The linear magnetic sensor controller can be mounted on the actuators below. For information about mounting it on other actuators, contact Koganei.



Air Hand



L hand



Air hand NHB



Flat type air hand

● Compatible actuators^{Note} and operation ranges (mm or angle)

Name	Model	Cylinder bore									
		6 [0.236]	8 [0.315]	10 [0.394]	12 [0.472]	14 [0.551]	16 [0.630]	18 [0.709]	20 [0.787]	25 [0.984]	32 [1.260]
Air Hand	NHC1D	—	—	4 [0.157]	—	—	6 [0.236]	—	5 [0.197]	5 [0.197]	—
L hand	NHL1D	—	4 [0.157]	4 [0.157]	—	—	5 [0.197]	—	5 [0.197]	5 [0.197]	—
Air hand NHB parallel type	NHB□PG(L)	—	4 [0.157]	—	6.5 [0.256]	—	10 [0.394]	—	14 [0.551]	—	20 [0.787]
Air hand NHB parallel type	NHB□P(A)	4 [0.157]	—	4 [0.157]	—	—	8 [0.315]	—	12 [0.472]	14 [0.551]	—
Air hand NHB swing type	NHB□S	—	-10 to 30°	-10 to 30°	—	—	-10 to 30°	—	-10 to 30°	-10 to 30°	—
NHB swing 180 degrees	NHBDSL(G)	—	—	—	80°	—	85°	—	65°	65°	—
Flat type air hand	AFDPG	5 [0.197]	9 [0.354]	—	7 [0.276]	10 [0.394]	—	9 [0.354]	—	—	—

Note: The actuators on which the linear magnetic sensor controller can be mounted are the sensor cylinders with the sensor switch magnets.

Remark: The values above are values that include response differentials. They are reference values. For information about actuators other than those above, contact Koganei.

Handling instructions and precautions

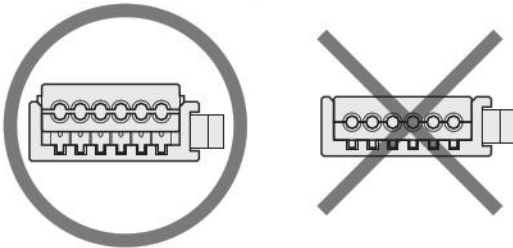


Mounting and piping

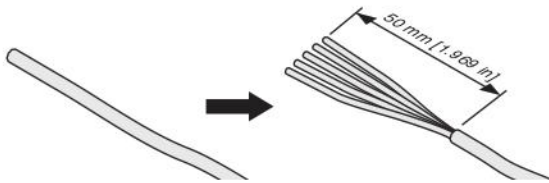
Sensor head and connector connection overview

The ZLS1-□ sensor head is provided with the mini clamp 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.
 6 P 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 raised above the body of the connector. Note that a connector whose cover is even with the body of the connector cannot be used.

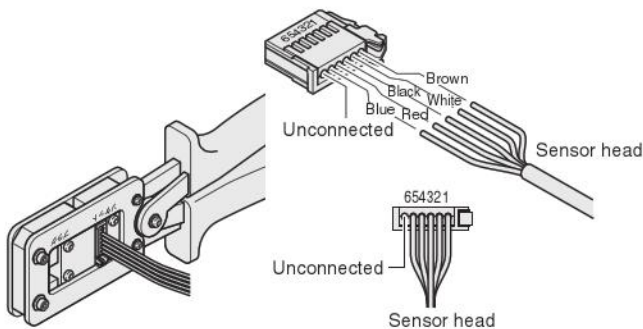


- Cut the sensor head cable to the required length. Strip the outer covering of the cable, 50 mm [1.969 in] from the end, to expose the lead wires. Do not strip the insulation from the individual lead wires at this time.



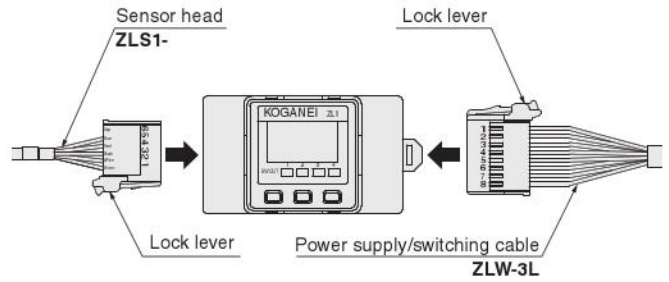
- Insert the lead wires into the connector cover holes in accordance with the information in the table below. Check to make sure the lead wires are fully inserted (wire goes in about 9 mm [0.354 in]) as far as they will go by looking into the semi-transparent top cover of the connector. Note that supplying power while connections are incorrect will damage the sensor head and controller.

