KEYENCE

96M1093

96M1093-4

Separate-amplifier Proximity Sensor

ES-M1(P)/M2(P)

Instruction Manual

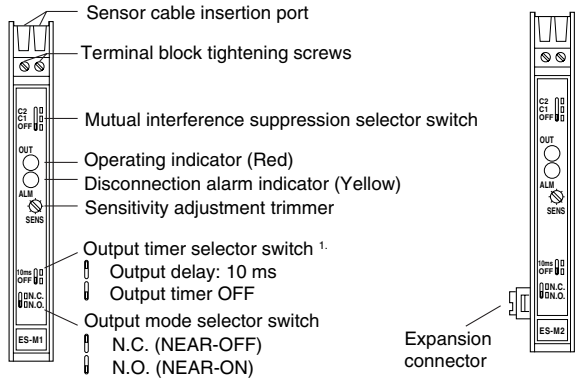
Read this manual before using the product in order to achieve maximum performance.
Keep this manual in a safe place after reading it so that it can be used at any time.

⚠ WARNING

- ***The ES-M1/M2 are intended for target detection. Do not use these products in a safety circuit for protecting the human body.***
- ***The ES-M1/M2 are not explosion-proof. Do not use these products in an environment where inflammable gas, liquid or powder is present.***

PART NAMES AND FUNCTIONS

ES-M1 (Main unit) **ES-M2 (Expansion unit)**

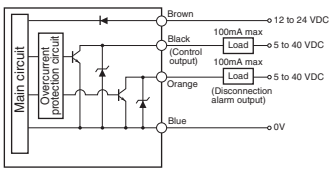


1. In N.O. operation mode: OFF-delay timer 10 ms
   In N.C. operation mode: ON-delay timer 10 ms

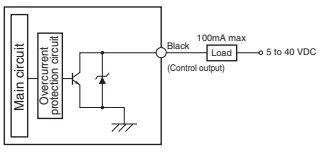
I/O CIRCUIT DIAGRAM

■ NPN

ES-M1

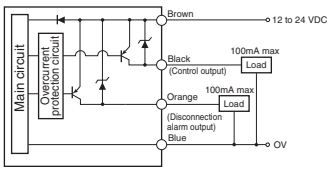


ES-M2

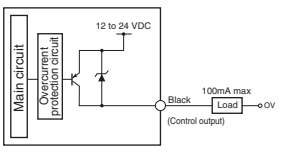


■ PNP

ES-M1P



ES-M2P



FEATURES

■ One-line connection system

See "MOUNTING SEVERAL AMPLIFIERS" on page 2.

A wire-saving sensor system can be established by combining other one-line connection amplifiers such as the FS-V10 Series or LV Series.

■ Easy connection with the European terminal

See "SENSOR HEAD CONNECTION" on page 1.

The sensor head is connected to the amplifier through the European terminal, allowing easy and quick connection.

■ Disconnection alarm indicator & output

See "PART NAMES AND FUNCTIONS" on page 1.

The alarm indicator and output turn on when the sensor head is disconnected, enabling quick discovery of abnormal condition. (The ES-M2 features the indicator only.)

■ Mutual interference suppression function

See "MUTUAL INTERFERENCE SUPPRESSION" on page 2.

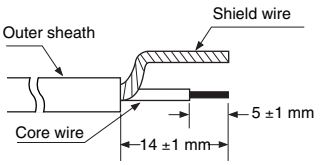
Mutual interference among several sensors that are used in close proximity can be suppressed by a simple operation.

ACCESSORIES

Instruction Manual: 1
Metal screwdriver: 1
Mounting bracket: 1 (ES-M1 only)
End unit: 2 (ES-M2 only)
Cautions sticker: 1 (ES-M2 only)

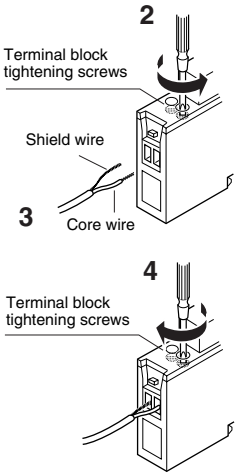
SENSOR HEAD CONNECTION

1. Modify the end of the sensor cable as illustrated on the right. Be sure to tightly twist the shield wire and core wire separately.



