

E3X-MDA Series

Instruction Sheet

Thank you for selecting an OMRON product. This sheet primarily describes precautions required in installing and operating the product.

- The specialist who has the knowledge of electricity must treat.
- Please often read this manual, and use it correctly after it understands enough.
- Please keep this manual importantly to refer at any time.

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Precautions for Safe Use

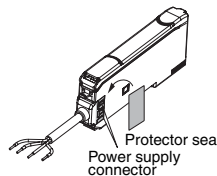
Please observe the following precautions for safe use of the product.

- 1) Do not use the Amplifier Unit in environments subject to flammable or explosive gases.
- 2) Do not use the Amplifier Unit in environments subject to exposure to water, oil, chemicals, etc.
- 3) Do not attempt to disassemble, repair, or modify the Amplifier Unit in any way.
- 4) Do not apply voltages or currents that exceed the rated ranges.
- 5) Wire the Amplifier Unit correctly, e.g., do not reverse the polarity of the power supply.
- 6) Connect the load correctly.
- 7) Do not short both ends of the load.
- 8) Do not use the Amplifier Unit if the case is damaged.
- 9) When disposing of the Amplifier Unit, treat it as industrial waste.

Precautions for Correct Use

Please observe the following precautions to prevent failure to operate, malfunction, or undesirable effects on product performance.

- 1) The optical fibers are made out of methacrylic resin. Do not use them in atmospheres where organic solvents are present.
- 2) Wire the Amplifier Unit separately from power supply or high-voltage lines. If the Amplifier Unit wiring is wired together with or placed in the same duct as high-power lines, inductive noise may cause operating errors or damage the Amplifier Unit.
- 3) Do not extend the cable to more than 100 m, and use a wire size of 0.3 mm² or larger for the extension cable.
- 4) The Amplifier Unit is ready to operate 200 ms after the power supply is turned ON. If the Amplifier Unit and load are connected to power supplies separately, turn ON the power supply to the Amplifier Unit first.
- 5) Always keep the protective cover in place when using the Amplifier Unit.
- 6) Connector Short-circuit Protection (for Amplifier Units with Connectors)
To prevent electric shock or short-circuits, attach the protector seals provided with E3X-CN-series Connectors to the sides of power supply connectors that are not being used.
- 7) Always turn OFF the power supply before connecting, separating, or adding Amplifier Units.
- 8) If the data is not written to the EEPROM correctly due to a power failure or static-electric noise, initialize the settings using the keys on the Amplifier Unit.
- 9) Using a Mobile Console
Use the E3X-MC11-SV2 Mobile Console for the E3X-DA-S series Amplifier Units. However, there is a function which cannot be used in part. Other Mobile Consoles, such as the E3X-MC11, cannot be used.
- 10) Optical communications are not possible with an E3X-DA-N Amplifier Unit.
- 11) Depending on the application environment, time may be required for the incident light level to stabilize after the power supply is turned ON.
- 12) Do not use thinners, benzene, acetone, or kerosene for cleaning the Amplifier Unit.
- 13) Do not pull or apply excessive pressure or force (exceeding 9.8 N·m) on the Fiber Unit when it is mounted to the Amplifier Unit.
- 14) Output pulses may occur when the power is interrupted and so turn OFF the power to the load or load line before turning OFF the power to the Sensor.



Confirming the Package Contents

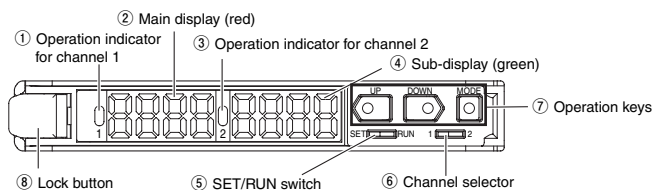
- Amplifier Unit: 1
- Instruction Sheet (this sheet): 1

1. Ratings and Specifications

Connection method		Prewired	Separate connector*1
Model number	NPN	E3X-MDA11	E3X-MDA6
	PNP	E3X-MDA41	E3X-MDA8
Red LED			
Light emitting element		12 to 24 VDC ±10%, ripple (p-p) 10% max.	
Supply voltage		1,080 mW max. (45 mA max. at 24 V)	
Power consumption		Open collector (26.4 VDC max.);	
Control output		load current: 50 mA max.; residual voltage: 1 V max.	
Timer		OFF, OFF-delay, ON-delay, or one-shot	
Timer time		1 ms to 5 s	
Power tuning		Supported	
Mutual interference prevention		Supported (optical communications sync method)*2	
		9 Sensors (18 channels)*3	

*1: When using individually or as a master, obtain the E3X-CN21 Master Connector (4-conductor), and when using as a slave, obtain the E3X-CN22 Slave Connector (2-conductor). Either Connector can be used.
*2: Communications are disabled if SHS is selected for the detection mode, and the communications functions for mutual interference prevention and the Mobile Console will not function.
*3: Mutual interference prevention can be used for only up to 6 Units if power tuning is enabled.