Number on connector	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	Unconnected



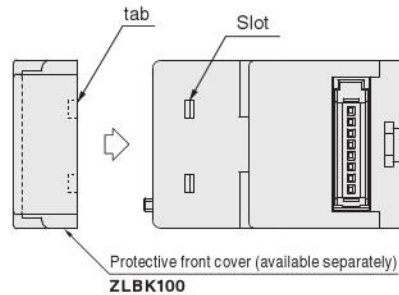
- Taking care not to allow the lead wires to come out of the connector, use the special tool to squeeze the cover and body of the connector until the cover is pressed into the body. Connection is complete when the cover is even with the connector body.
- Double check to make sure that wiring is correct.

Attaching and detaching of the sensor head and power supply/switching cables

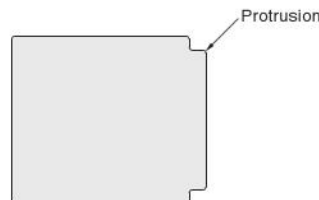


To attach the sensor head and the power supply/switching cables, position the lock levers as shown in the illustration above, and then insert until they lock into place with the controller side connectors. To disconnect, press the lock lever down as far as it will go as you pull the connector to unplug 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

- Insert the sensor head into the switch mounting groove of the air hand or cylinder to be used. Tighten to a torque of less than 0.2 N·m [1.77 in·lbf].
- For information of the sensor head insertion direction, refer to the "Sensor switch mounting" for the air hand or cylinder you are using.

Handling instructions and precautions



General precautions

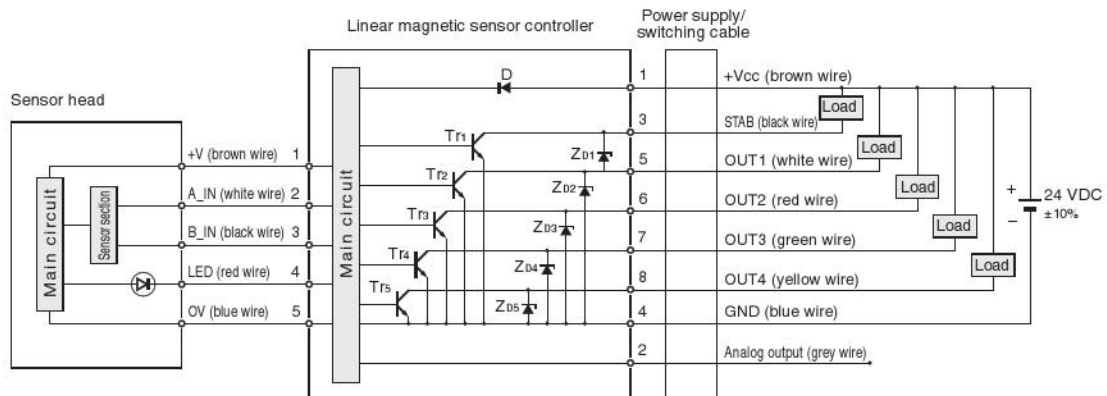
Wiring

1. When using a power supply with a commercially available switching regulator, be sure to connect a frame ground (F.G.).
2. Be sure to connect a frame ground (F.G.) to the devices when using devices that generate noise (switching regulator, inverter motor, etc.) in the vicinity of the installed sensor.
3. After completing wiring work, check to make sure that all connections are correct.

Other

1. Check fluctuations in the power source to confirm they do not exceed the ratings before turning on the power.
2. Avoid use during the transitional state (1 second) when the power is turned on.
3. Never use a needle or any other sharp, pointed object to perform key operations.

Diagram of inner circuits



Note: If you use an extended cable, be aware that voltage decreases due to its resistance.

Symbol D	: Power supply reverse-polarity protection diode
Zb1 to Zb5	: Surge voltage absorption zener diode
Tr1 to Tr5	: NPN output transistor

Linear magnetic sensor controller

ZL1



Specifications

● Controller

Item	Model	ZL1
Power supply voltage		24 VDC \pm 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		\pm 1% F.S. \pm 1 digit ^{Note}
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 to 5 VDC (1 K Ω output impedance)
Analog output repeatability		\pm 1% of F.S. (25°C \pm 5°C [77°F \pm 9°F]) ^{Note}
Insulation resistance		100 M Ω min. (at 500 VDC megger, between case and lead wire terminal)
Withstand voltage		500 VAC (50/60 Hz) 1 minute (between case and lead wire terminal)
Shock resistance		294.2 m/s ² [30 G] (non-repeated)
Ambient temperature		0 to 50°C [32 to 122°F] (non-condensation, non-freezing)
Storage temperature range		-10 to 70°C [14 to 158°F] (non-condensation, non-freezing)
Mass		40 g [1.411 oz]

