Long-distance Proximity Sensor

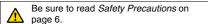


CSM\_E2EM\_DS\_E\_3\_1

# No-polarity 2-Wire Proximity Sensor with a 30-mm Sensing Distance

- Detection at up to 30 mm to reduce problems with workpiece collisions.
- No-polarity for easy wiring.
- Cable protector provided as a standard feature.





# **Ordering Information**

### Sensors [Refer to *Dimensions* on page 7.] DC 2-Wire, Pre-wired Models

Appearar	Appearance		g distance	Model			
Appearar		Sensin	guistance	NO	NC		
Shielded	M12	4 mm		E2EM-X4X1 2M *	E2EM-X4X2 2M		
	M18	8 mr	n	E2EM-X8X1 2M *	E2EM-X8X2 2M		
	M30		15 mm	E2EM-X15X1 2M *	E2EM-X15X2 2M		
Unshielded	M18		16 mm	E2EM-X16MX1 2M	E2EM-X16MX2 2M		
	M30		<b>30 mm</b>	E2EM-X30MX1 2M	E2EM-X30MX2 2M		

\* Pre-wired M12 Connector Models with a cable length of 300 mm are also available. Add -M1J to the end of the model number (example: E2EM-X4X1-M1J).

## DC 3-Wire, Pre-wired Models

Appearance		Sensing distance		Model				
		Sensing u	Istance	Output configuration: NPN NO	Output configuration: NPN NC			
	M8	2 mm		E2EM-X2C1 2M	E2EM-X2C2 2M			
Shielded	M12	4 mm		E2EM-X4C1 2M	E2EM-X4C2 2M			
<b></b>	M18	<b>8</b> mm		E2EM-X8C1 2M	E2EM-X8C2 2M			
	M30	15	mm	E2EM-X15C1 2M	E2EM-X15C2 2M			

### DC 3-Wire, M12 Connector Models

Appeara	Appearance		distance	Output configuration	Model
	M8	2 mm			E2EM-X2C1-M1
Shielded	M12	4 mm			E2EM-X4C1-M1
	M18	8 mm		- NPN NO	E2EM-X8C1-M1
	M30	1	5 mm		E2EM-X15C1-M1

Note: Models with NPN NC output configurations are also available for all of the above models.

### **Accessories (Order Separately)** Sensor I/O Connectors (M12) [Refer to XS2.]

Appearance	Cable length	Sensor I/O Connector model number	Applicable Proximity Sensor model number		
Straight	2 m	XS2F-D421-DC0-A			
	2 111	XS2F-D421-D80-A			
	5 m	XS2F-D421-GC0-A			
	o III	XS2F-D421-G80-A			
L-shape	2 m	XS2F-D422-DC0-A			
E onapo	2 111	XS2F-D422-D80-A			
	Γ	XS2F-D422-GC0-A	1		
Omen and a second secon	5 m	XS2F-D422-G80-A			

Note: Refer to Introduction to Sensor I/O Connectors for details. Use the XS2F-D42□-□CO-A for the E2EM-X□X1-M1J. (Terminal 3: 0 V (+V), Terminal 4: +V (0 V))