* When the outer sheath is stripped, the shield wire appears around the core wire. Separate the core wire and shield wire before modifying the cable.

2. Turn the terminal block tightening screws counterclockwise to loosen them.
3. Insert the sensor cable straight into the insertion port of the amplifier. Make sure that the core wire and shield wire are inserted into the correct ports and that the cable does not twist.
4. Turn the terminal block tightening screws clockwise to tighten them. Be sure to limit the tightening torque to 0.15 N•m.
5. Turn ON the amplifier and check that the disconnection alarm indicator remains OFF. If the indicator is ON, go back to step 1 and repeat the procedure again.

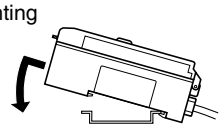


MOUNTING AMPLIFIER

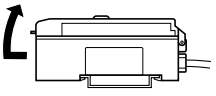
■ Mounting/Detaching the amplifier to/from a DIN rail or the mounting bracket

Hook the claw located at the amplifier cable side onto the DIN rail, and then hook the front side claw to the rail while pressing the amplifier forward. To detach the amplifier, unhook the front claw by lifting the amplifier front side while pressing it forward.

Mounting

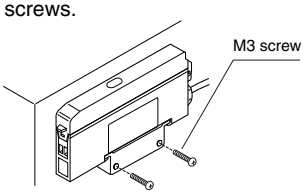


Detaching



■ Side mounting

Using the side holes of the supplied mounting bracket (ES-M1 only), fix the amplifier with screws.



HINTS ON CORRECT USE

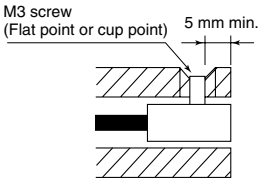
- To extend the sensor head cable, be sure to use a high-frequency coaxial cable and limit the length between the amplifier and sensor head to 10 m or less (5 m when the EH-302/402 is used). Be sure to use an BNC connector (see the table below).

Plug	BNC-P-1.5 (or equivalent products)
Jack	BNC-J-1.5 (or equivalent products)

- To extend the amplifier cable, use a cable with at least a 0.3 mm^2 nominal cross-section area. Limit the length of cable extension to no more than 100 m. (To connect several amplifiers, contact KEYENCE for further information.)
- If the amplifier cable is placed together with power lines or high-voltage lines in the same conduit, detection error may occur due to noise interference, or the sensor may be damaged. Isolate the amplifier cable from these lines.
- When using a commercially available switching regulator, ground the F.G. terminal and ground terminal.
- During maximum sensitivity setting, the detecting distance may vary due to the difference in characteristics of each unit.
- If the wiring is incorrect, the unit may heat up, or the sensitivity may fluctuate. (See “I/O CIRCUIT DIAGRAM”.)
- The EH-422, 430, 440, and 290 sensor heads cannot be connected to the ES-M1/M2. Contact KEYENCE for information on connectable amplifiers.

MOUNTING THE SENSOR HEAD

- Cylindrical type
  Secure the sensor head with a screw at a position 5 mm or more from the tip of the head. (Tightening torque: 0.2 N•m max.)



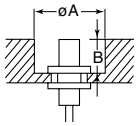
- For the EH-402, secure the sensor head to the metal part 15 mm or more from the tip.
- Threaded type
  When mounting the threaded-type sensor head, do not tighten beyond the torque specified in the following table.

Model	Tightening torque
EH-108	8 N•m max.
EH-110	10 N•m max.
EH-114	20 N•m max.
EH-416	

SURROUNDING METAL

Shielded-type sensors can be flush-mounted in a metal base. Sensors of the non-shielded type, however, should be mounted according to the guidelines given below in order to minimize interference from the surrounding metal.