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 \pm 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 settings)
Lead wires		Heat-resistant, oil-resistant vinyl sheath instrumentation cable ϕ 2.9 [0.114] 0.15 mm ² 5-lead with 6 P connectors
Insulation resistance		100 M Ω min. (at 500 VDC megger, between case and lead wire terminal)
Withstand voltage		500 VAC (50/60 Hz) 1 minute (between case and lead wire terminal)
Shock resistance		294.2 m/s ² [30 G] (non-repeated)
Protective structure		IP67
Vibration resistance		88.3 m/s ² [9 G] (total amplitude of 1.5 mm [0.059 in], 10 to 55 Hz)
Ambient temperature		0 to 50°C [32 to 122°F] (non-condensation, non-freezing)
Storage temperature range		-10 to 70°C [14 to 158°F] (non-condensation, non-freezing)
Mass		20 g [0.705 oz] (when 1 L lead wire length is 1000 mm [39 in])

Connector number

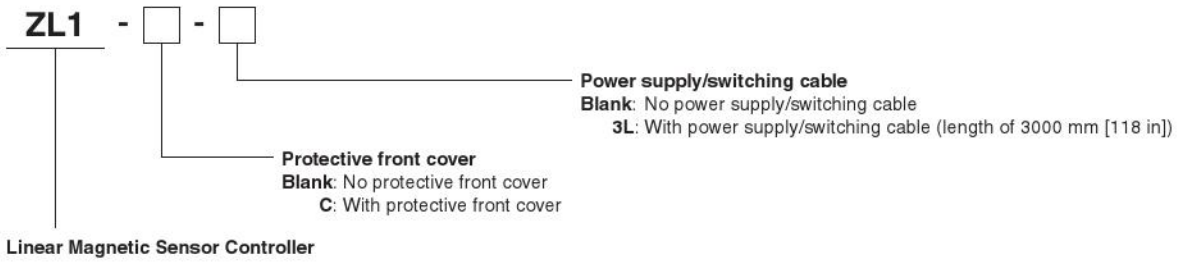
● Sensor head

Number on connector	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	Unconnected

● Power supply

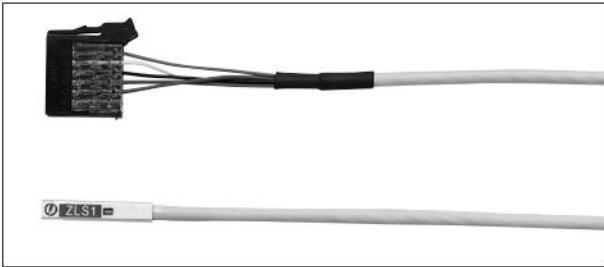
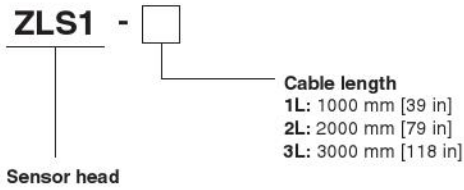
Pin number	Signal name	Lead wire color
1	Power supply voltage input (24 V)	Brown
2	Analog output (1 to 5 V)	Gray
3	Effective measuring range signal output (STAB)	Black
4	GND	Blue
5	Switch output OUT1	White
6	Switch output OUT2	Red
7	Switch output OUT3	Green
8	Switch output OUT4	Yellow

Order codes



Additional parts (available separately)

● Sensor head



● Power supply/switching cable

ZLW-3L



● Protective front cover

ZLBK100



● Mini clamp wire mount plug, 6 P (for sensor head)