# **Ratings and Specifications**

# E2EM-X X DC 2-Wire Models

	Size	M12	M	18	M	30		
	Shielded	Shielded	Shielded	Unshielded	Shielded	Unshielded		
ltem	Model	E2EM-X4X	E2EM-X8X	E2EM-X16MX	E2EM-X15X	E2EM-X30MX		
Sensing	distance	4 mm ±10%	8 mm ±10%	16 mm ±10%	15 mm ±10%	30 mm ±10%		
Set dista	ince *1	0 to 3.2 mm	0 to 6.4 mm	0 to 12.8 mm	0 to 12 mm	0 to 24 mm		
Different	tial travel	15% max. of sensing of	listance					
Detectab	ole object	Ferrous metal (The se		es with non-ferrous met	al. Refer to Engineering	g Data on page 4.)		
	d sensing object	Iron, $12 \times 12 \times 1$ mm	Iron, $18 \times 18 \times 1$ mm	Iron, $45 \times 45 \times 1 \text{ mm}$	Iron, $30 \times 30 \times 1 \text{ mm}$	Iron, $70 \times 70 \times 1 \text{ mm}$		
•	se frequency *2	1 kHz	0.5 kHz	0.4 kHz	0.25 kHz	0.1 kHz		
	upply voltage ng voltage	12 to 24 VDC (10 to 30	0 VDC), ripple (p-p): 10	% max.				
Leakage	current	0.8 mA max.						
Con-	Load current	3 to 100 mA						
trol out- put	Residual volt- age *3		t: 100 mA, Cable lengtł	·				
Indicator		X1 Models: Operation indicator (red), Setting indicator (green) X2 Models: Operation indicator (red)						
Operatio (with ser approacl	nsing object	X1 Models: NO X2 Models: NC	r to the timing charts ur	der I/O Circuit Diagram	<i>s</i> on page 5 for details.			
Protectio	on circuits	Surge suppressor, Loa	Surge suppressor, Load short-circuit protection					
Ambient range	temperature	Operating: -25 to 70°C	C, Storage: –40 to 85°C	(with no icing or conde	nsation)			
Ambient	humidity range	Operating/Storage: 35	% to 95% (with no cond	lensation)				
	ture influence	5		temperature range of -				
-	influence	•	•	e in the rated voltage $\pm 1$	5% range			
	n resistance	•	DC) between current-ca					
	c strength			irrent-carrying parts and				
	n resistance			litude for 2 hours each i	n X, Y, and Z directions	8		
	esistance		<sup>2</sup> 10 times each in X, Y					
<u> </u>	of protection		use standards: oil-resis					
	ion method	Pre-wired Models (Standard cable length: 2 m)						
weight (	packed state)	Approx. 60 g	Approx. 130 g	Approx. 150 g	Approx. 180 g	Approx. 210 g		
	Case Sensing sur-	Nickel-plated brass						
Materi-	face							
als	Clamping nuts	Nickel-plated brass						
	Toothed wash- er	Zinc-plated iron						
Accesso	ories	Instruction manual						

\*1. Use the Sensor within the range in which the setting indicator (green LED) is ON (except X2 Models).
\*2. The response frequency is an average value. Measurement conditions are as follows: standard sensing object, a distance of twice the standard sensing object, and a set distance of half the sensing distance.
\*3. The residual voltage is 5 V. Make sure that the device connected to the Sensor can withstand the residual voltage. (Refer to page 6 for details.)