2. Nomenclature



- ① Lit when the output for channel 1 is ON.
- ② Displays the incident light level or the function name.
- ③ Lit when the output for channel 2 is ON.
- ④ Displays the incident light level, additional information for detection, or the function setting for channel 2.
- ⑤ Used to switch the mode.
- ⑥ Used to select the channel to display or set.
- ⑦ Used to change the display, set functions, etc.
- ⑧ Used to connect and disconnect the Fiber Unit.

3. Basic Operating Information

Setting the Mode

The mode is set using the SET/RUN switch. Set this switch according to the operation to be performed.

Mode	Description
SET	Select to set detection conditions, to teach the threshold value, etc.
RUN	Select for actual detection operation or to set the following: Manual adjustment of threshold value, teaching power adjustment, zero reset, or key lock.

Key Operations

The operation keys are used to switch the displays and set detection conditions. The functions of the keys depend on the current mode.

Key	Function	
	RUN mode	SET mode
UP key ⬅	Increases the threshold value.	Depends on the setting. • Executes teaching. • Changes the setting forward.
DOWN key ➡	Decreases the threshold value.	Depends on the setting. • Executes teaching. • Changes the setting in reverse.
MODE key ⏏	Depends on the MODE key setting. • Teaching • Executes power tuning. • Executes a zero reset.	Switches the function to be set on the display.

Time to Press Keys
If a specific time for pressing a key is not given in a procedure, press the key for approximately 1 second. For example, if the procedure says "press the UP key" then press the UP key for approximately 1 second and then release it.

Reading Displays

The information displayed on the main display and sub-display depends on the current mode. For the default settings, the RUN mode displays will appear when the power supply is turned ON for the first time.

Mode	Main display (red)	Sub-display (green)
SET	Displays the incident light level, function name, or other information depending on the key operation.	Displays threshold value or the setting of the function displayed on the main display depending on the key operation.
RUN (See note.)	For the default setting, the current incident light level for channel 1 will be displayed.	For the default setting, the current incident light level for channel 2 will be displayed.

Note: The information that appears on the displays can be set using the display switch function. Refer to 5. Detailed Settings.

4. Basic Settings

1. Setting the Operation Mode

Select either light-ON or dark-ON operation. Set as the operation mode in SET mode. Refer to 5. Detailed Settings.

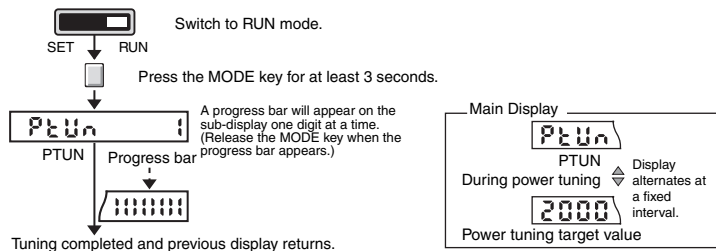
Selection	Description
LON (light-ON) (default)	The output will turn ON when the incident light level is above the threshold.
DON (dark-ON)	The output will turn ON when the incident light level is below the threshold.

2. Adjusting the Power (as Required)

Power tuning can be used to adjust the incident light level that is currently being received to the power tuning target value (default: 2,000). Before tuning ON the power, always secure the detection object and Head and be sure that the incident light level is stable.

Setting Method

Confirm that the MODE key setting is PTUN (power tuning) in advance. PTUN is the default setting. Refer to 5. Detailed Settings. Select the channel for power tuning with the channel selector.



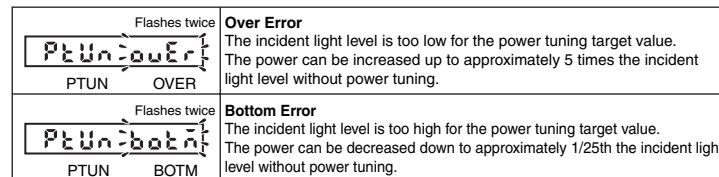
The power tuning target value can be changed. Refer to 5. Detailed Settings.