ZL-6M



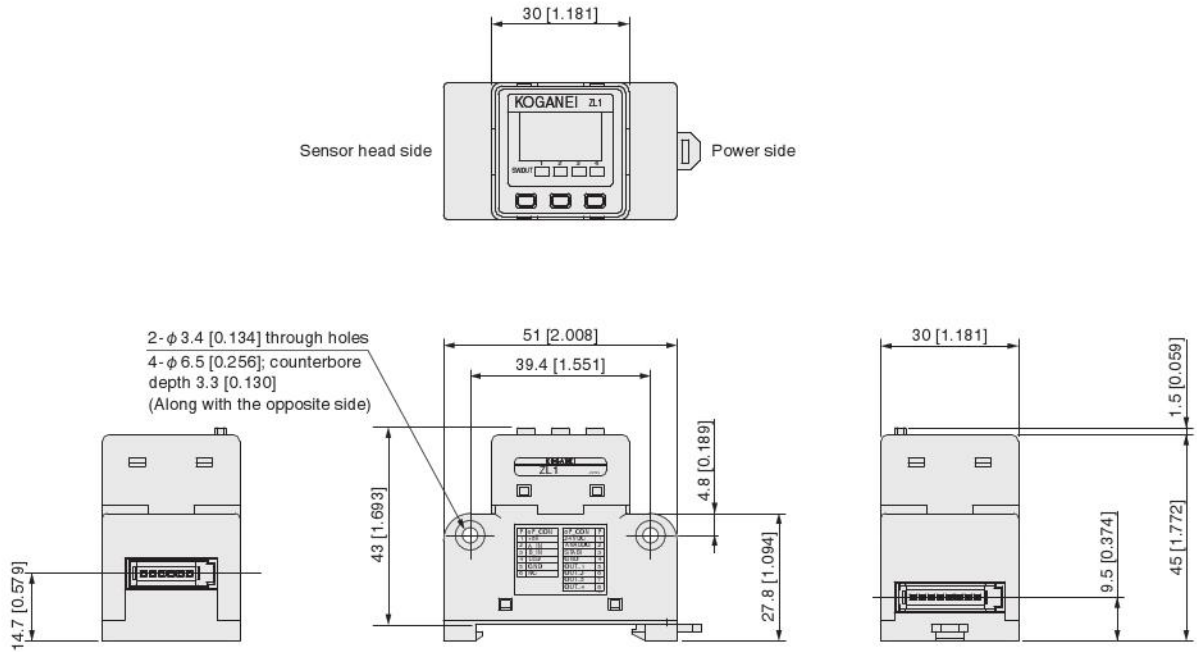
● Mini clamp wire mount plug, 8 P (for power supply/switching cable)

ZL-8M

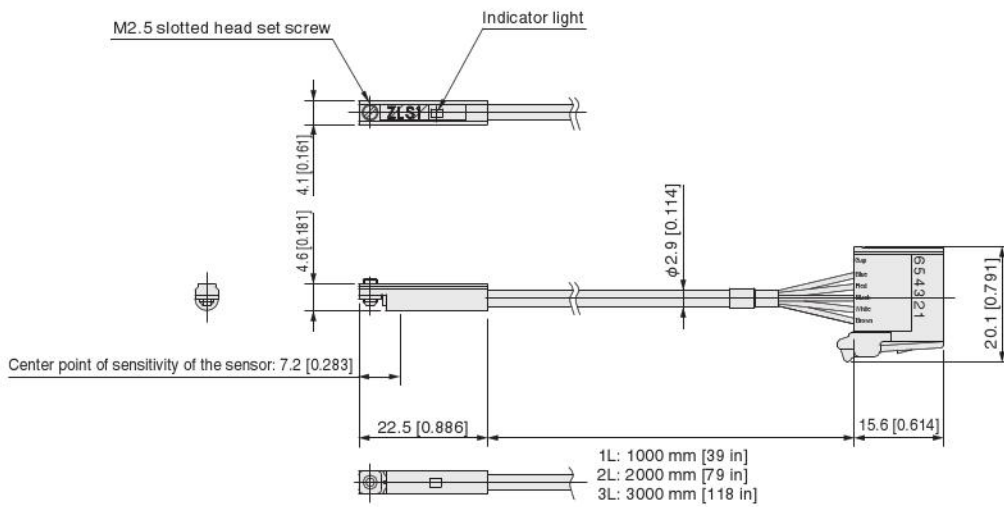


Dimensions mm [in]

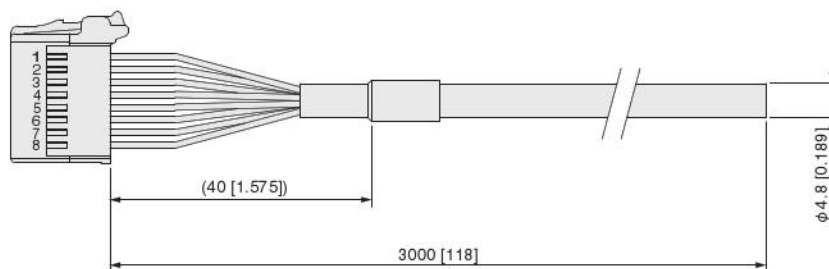
● ZL1-□-□ (controller part)



● ZLS1-□L (sensor head part)