### E2EM-XCC DC 3-Wire Models

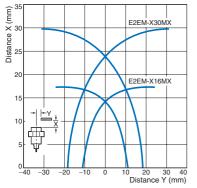
	Size	M8	M12	M18	M30	
	Shielded	Shielded	Shielded	Shielded	Shielded	
Item	Model	E2EM-X2C□(-M1)	E2EM-X4C□(-M1)	E2EM-X8C□(-M1)	E2EM-X15C□(-M1)	
Sensing o	distance	2 mm ±10%	4 mm ±10%	8 mm ±10%	15 mm ±10%	
Set distar	nce	0 to 1.6 mm	0 to 3.2 mm	0 to 6.4 mm	0 to 12 mm	
Differenti	al travel	10% max. of sensing distar	ice			
Detectabl	e object	Ferrous metal (The sensing	distance decreases with no	n-ferrous metal. Refer to Er	ngineering Data on page 4.)	
Standard	sensing object	Iron, $8 \times 8 \times 1 \text{ mm}$	Iron, $12 \times 12 \times 1$ mm	Iron, $18 \times 18 \times 1$ mm	Iron, $30 \times 30 \times 1$ mm	
Response	e frequency *1	1.5 kHz	0.5 kHz	0.3 kHz	0.1 kHz	
	pply voltage g voltage range) *2	12 to 24 VDC (10 to 40 VD	C), ripple (p-p): 10% max.			
Current c	onsumption	13 mA max.				
Control	Load current *2	200 mA max.				
output	Residual voltage	2 V max. (Load current: 200	0 mA, Cable length: 2 m)			
Indicators	6	Operation indicator (yellow)				
	n mode (with sens- t approaching)	C1 Models: NO C2 Models: NC	ne timing charts under I/O C	<i>ircuit Diagrams</i> on page 5 fo	or details.	
Protectio	n circuits	Reverse polarity protection,	, Load short-circuit protectior	n, Surge suppressor		
Ambient t *1	Ambient temperature range         Operating/Storage: -40 to 85°C (with no icing or condensation)				Operating: -25 to 70°C Storage: -40 to 85°C (with no icing or condensation)	
Ambient I	humidity range	Operating/Storage: 35% to				
Temperat	ure influence		ance at 23°C in the temperat ance at 23°C in the temperat		$\pm$ 15% max. of sensing distance at 23°C in the temperature range of –25 to 70°C	
Voltage ir	nfluence	$\pm$ 1% max. of sensing distar	nce at rated voltage in the rat	ted voltage $\pm$ 15% range		
Insulatior	n resistance	50 $\text{M}\Omega$ min. (at 500 VDC) b	etween current-carrying part	ts and case		
Dielectric	strength	1,000 VAC, 50/60 Hz for 1 minute between current-carrying parts and case				
Vibration	resistance	Destruction: 10 to 55 Hz, 1.	5-mm double amplitude for 2	2 hours each in X, Y, and Z	directions	
Shock res	sistance	Destruction: 500 m/s <sup>2</sup> 10 times each in X, Y, and Z directions	Destruction: 1,000 m/s <sup>2</sup> 10	times each in X, Y, and Z d	irections	
Degree of	fprotection	Pre-wired Models: IEC 605 Connector Models: IEC 605	29 IP67, in-house standards 29 IP67	: oil-resistant		
Connectio	on method	Pre-wired Models (Standard Connector Models	d cable length: 2 m)			
Weight	Pre-wired Models	Approx. 65 g	rox. 65 g Approx. 75 g Approx. 150 g		Approx. 195 g	
(packed state)	Connector Mod- els	Approx. 15 g	Approx. 25 g	Approx. 40 g	Approx. 90 g	
	Case	Stainless steel (SUS303)	Nickel-plated brass			
Materials	Sensing surface	PBT				
materials	Clamping nuts	Nickel-plated brass				
	Toothed washer	Zinc-plated iron				
Accessor	ies	Instruction manual				

\*1. The response frequency is an average value. Measurement conditions are as follows: standard sensing object, a distance of twice the standard sensing object, and a set distance of half the sensing distance.
 \*2. When using an M8 Model at an ambient temperature between 70 and 85°C, supply 10 to 30 VDC to the Sensor and make sure that the Sensor has a control output of 100 mA maximum.

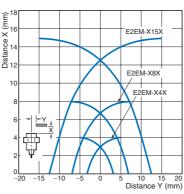
# **Engineering Data (Typical)**

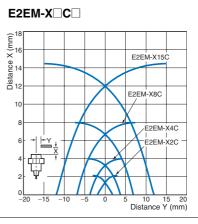
## **Sensing Area**

# Unshielded Models E2EM-X MX



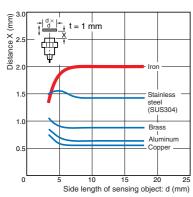
Shielded Models E2EM-X X



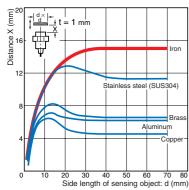


# Influence of Sensing Object Size and Material

E2EM-X2□□(-M1)