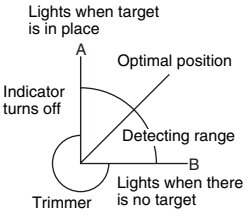
Distance (mm) / Model	A	B
EH-402	20	15
EH-416	30	10



NEAR-ON OPERATION

■ NEAR-ON operation

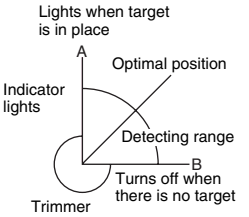
1. With the target in place, turn the trimmer clockwise and find point A at which the output indicator lights. (If the output indicator is already lit, turn the trimmer counterclockwise.)
2. With the target removed, again turn the trimmer clockwise and find point B at which the output indicator lights.



3. Set the trimmer midway between points A and B. The output circuit will now actuate when the output indicator lights.
   The values in parentheses are the values when the mutual interference suppression function is used.

■ NEAR-OFF operation

1. With the target in place, turn the trimmer clockwise and find point A at which the output indicator lights. (If the output indicator is already lit, turn the trimmer counterclockwise.)
2. With the target removed, again turn the trimmer clockwise and find point B at which the output indicator lights.
3. Set the trimmer midway between points A and B. The output circuit will now actuate when the output indicator lights.
   The values in parentheses are the values when the mutual interference suppression function is used.



MUTUAL INTERFERENCE SUPPRESSION

- When installing two or more sensors of the same model face-to-face or in parallel, separate by the distance specified in the following table to prevent interference. The values in parentheses are for when the mutual interference suppression function is used.

Distance / Model	Face-to-face (mm min.)	Parallel (mm min.)
EH-302	2 (1)	No space required
EH-303A	2 (1)	No space required
EH-305(S)	5 (3)	No space required
EH-308(S)	10 (7)	No space required
EH-110(S)	7 (4)	35 (no space required)
EH-114	11(6)	39 (no space required)
EH-605	5 (3)	14 (no space required)
EH-614A	11(6)	64 (no space required)
EH-108	7 (4)	No space required
EH-910	26 (9)	22 (no space required)
EH-402	53 (12)	23 (11)
EH-416	11 (7)	115 (no space required)

[Note]
The above figures apply when the trimmer is turned to its optimal position for stable detection.

- When the mutual interference suppression function is used for three or less sensor heads, set the mutual interference suppression selector switch located on the amplifier to “OFF” for the first unit, “C1” for the second unit, “C2” for the third unit. Contact KEYENCE when four or more sensors are connected.

MOUNTING SEVERAL AMPLIFIERS

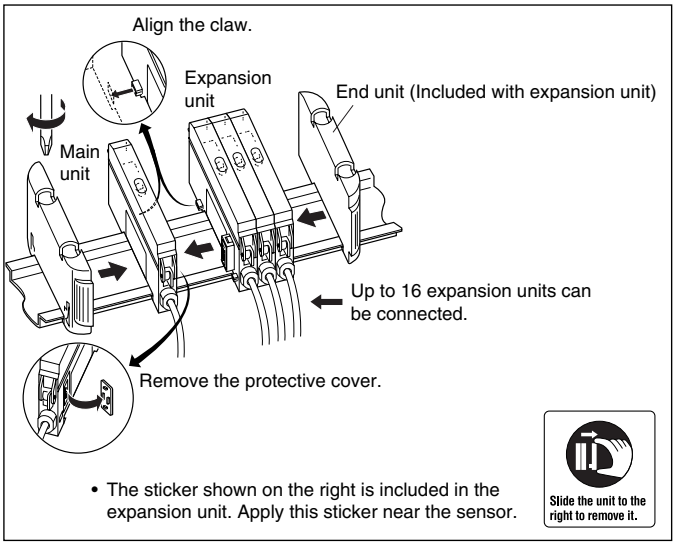
■ Mounting several units

1. Remove the protective cover.
2. Mount the amplifiers to the DIN rail one by one.
3. Slide one expansion unit toward another. Align the front claws of the amplifiers and push the amplifiers together until they click.
4. Fix the amplifiers together by pushing the end units toward each end (End units are included with the ES-M2).