If power is tuned when SHS is selected for the detection method, the power will be set to the minimum value.

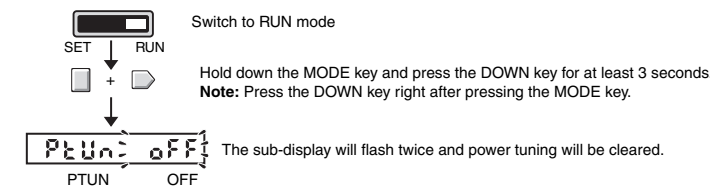
Power tuning will be cleared whenever the detection method is changed from STND, HRES, or SHS.

Power tuning Errors

An error has occurred if one of the following displays appears after the progress bar is displayed.

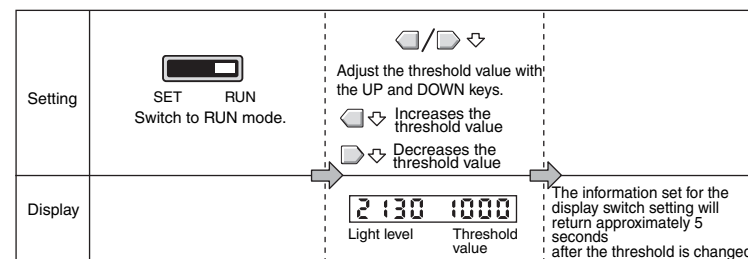


Clearing Method



3. Setting Thresholds

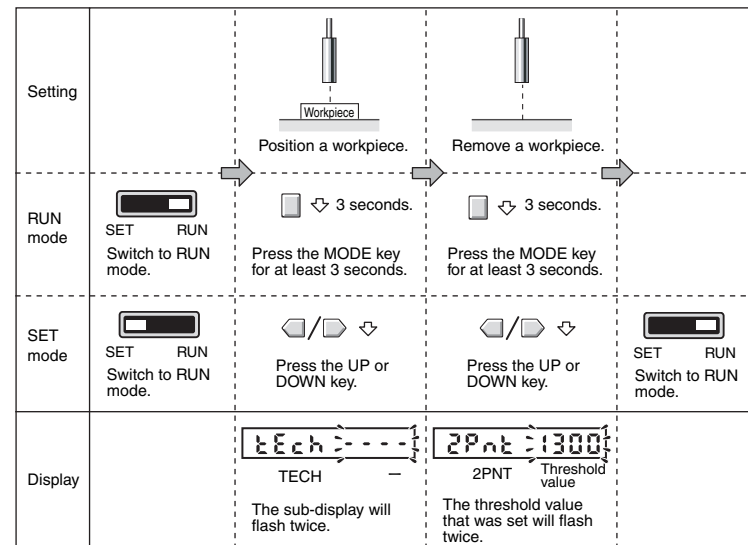
1) Manually Setting



2) Teaching

Teaching With and Without a Workpiece

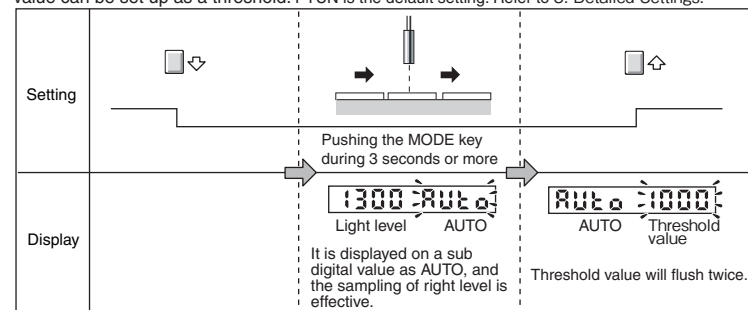
Teaching can be performed twice, once with and once without a workpiece, and the value between the two measured values is set as the threshold. RUN mode and SET mode – each mode can be set up. PTUN is the default setting. Refer to 5. Detailed Settings.



If the output setting is set to 1-2 (differential operation), the value between the two differential values when teaching is performed is used as the threshold setting.

2) Automatic-teaching (It sets up at move work.)