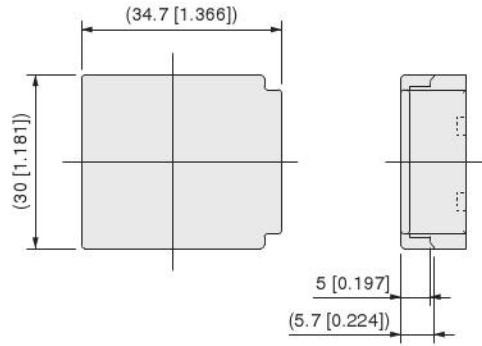


● ZLW-3L (power supply/switching cable)

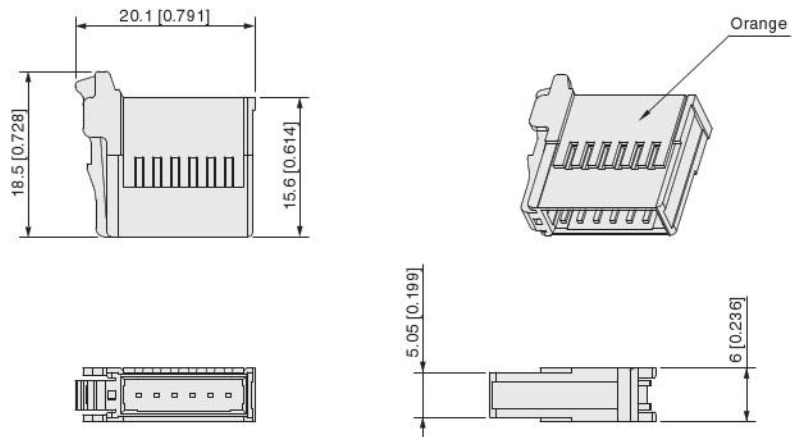


Dimensions mm [in]

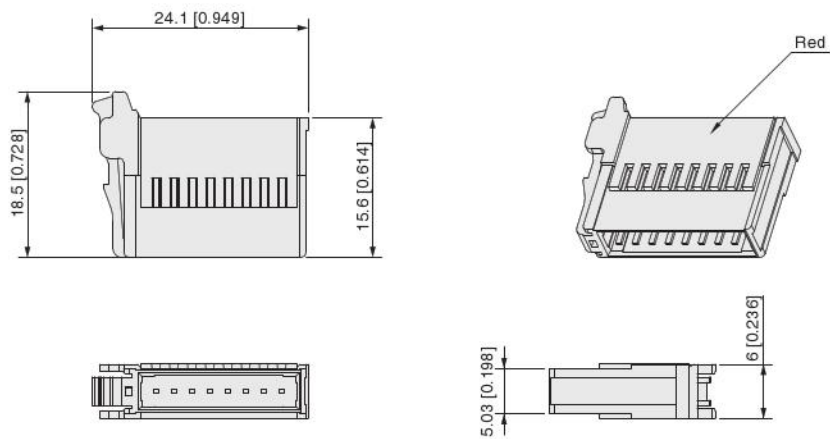
● **ZLBK100** (protective front cover)



● **ZL-6M** (mini clamp wire mount plug, 6 P, for sensor head)



● **ZL-8M** (mini clamp wire mount plug, 8 P, for power supply/switching cable)

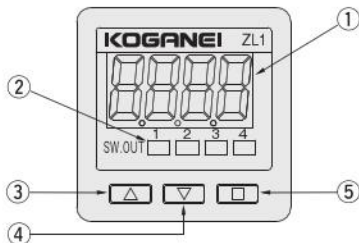





Setting guidelines

CAUTION

1. Incorrect wiring to the sensor head or power/switch cables creates the risk of damage to both the controller and sensor head. Confirm that wiring is correct before turning on power.
2. Record write conditions that were configured by writing them to flash memory. Note that flash memory has a limited life, and the number of rewrites is 10,000.

Nomenclature and functions



No.	Name	Description
①	Display	Effective measuring range %, setting details, error indicators
②	Switch output indicator	Lights when switch output is ON (Channels 1 to 4)
③	UP key ()	Use to increase a setting value.
④	DOWN key ()	Use to decrease a setting value.
⑤	Mode key ()	Use when configuring settings.

Settings

CAUTION

1. Incorrect wiring to the sensor head or power/switch cables creates the risk of damage to both the controller and sensor head. Confirm that wiring is correct before turning on power.
2. Record write conditions that were configured by writing them to flash memory. Note that flash memory has a limited life, and the number of guaranteed writes is 10,000.