■ Detaching amplifiers from DIN rail

1. Remove the end units.
2. Slide the expansion units apart and detach them individually. (Do not detach multiple amplifiers connected together with end units.)

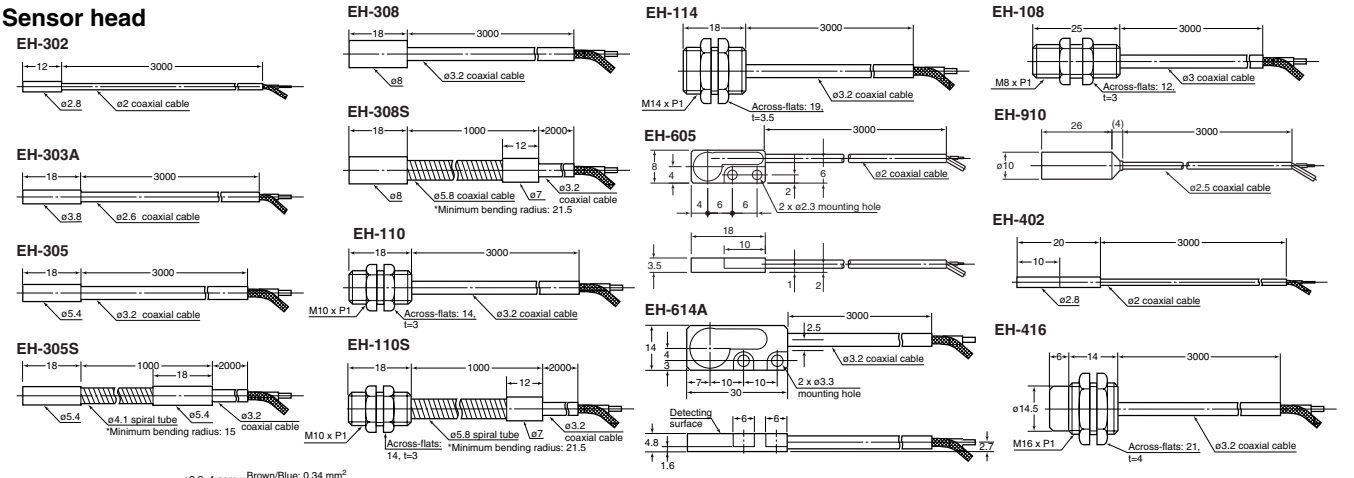
[Notes]
- To connect several units, be sure to use a DIN rail and end units.
- To mount or detach several units, be sure to turn the power off.
- Do not remove the protective cover of the expansion connector on the outermost unit.