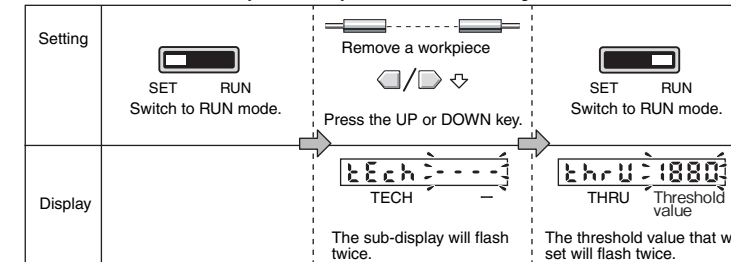
While continuing pushing a key, the middle of the detected maximum and the minimum value can be set up as a threshold. PTUN is the default setting. Refer to 5. Detailed Settings.



If the output setting is set to 1-2 (differential operation), the value between the detected maximum and the minimum differential values when teaching is performed is used as the threshold setting.

Teaching for Through-beam Sensor Heads

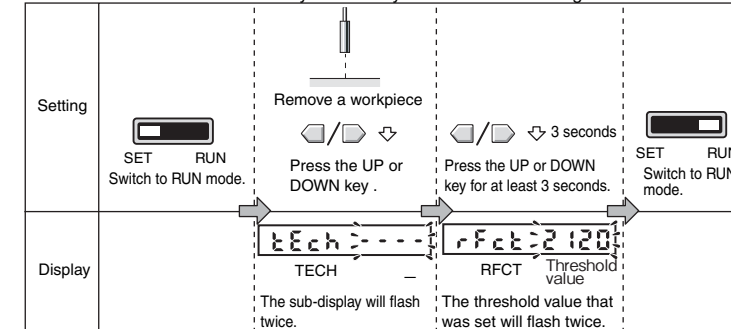
Teaching for a Through-beam Sensor Head is performed without a workpiece. A value about 6% less than the incident light level with no workpiece is set as the threshold value. This method is ideal to stably detect very small differences in light level.



If the output setting is set to 1-2 (differential operation), the differential value when teaching is performed is used as the threshold setting for channel 2. (Same as for Teaching for Reflective Sensor Heads.)

Teaching for Reflective Sensor Heads

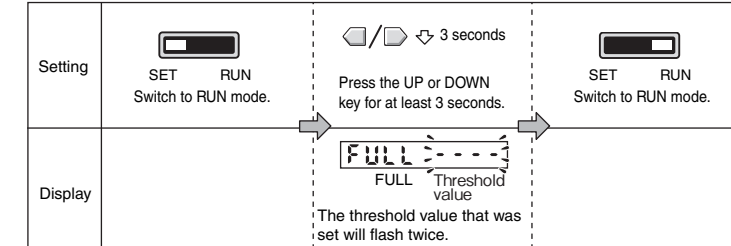
Teaching for a Reflective Sensor Head is performed without a workpiece (i.e., for the background). A value about 6% greater than the incident light level is set as the threshold value. This method is ideal to stably detect very small differences in light level.



If the output setting is set to 1-2 (differential operation), the differential value when teaching is performed is used as the threshold setting for channel 2. (Same as for Teaching for Through-beam Sensor Heads.)

Setting the Threshold at the Maximum Sensitivity

The threshold can be set at the maximum sensitivity. This is convenient when using the longest sensing distance.



It does not matter whether or not there is a workpiece.

The value that is set will depend on the detection method and power adjustment settings. If the output setting is set to 1-2 (differential operation), no threshold setting is possible for channel 2.

Teaching Error

After performing teaching, when the following is displayed on sub digital display, the error has occurred. However, the threshold might not be able to be detected correctly though is set within the possible range.

flash twice. OVER	Over error	Light level is too large. Do one of the following and then repeat the operation. • Adjust the Head to decrease the incident light level. • Execute power tuning.
flash twice. LO	Low error	Light level is too small. Do one of the following and then repeat the operation. • Adjust the Head to increase the incident light level. • Execute power tuning.
flash twice. NEAR	Near error	The difference of incident light level is too small. Do one of the following and then repeat the operation. • Adjust the Head to increase the difference between the two incident light levels.

5. Detailed Settings

The following functions can be set in SET mode. The default settings are shown in the transition boxes between functions.
All settings except for the operation mode and timer settings are the same for both channels.

*: The values shown for thresholds, incident light levels, percentages, etc., are examples only. Actual displays may vary.

Switch to SET mode.

Teaching (Light level/Threshold display)

2130 1000

2 Ech 1000

Note: Refer to 4. Basic Settings for teaching methods.
A display is changed in fixed time.