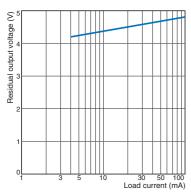


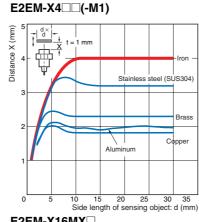
E2EM-X15□□(-M1)

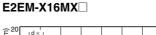


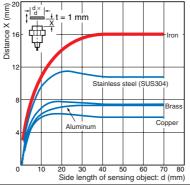
**Residual Output Voltage** 

## E2EM-X X

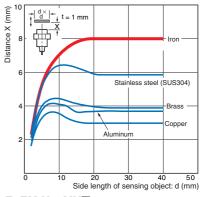




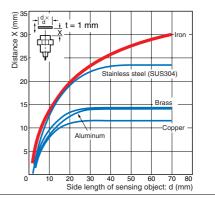




## E2EM-X8□□(-M1)

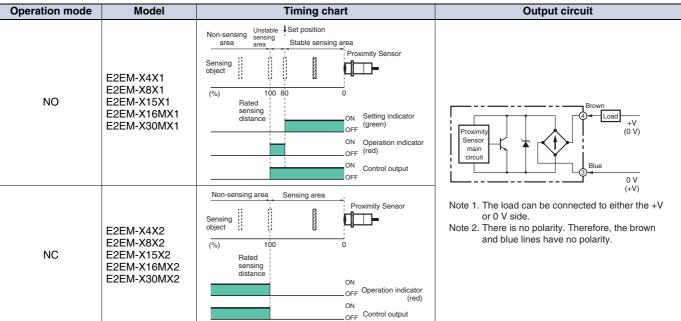


# E2EM-X30MX

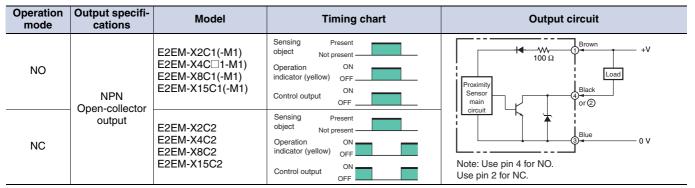


# I/O Circuit Diagrams

# E2EM-X X DC 2-Wire Models



### E2EM-X C (-M1) DC 3-Wire Models



# **Connections for Sensor I/O Connectors**

Proximity Sensor			Sensor I/O Connector	Connections			
Туре	Operation mode	Model	model	Connections			
DC 2-wire	NO	E2EM-X□X1-M1J	1: Straight 2: L-shape	E2EM XS2F Brown (not connected) (not connected) Blue (+) (-) Black (-) (+)			
	NO	E2EM-X□C1-M1	XS2F-D42 D: 2-m cable G: 5-m cable	E2EM XS2F Brown (+V) C C C C C C C C C C C C C			
DC 3-wire			T: Straight 2: L-shape XS2F-D42□-□80-A	E2EM XS2F			
	NC	E2EM-X□C2-M1	C: 5-m cable	E2EM XS2F			
	Refer to the Sensor I/O Connector Group Catalog (Cat. No. X073) for details.						

# **Safety Precautions**

## Refer to Warranty and Limitations of Liability.

# WARNING

This product is not designed or rated for ensuring safety of persons either directly or indirectly. Do not use it for such purposes.



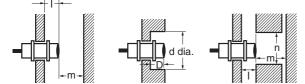
### **Precautions for Correct Use**

Do not use this product under ambient conditions that exceed the ratings.

#### Design

#### Influence of Surrounding Metal

When mounting the Sensor within a metal panel, ensure that the clearances given in the following table are maintained. Failure to maintain these distances may cause deterioration in the performance of the Sensor.