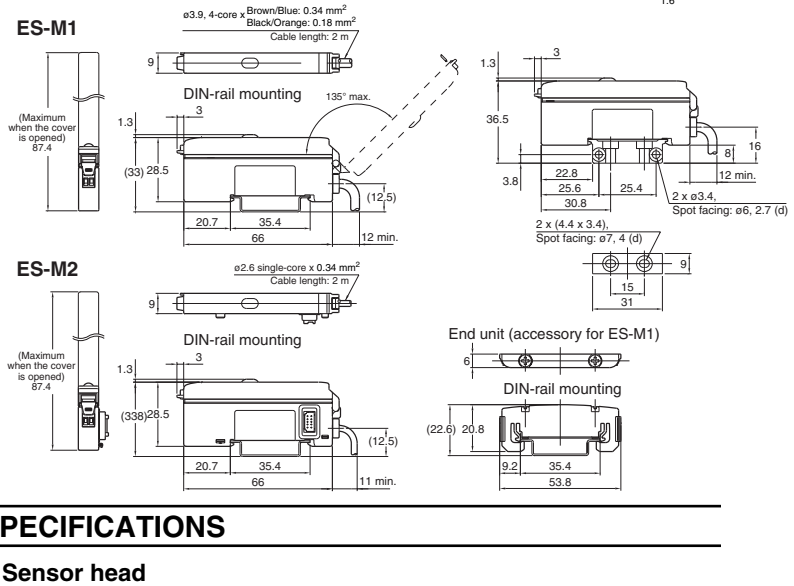


- The sticker shown on the right is included in the expansion unit. Apply this sticker near the sensor.

DIMENSIONS

■ Sensor head





SPECIFICATIONS

■ Sensor head

Type	Standard / Shielded							
Shape	Cylindrical				Threaded		Thin	
Model	EH-302	EH-303A	EH-305	EH-308	EH-110	EH-114	EH-605	EH-614A
Stable detecting range	0 to 0.6 mm	0 to 0.8 mm	0 to 1 mm	0 to 2 mm		0 to 5 mm	0 to 1 mm	0 to 5 mm
Maximum detecting distance [1]	1.2 mm	2 mm	3 mm	5 mm		8 mm	3 mm	8 mm

Type	Highly oil-resistant	Chemical-resistant	Stainless-spiral tube			Standard	
	Shielded					Non-shielded	
Shape	Threaded	Cylindrical			Threaded	Cylindrical	Cylindrical and Threaded
Model	EH-108 [2]	EH-910	EH305S	EH-308S	EH-110S	EH-402	EH-416
Stable detecting range	0 to 1.5 mm	0 to 2 mm	0 to 1 mm	0 to 2 mm		0 to 3 mm	0 to 6 mm
Maximum detecting distance [1]	2.5 mm	4.5 mm	3 mm	5 mm		7 mm	13 mm

1. Shows the maximum detecting distance obtained at constant temperature of +23°C (73.4°F) while accuracy is ignored.
2. Although the EH-109 is designed to be highly oil-resistant, do not immerse it in oil.
   Contact KEYENCE for detailed specifications of the sensor heads.

■ Amplifier

Model	NPN output	ES-M1	ES-M2
	PNP output	ES-M1P	ES-M2P
Sensitivity adjustment		25-turn trimmer	
Response time		1 ms max.	
Operation mode		N.O./N.C. switch selectable	
Indicators		Output indicator: Red, Disconnection alarm indicator: Yellow	
Timer function		Delay: 10 ms/Timer OFF	
Temperature fluctuation		±8% or less of the detecting distance at +23°C (73.4°F) within the temperature range of 0 to +50°C (32 to 122°F)	
Output: Control output		NPN or PNP open-collector 100 mA max. (NPN: 40 V max, PNP: 26.4 V max), Residual voltage: 1 V max	
Output: Disconnection alarm output [1]		NPN or PNP open-collector 100 mA max (40 V max.), Residual voltage: 1 V max.	—
Protection circuit		Reverse polarity protection, over-current protection, surge absorber	
Power supply voltage		12 to 24 VDC, Ripple (P-P) 10% max.	
Current consumption		25 mA max.	
Ambient temperature		0 to +50°C (32 to 122°F), No freezing [2]	
Relative humidity		35 to 85%, No condensation	
Weight (including 2 m cable)		Approx. 65 g	Approx. 35 g

1. The ES-M2 does not include the disconnection alarm output. It allows monitoring with the disconnection alarm indicator only.
2. When several units are connected, the ambient temperature requirement varies depending on the total number of units connected as shown below. To connect several units, be sure to mount them to a metallic DIN rail. Make sure that the output current does not exceed 20 mA.
   When 1 to 10 units are connected: 0 to +50°C (32 to 122°F)
   When 11 to 16 units are connected: 0 to +45°C (32 to 113°F)

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