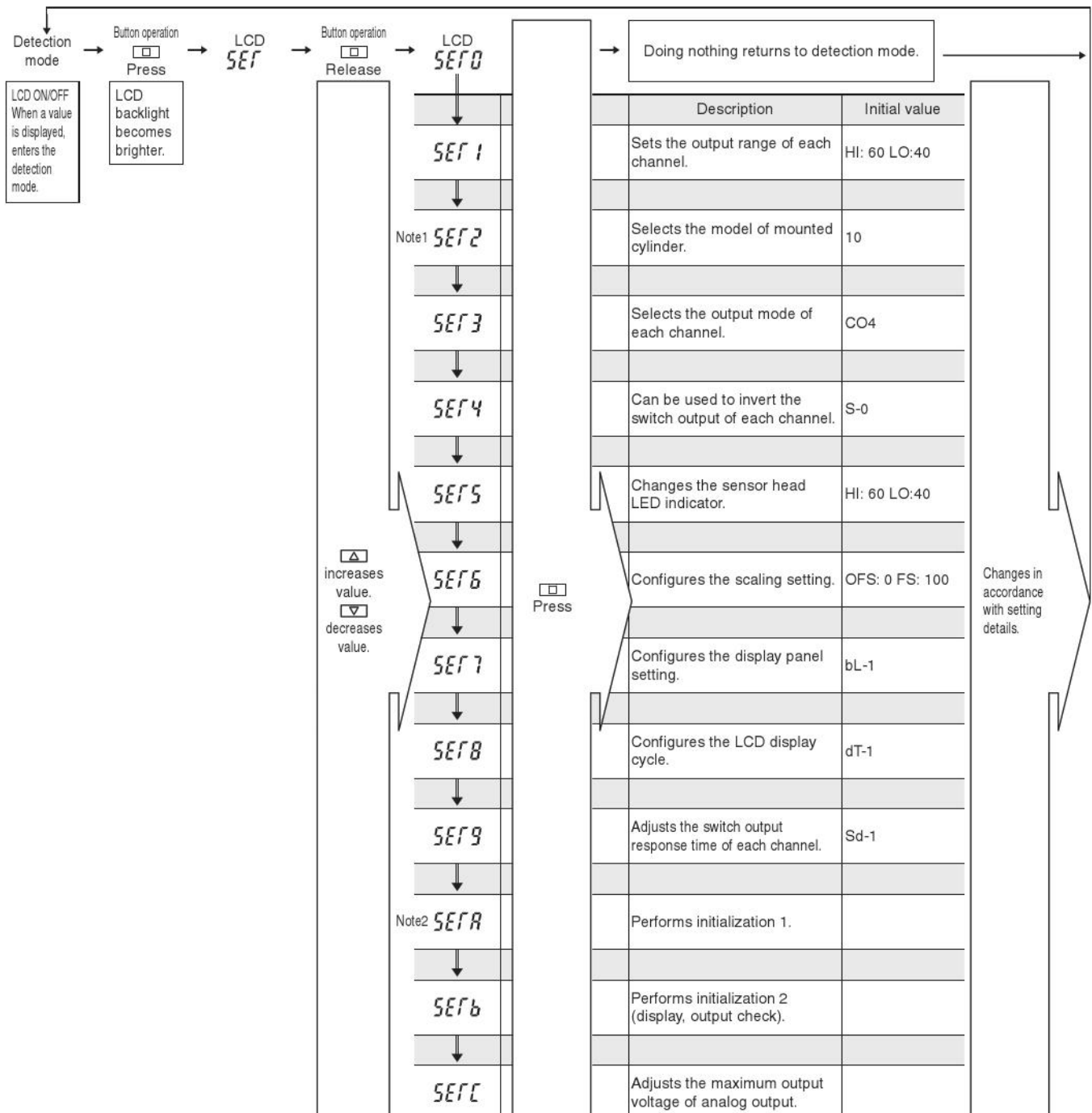
Preparation for settings

- Connect the sensor head and power/switching cable to the controller. Refer to "Attaching and detaching of the sensor head and power supply/switching cables" on page 848.

Configuring settings

General flow

First specify the built-in cylinder type (SET2) and then configure other settings as shown below. You can change settings using the procedure below.



Note 1: Be sure to specify the model of cylinder for mounting. Failure to do so creates the risk of erratic operations.

Note 2: Since initialization (SET A, SET B) returns settings to their initial defaults, all data settings to date are lost.

Setting guidelines

Threshold value setting (SET1)

Use the procedure below to configure threshold value setting for each channel.

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

Procedure	Button operation	Display after operation	Indicator	Backlight	Remark
1		SEF1		Green	Set the output range of each OUT.
2	<input type="checkbox"/>	(Initial default: 80)	OUT flashes	Red	Set the upper limit setting for flashing indicator.
3	<input type="button" value="▲"/> <input type="button" value="▼"/>		↓		Select the value to be changed.
4	<input type="checkbox"/>	(Initial default: 40)		Green	Set the lower limit setting for flashing indicator.
5	<input type="button" value="▲"/> <input type="button" value="▼"/>		↓		Select the value to be changed.
6	<input type="checkbox"/>	(Initial default: 80)	OUT flashes	Red	OUT2, OUT3: Repeat steps 2 through 5. OUT4: Return to sensing mode.