0. Operation Mode

0-op Lon

Set separately for each channel.

Lon	Light-ON
don	Dark-ON

1. Detection Method

1-fn Stnd

Stnd	Standard mode Response Time:1ms
HRES	High-resolution mode: Response Time:4ms
SXS	Super-high-speed mode Response time: 130 μs (200 μs when AND, OR, leading edge sync, falling edge sync, or differential output is enabled)
HS	High-speed mode Response time:450 μs

Differential Edge Selection

9 -f-

-f-	Single edge Either the rising or falling edge is detected.
-n-	Double edge Both the rising and falling edge are detected.

Differential Response Time

5P 3

	Single edge	Double edge
1	250 μs	500 μs
2	500 μs	1 ms
3	1 ms	2 ms
4	10 ms	20 ms
5	100 ms	200 ms

2. Timer

2-tF

Set separately for each channel.

----	Timer disabled.
OFFd	OFF-delay timer
ON-d	ON-delay timer
1ShT	One-shot timer

Timer Time

40

Setting range: 1 to 5,000

1 to 20 ms	1-ms increments
20 to 200 ms	5-ms increments
200 ms to 1 s	100-ms increments
1 to 5 s	1-s increments

3. Output Setting

3-ot 2out

The operation of channel 2 output can be selected.

2out

The settings described below apply to channel 2 output. (Channel 1 output is not affected.)

And	Output when the output is ON for both channels 1 and 2.
or	Output when the output is ON for either channel 1 or channel 2.
S-f-	Rising edge sync. Output if channel 1 is ON when channel 2 changes from OFF to ON.
S-l-	Falling edge sync. Output if channel 1 is ON when channel 2 changes from ON to OFF.
1-2	Operates according to the difference between channels (channel 1 - channel 2). The difference is used for both threshold and output judgement execution.

4. MODE Key Setting

4-and Ptun

The function of the MODE key in RUN mode can be selected.

Ptun	Tunes the power.
OrSt	Executes a zero reset.
2Pnt	Teaching With and Without a Workpiece
Auto	Automatic-teaching

Setting range: 1 to 5,000

1 to 20 ms	1-ms increments
20 to 200 ms	5-ms increments
200 ms to 1 s	100-ms increments
1 to 5 s	1-s increments

5. Display Switch

5-dP

The information displayed in RUN mode can be selected. When going to SET mode, this setting will be ignored and the incident light level and threshold value will be displayed.

3112 1108	The incident light levels for channels 1 and 2.
3112 2000	The incident light level and threshold value
P123 2000	The incident light level as a percentage of the threshold value and the threshold value.
PEAK BOTM	The peak incident level and bottom incident level of fixed time(2s).
3112 2315	The incident light peak level and no incident light bottom level.
L-PE d-bt	The incident light peak level and no incident light bottom level.
	Analog bar display. The current detection status is displayed as an analog bar. The bar will lengthen from the right
3112 PEAK	The current incident light level and the peak incident light level.
3112 2ch	The incident light level and the channel.

6. Display Orientation

6-rw d123

d123	Normal display
E2IP	Reversed display

6. Convenient Functions

Zeroing the Main Display

The incident light level displayed on the main display can be zeroed. The threshold displayed in the sub-display is shifted by an amount corresponding to the amount the incident light level was changed.
Confirm that the MODE key setting is ORST (zero reset) in advance. PTUN (power tuning) is the default setting. Refer to 5. Detailed Settings.
Select the channel for zeroing with the channel selector.

Setting Method

Switch to RUN mode.

Press the MODE key for at least 3 seconds.
The display of the incident light level will stop changing.

0 1310

The display will be zeroed, i.e., the incident light level will be displayed as 0.

Clearing Method

Switch to RUN mode.

Hold down the MODE key and press the DOWN key for at least 3 seconds.
Press the DOWN key right after pressing the MODE key.

2130 1310

The zero reset function will be cleared.

Key Lock

All key operations can be disabled to help prevent key operating errors. Only the operation keys are disabled. The switches and selectors will still function.

Setting Method

Switch to RUN mode.

Hold down the MODE key and press the UP key for at least 3 seconds. Press the UP key right after pressing the MODE key.

LOC ON

The sub-display will flash twice and key input will be disabled.

Clearing Method

Switch to RUN mode.

Hold down the MODE key and press the UP key for at least 3 seconds. Press the UP key right after pressing the MODE key.

LOC OFF

The sub-display will flash twice and key input will be enabled.