Influence of Surrounding Metal (Unit: mm)

Туре	Item	M8	M12	M18	M30	
		1		2.4	3.6	6
		d		18	27	45
	Shielded	D		2.4	3.6	6
		m		12	24	45
DC 2-wire		n		18	27	45
E2EM-X□X□	Unshielded	I			25	45
		d			70	120
		D			25	45
		m			48	90
		n			70	120
		I	0	2.4	3.6	6
50 0 ·		d	8	18	27	45
DC 3-wire E2EM-X□C□	Shielded	D	0	2.4	3.6	6
		m	4.5	12	24	45
		n	12	18	27	45

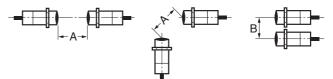
# are any problems in operation. **Mutual Interference**

**AND/OR Connections** 

When installing Sensors face-to-face or side-by-side, ensure that the minimum distances given in the following table are maintained.

Error pulses and leakage current may prevent application in AND or

OR circuits. Always confirm operation in advance to confirm if there



#### Mutual Interference (Unit: mm)

Туре	Item	M8	M12	M18	M30	
	Shielded	Α	· ·	30	60	110
DC 2-wire	Sillelueu	В		20	35	90
E2EM-X X	Unshield- ed	Α			200	350
		В			120	300
DC 3-wire	Shielded	Α	20	30	60	110
E2EM-X□C□	Shielded	В	15	20	35	90

Connecting a DC 2-	wire Proximity	Sensor t	o a PLC	(Progra	ımma	able	Contro	oller)
<b>Required Conditions</b>								

Connection to a PLC is possible if the specifications of the PLC and the Proximity Sensor satisfy the following conditions. (The meanings of the symbols are given below.)

1. The ON voltage of the PLC and the residual voltage of the Proximity Sensor must satisfy the following.

2. The OFF current of the PLC and the leakage current of the Proximity Sensor must satisfy the following.

- (If the OFF current is not listed in the specifications, take it to be 1.3 mA.)
- 3. The ON current of the PLC and the control output (Iout) of the Proximity Sensor must satisfy the following.

IOUT (min.)  $\leq$  ION  $\leq$  IOUT (max.)

The ON current of the PLC will vary, however, with the power supply voltage and the input impedance, as shown in the following equation.

### ION = (VCC - VR - VPC)/RIN

## Example

In this example, the above conditions are checked when the PLC Unit is the C200H-ID212, the

- Proximity Sensor is the E2EM-X8X1, and the power supply voltage is 24 V.
- 1. Von  $(14.4 \text{ V}) \leq \text{Vcc} (20.4 \text{ V}) \text{Vr} (5 \text{ V}) = 15.4 \text{ V}$ : OK OK
- 2. IOFF (1.3 mA)  $\geq$  leak (0.8 mA):

3. ION =  $[V_{CC} (20.4 \text{ V}) - \text{V}_{R} (5 \text{ V}) - \text{V}_{PC} (4 \text{ V})]/\text{Rin} (3 \text{ k}\Omega) = \text{Approx. 3.8 mA}$ OK

Therefore, IOUT(min.) (3 mA)  $\leq ION$  (3.8 mA):

- Von: ON voltage of PLC (14.4 V)
- ON current of PLC (typ. 7 mA) Ion:
- OFF. OFF current of PLC (1.3 mA)
- RIN: Input impedance of PLC (3 k $\Omega$ ) Internal residual voltage of PLC (4 V)
- VPC: V<sub>R</sub>: Output residual voltage of Proximity
- Sensor (5 V) leak:
- Leakage current of Proximity Sensor (0.8 mA) IOUT:
- Control output of Proximity Sensor (3 to 100 mA) Power supply voltage (PLC: 20.4 to Vcc:
- 26.4 V)

Values in parentheses apply to the following PLC model and Proximity Sensor model. PLC: C200H-ID212

Sensor: E2EM-X8X1

 $V_{ON} \leq V_{CC} - V_{R}$ 

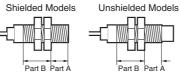
 $IOFF \ge I_{leal}$ 

# Mounting

# **Tightening Force**

Do not tighten the nut with excessive force. A washer must be used with the nut.