Note 1: Input conditions: Upper limit value (L2) > Lower limit value (L1) + 1
 2: When the difference between scaling set time 0Fs and Fs is 500 or more, use the following upper limit value (L2) > Lower limit value (L1) + 10.

Setting the type of mounted cylinder (SET2)

Change the setting in accordance with the cylinder on which the sensor head is installed.

Procedure	Button operation	Display after operation	Remark
1		SEF2	Selects the type of mounted cylinder.
2	<input type="checkbox"/>	RnLG	
3	<input type="checkbox"/>	(Initial default: 10)	
4	<input type="button" value="▲"/> <input type="button" value="▼"/>		Changes the model number of the cylinder that is mounted.
5	<input type="checkbox"/>	oF	Returns to sensing mode after one second.

Compatible cylinder	Cylinder bore	SET 2 number	Compatible cylinder	Cylinder bore	SET 2 number
NHC1D	Total cylinder bore	10	MGA	Total cylinder bore	20
NHL1D	Total cylinder bore	10	TBDA	Total cylinder bore	18
NHB□PG(L)	Total cylinder bore	10	ARS	Total cylinder bore	16
NHB□P(A)	Total cylinder bore	10		6 [0.236]	13
NHB□S	Total cylinder bore	10	CDAS	8 [0.315]	14
NHBDSL(G)	Total cylinder bore	10	SGDA	32 [1.260]	16
	6.18 [0.243]	15		Other than above	15
AFFDPG	8.14 [0.32]	12	MS	6.10 [0.240]	18
	12 [0.472]	16		16.20 [0.638]	16

For information about other cylinders, contact Koganei.

Output mode setting (SET3)

Use the procedure below to specify the output mode for each channel.

Procedure	Button operation	Display after operation	Remark
1		SEF3	Set the output mode of each OUT.
2	<input type="checkbox"/>	CH1	Select the channel of each OUT.
3	<input type="button" value="▲"/> <input type="button" value="▼"/>	CH1 to CH4	CH1:OUT1 CH2:OUT2 CH3:OUT3 CH4:OUT4
4	<input type="checkbox"/>	CO4	Select the output mode.
5	<input type="button" value="▲"/> <input type="button" value="▼"/>	OFF to HFS	OFF : Output off CO4 : Window comparator mode HFS : Hysteresis modeNote
6	<input type="checkbox"/>	CH*	Displays the set channel number (one second) Displays the set channel mode (one second)
7		oF	Returns to detection mode after one second.

Note: These settings are valid within the effective measuring range (operation range).

Switch output inversion setting (SET4)

The switch output can be inverted for each channel.

Procedure	Button operation	Display after operation	Remark
1		SEF4	Set the contact type of each OUT.
2	<input type="checkbox"/>	CH1	Select the channel of each OUT.
3	<input type="button" value="▲"/> <input type="button" value="▼"/>	CH1 to CH4	CH1:OUT1 CH2:OUT2 CH3:OUT3 CH4:OUT4
4	<input type="checkbox"/>	S-0	Select the contact point type.
5	<input type="button" value="▲"/> <input type="button" value="▼"/>	S-0 to S-1	S-0: Non-inverted (A contact) S-1: Inverted (B contact)
6	<input type="checkbox"/>	CH*	Displays the set channel number (one second) Displays the set channel mode (one second)
7		oF	Returns to detection mode after one second.

LED display range setting (SET5)

Use the procedure below to change the sensor head LED display position.

Procedure	Button operation	Display after operation	Remark
1		SEF5	
2	<input type="checkbox"/>	Lo	Set the display lower limit value.
3	<input type="checkbox"/>	(Initial default: 40)	
4	<input type="button" value="▲"/> <input type="button" value="▼"/>		Change the value.
5	<input type="checkbox"/>	Hi	Set the display upper limit value.
6	<input type="checkbox"/>	(Initial default: 60)	
7	<input type="button" value="▲"/> <input type="button" value="▼"/>		Change the value.
8	<input type="checkbox"/>	oF	Returns to detection mode after one second.

Scaling setting (SET6)

Scaling is performed at the positions between two specified points.