If a key is pressed while key operations are locked, "LOC ON" will flash twice on the display to indicate that key operations have been disabled.

Initializing Settings

This procedure can be used to return all the settings to the original default values.

Setting Method

Switch to SET mode.

Press the UP or DOWN key for at least 3 seconds.

INIT NO?

Press the MODE key at the NO? or YES? display.

INIT GOOD

Initialization has been completed.

7. Installing the Amplifier Unit

Mounting Units

Catch the hook on the Fiber Unit connector end of the Unit on the DIN Track and then press down on the other end of the Unit until it locks into place.

Always attach the Fiber Unit connector end first. If the incorrect end is attached first, the mounting strength will be reduced.

Removing Units

Press the Unit in the direction indicated by "1" and then lift up on the Fiber Unit connector end of the Unit in the direction indicated by "2."

Joining Amplifier Units (for Units with Connectors)

Up to 16 Units can be joined.

- Mount the Amplifier Units one at a time onto the DIN Track.
- Slide the Amplifier Units together and press the Amplifier Units together until they click into place.

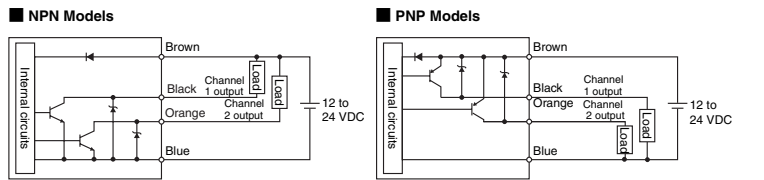
Secure the Units with an End Plate (PEP-M) if there is a possibility of the Amplifier Units moving, e.g., due to vibration.

8. Connecting the Fiber Unit

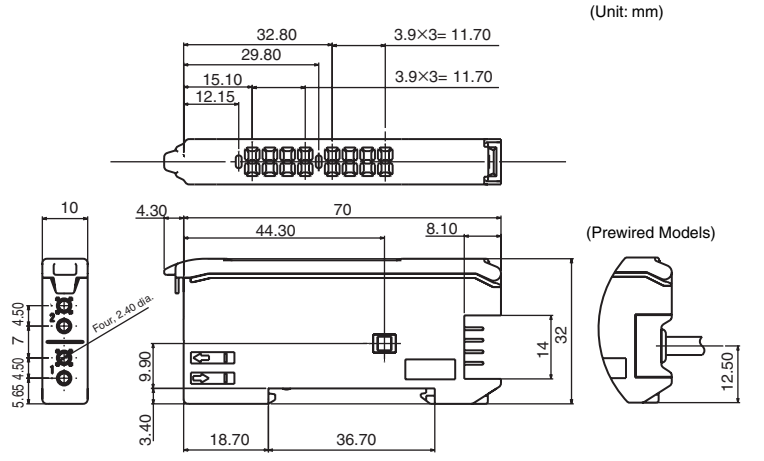
- Open the protective cover
- Press up the lock button.
- Insert the fibers all the way to the back of the connector insertion opening.
- Return the lock button to its original position to secure the fibers.

Reverse the above procedure to disconnect the Fiber Unit.

9. I/O Circuits



10. Dimensions



Suitability for Use

THE PRODUCTS CONTAINED IN THIS SHEET ARE NOT SAFETY RATED. THEY ARE NOT DESIGNED OR RATED FOR ENSURING SAFETY OF PERSONS, AND SHOULD NOT BE RELIED UPON AS A SAFETY COMPONENT OR PROTECTIVE DEVICE FOR SUCH PURPOSES.

Please refer to separate catalogs for OMRON's safety rated products. OMRON shall not be responsible for conformity with any standards, codes, or regulations that apply to the combination of the products in the customer's application or use of the product. Take all necessary steps to determine the suitability of the product for the systems, machines, and equipment with which it will be used. Know and observe all prohibitions of use applicable to this product.

NEVER USE THE PRODUCTS FOR AN APPLICATION INVOLVING SERIOUS RISK TO LIFE OR PROPERTY WITHOUT ENSURING THAT THE SYSTEM AS A WHOLE HAS BEEN DESIGNED TO ADDRESS THE RISKS, AND THAT THE OMRON PRODUCT IS PROPERLY RATED AND INSTALLED FOR THE INTENDED USE WITHIN THE OVERALL EQUIPMENT OR SYSTEM. See also Product catalog for Warranty and Limitation of Liability.

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