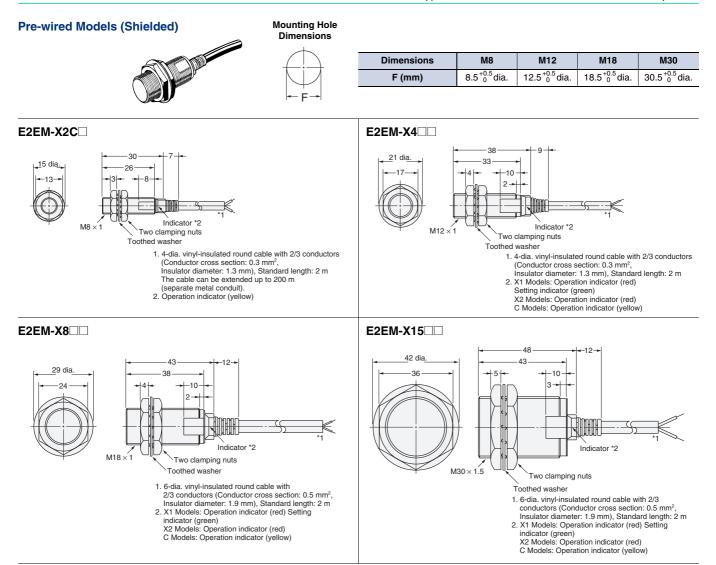
Note: 1. The allowable tightening strength depends on the distance from the edge of the head, as shown in the following table. (A is the distance from the edge of the head. B includes the nut on the head side. If the edge of the nut is in part A, the tightening torque for part A applies instead.)

2. The following strengths assume washers are being used.

	Torque	Par	Part B		
Model		Dimension (mm) Torque		Torque	
M8	Shielded	9	12 N⋅m		
M12			30 N⋅m		
M18					
M30		180 N·m			

# Dimensions

(Unit: mm) Tolerance class IT16 applies to dimensions in this data sheet unless otherwise specified.

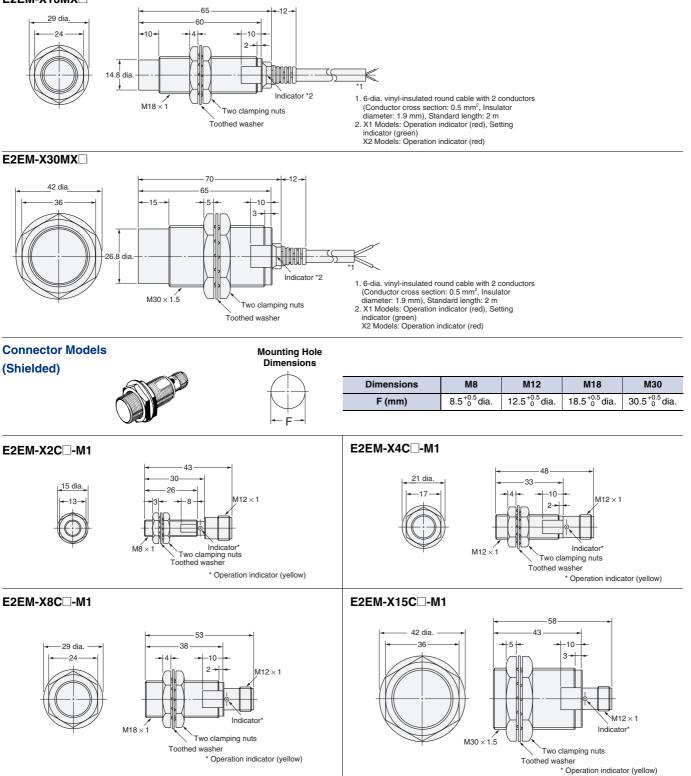


E2EM

# Pre-wired Models (Unshielded)



### E2EM-X16MX



### **Read and Understand This Catalog**

Please read and understand this catalog before purchasing the products. Please consult your OMRON representative if you have any questions or comments.