Procedure	Button operation	Display after operation	Remark
1		SEF6	
2	<input type="checkbox"/>	0FS	Move the cylinder to the lower limit position.
3	<input type="checkbox"/>	(Initial default: 0)	Set the scaling lower limit value.
4	<input type="button" value="▲"/> <input type="button" value="▼"/>		Change the value.
5	<input type="checkbox"/>	FS	Move the cylinder to the upper limit position.
6	<input type="checkbox"/>	(Initial default: 100)	Set the scaling upper limit value.
7	<input type="button" value="▲"/> <input type="button" value="▼"/>		Change the value.
8	<input type="checkbox"/>	oF	Returns to detection mode after one second.

Input conditions

0<0FS<FS

0FS<FS<1000

The voltage differential of at least 1 V is required between the 0FS position and the FS position.

If conditions are not satisfied, E-1 will appear on the display and settings will be disregarded.

Note 1: Once this setting is changed, initialization will be required to return to its previous setting.

2: Configuring scaling settings causes all threshold values to change to the following: Upper limit value (L2) = FS; lower limit value (L1) = 0FS. Change the threshold value settings as required.

3: Configuring scaling settings causes the scaling value setting range to become 0FS to FS.

Backlight display setting (SET7)

Use the procedure below to set the backlight color.

Procedure	Button operation	Display after operation	Remark
1		SEF7	
2	<input type="checkbox"/>	bl-1	Backlight setting
3	<input type="up"/> <input type="down"/>		bl-0 to bl-4
4	<input type="checkbox"/>	of	Returns to detection mode after one second.

Setting the backlight color

bl-0 Backlight OFF
 bl-1 Switch output OFF: Green Switch output ON: Red
 bl-2 Switch output OFF: Red Switch output ON: Green
 bl-3 Always green
 bl-4 Always red

• Connection to switch output is linked with switch output channel 1.

LCD display cycle setting (SET8)

Use the procedure below to configure the LCD display cycle setting.

Procedure	Button operation	Display after operation	Remark
1		SEF8	
2	<input type="checkbox"/>	df-1	Sampling cycle setting
3	<input type="up"/> <input type="down"/>		df-1 to df-3
4	<input type="checkbox"/>	of	Returns to detection mode after one second.

LCD display cycle setting

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

Switch output response time setting (SET9)

Use the procedure below to set the switch output response time.

Procedure	Button operation	Display after operation	Remark
1		SEF9	
2	<input type="checkbox"/>	sd-1	Output delay setting
3	<input type="up"/> <input type="down"/>		sd-1 to sd-4
4	<input type="checkbox"/>	of	Returns to detection mode after one second.

Switch output response time setting

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

Initialization 1

Use the procedure below to return settings to their initial defaults.

Procedure	Button operation	Display after operation	Remark
1	<input type="checkbox"/>	SEFA	Performs initialization.
2	<input type="up"/> <input type="down"/> <input type="checkbox"/>		Press the 3 buttons at the same time. <input type="checkbox"/> <input type="up"/> While holding down [MODE], press the following in sequence: <input type="up"/> → <input type="down"/>

Note: All data is initialized after the above operation is performed.
 Keep a separate record of settings you have changed.

Initialization 2 (display, output check)

Use the procedure below to return settings to their initial defaults. At the same time, you can also check the status of the display and output.

Procedure	Button operation	Display after operation	Remark
1		SEFb	Perform initialization. (Check display)
2	<input type="up"/> <input type="down"/> <input type="checkbox"/>		Press the 3 buttons at the same time. <input type="checkbox"/> While holding down [MODE], press the following in sequence <input type="up"/> → <input type="down"/>

Note: Performing the above operation causes all switch output to become ON momentarily.

Also, all data is initialized after the above operation is performed. Make written copies of any settings you have changed before performing the above operation.

Adjustment for the maximum output voltage of analog output (SETC)

Use the procedure below to adjust the maximum output voltage of analog output.

Procedure	Button operation	Display after operation	Remark
1		SEFc	Adjusts the maximum output voltage of analog output.
2	<input type="checkbox"/>	SPRn	
3	<input type="checkbox"/>	4095	Voltage output by analog output.
4	<input type="up"/> <input type="down"/>	Value change	Check the analog output voltage with a multimeter or some other instrument and adjust the maximum output voltage.
5	<input type="checkbox"/>	of	Returns to detection mode after one second.

Error indications

Name	Error description	Error clear
oFF	The selected channel's sensor head is burned out or not connected.	In case of burn out, turn off power and then replace the sensor head.
E-1	Invalid setting when configuring the scaling setting.	Reconfigure the scaling setting so it satisfies the required scaling conditions.
E-2	Overvoltage applied to sensor input.	After eliminating the cause of the error, hold down the mode key for at least one second.
E-3n (n = applicable channel)	Overcurrent flowing to switch output.	