### Warranty and Limitations of Liability

#### WARRANTY

OMRON's exclusive warranty is that the products are free from defects in materials and workmanship for a period of one year (or other period if specified) from date of sale by OMRON.

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#### LIMITATIONS OF LIABILITY

OMRON SHALL NOT BE RESPONSIBLE FOR SPECIAL, INDIRECT, OR CONSEQUENTIAL DAMAGES, LOSS OF PROFITS OR COMMERCIAL LOSS IN ANY WAY CONNECTED WITH THE PRODUCTS, WHETHER SUCH CLAIM IS BASED ON CONTRACT, WARRANTY, NEGLIGENCE, OR STRICT LIABILITY.

In no event shall the responsibility of OMRON for any act exceed the individual price of the product on which liability is asserted.

IN NO EVENT SHALL OMRON BE RESPONSIBLE FOR WARRANTY, REPAIR, OR OTHER CLAIMS REGARDING THE PRODUCTS UNLESS OMRON'S ANALYSIS CONFIRMS THAT THE PRODUCTS WERE PROPERLY HANDLED, STORED, INSTALLED, AND MAINTAINED AND NOT SUBJECT TO CONTAMINATION, ABUSE, MISUSE, OR INAPPROPRIATE MODIFICATION OR REPAIR.

### **Application Considerations**

#### SUITABILITY FOR USE

OMRON shall not be responsible for conformity with any standards, codes, or regulations that apply to the combination of products in the customer's application or use of the products.

At the customer's request, OMRON will provide applicable third party certification documents identifying ratings and limitations of use that apply to the products. This information by itself is not sufficient for a complete determination of the suitability of the products in combination with the end product, machine, system, or other application or use.

The following are some examples of applications for which particular attention must be given. This is not intended to be an exhaustive list of all possible uses of the products, nor is it intended to imply that the uses listed may be suitable for the products:

- · Outdoor use, uses involving potential chemical contamination or electrical interference, or conditions or uses not described in this catalog.
- Nuclear energy control systems, combustion systems, railroad systems, aviation systems, medical equipment, amusement machines, vehicles, safety equipment, and installations subject to separate industry or government regulations.
- · Systems, machines, and equipment that could present a risk to life or property.

Please know and observe all prohibitions of use applicable to the products.

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 PRODUCTS ARE PROPERLY RATED AND INSTALLED FOR THE INTENDED USE WITHIN THE OVERALL EQUIPMENT OR SYSTEM.

#### PROGRAMMABLE PRODUCTS

OMRON shall not be responsible for the user's programming of a programmable product, or any consequence thereof.

### Disclaimers

#### CHANGE IN SPECIFICATIONS

Product specifications and accessories may be changed at any time based on improvements and other reasons.

It is our practice to change model numbers when published ratings or features are changed, or when significant construction changes are made. However, some specifications of the products may be changed without any notice. When in doubt, special model numbers may be assigned to fix or establish key specifications for your application on your request. Please consult with your OMRON representative at any time to confirm actual specifications of purchased products.

### DIMENSIONS AND WEIGHTS

Dimensions and weights are nominal and are not to be used for manufacturing purposes, even when tolerances are shown.

#### PERFORMANCE DATA

Performance data given in this catalog is provided as a guide for the user in determining suitability and does not constitute a warranty. It may represent the result of OMRON's test conditions, and the users must correlate it to actual application requirements. Actual performance is subject to the OMRON Warranty and Limitations of Liability.

#### ERRORS AND OMISSIONS

The information in this document has been carefully checked and is believed to be accurate; however, no responsibility is assumed for clerical, typographical, or proofreading errors, or omissions.

2008.11

In the interest of product improvement, specifications are subject to change without notice.

### OMRON Corporation Industrial Automation Company

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