

# Absolute 60-mm-dia. Rotary Encoder E6F-A

## High Accuracy and Durability for Automatic Equipment

- Stronger shaft and greater durability (120 N in the radial direction and 50 N in the thrust direction) than previous E6F Encoders.
- Water- and oil-proof structure (IP65f) for a greater degree of protection against water, oil, and other substances.
- Wider range of resolutions for even more applications (series includes models with resolutions up to 1,024).
- Faster response for high-speed control applications (grey code: 20 kHz).



### <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.

## Ordering Information

### ■ Rotary Encoders

Supply voltage	Output configuration	Output code	Resolution (P/R)	Connection	Model
5 to 12 VDC	NPN open collector	BCD	360	Prewired	E6F-AB3C
				Connector	E6F-AB3C-C
12 to 24 VDC	NPN open collector	Grey binary	256	Prewired	E6F-AB5C C€
				Connector	E6F-AB5C-C C€
	PNP open collector	256, 360, 720, or 1,024	Prewired	E6F-AB5B C€	
			Connector	E6F-AG5C-C	
	NPN open collector	256, 360, 720, or 1,024	Prewired	E6F-AG5C	
			PNP open collector	E6F-AG5B C€	

- Note 1.** When ordering, specify the resolution together with the model number (e.g., F6F-AG5C 256).  
**2.** The E6F-AB3C-C connects to the H8PR-8, H8PR-16, or H8PR-24 Rotary Positioner.  
**3.** The E6F-AG5C-C connects to the H8PS-8A or H8PS-8AF Cam Positioner.

### ■ Accessories (Order Separately)

Name	Model	Remarks
Coupling	E69-C10B	Included with the E6F-AB3C.
	E69-C610B	Different end diameter
	E69-C10M	Metal construction
Servo Mounting Brackets	E69-2	Three brackets in a set; included with the Encoder.
Extension Cable	E69-DF5	5 m (10-, 15-, 20-, and 98-m cables are also available.)

# Specifications

## ■ Ratings/Characteristics

Item	E6F-AB3C-C	E6F-AB3C	E6F-AB5C-C	E6F-AB5C	E6F-AB5B	E6F-AG5C-C	E6F-AG5C	E6F-AG5B
<b>Power supply voltage</b>	5 VDC -5% to 12 VDC +10%, ripple (p-p): 5% max.		12 VDC -10% to 24 VDC +15%, ripple (p-p): 5% max.					
<b>Current consumption (See note 1.)</b>	60 mA max.							
<b>Resolution (P/R) (See note 2.)</b>	360					256	256, 360, 720, or 1,024	
<b>Output code</b>	BCD					Grey binary		
<b>Output configuration</b>	NPN open collector				PNP open collector	NPN open collector		PNP open collector
<b>Output capacity</b>	Applied voltage: 30 VDC max. Sink current: 35 mA max. Residual voltage: 0.4 V max. (when sink current is 35 mA)				Source current: 35 mA max. Residual voltage: 0.4 V max. (when source current is 35 mA)	Applied voltage: 30 VDC max. Sink current: 35 mA max. Residual voltage: 0.4 V max. (when sink current is 35 mA)		Source current: 35 mA max. Residual voltage: 0.4 V max. (when source current is 35 mA)
<b>Max. response frequency (See note 3.)</b>	10 kHz					20 kHz		
<b>Logic</b>	Negative logic (H = OFF; L = ON)				Positive logic (H = ON; L = OFF)	Negative logic (H = OFF; L = ON)		Positive logic (H = ON; L = OFF)
<b>Rotation direction</b>	Output codes increase CW (as seen from the shaft)							
<b>Rise and fall times of output</b>	1 μs max. (For E6F-AB3C and A□5C, load voltage: 5 V; load resistance: 1 kΩ; cable length: 2 m max.) (For E6F-A□5B, power supply voltage: 12 V; load resistance: 1 kΩ; cable length: 2 m max.)							
<b>Starting torque</b>	9.8 mN·m max. (at room temperature), 14.7 mN·m max. (at low temperature)							
<b>Moment of inertia</b>	1.5 × 10 <sup>-6</sup> kg·m <sup>2</sup> max.							
<b>Shaft loading</b>	<b>Radial</b>	120 N						
	<b>Thrust</b>	50 N						
<b>Max. permissible revolution</b>	5,000 r/min							
<b>Ambient temperature</b>	Operating: -10 to 70°C (with no icing) Storage: -25 to 80°C (with no icing)							
<b>Ambient humidity</b>	Operating: 35% to 85% (with no condensation) Storage: 35% to 95% (with no condensation)							
<b>Insulation resistance</b>	10 MΩ min. (at 500 VDC) between carry parts and case							
<b>Dielectric strength</b>	500 VAC, 50/60 Hz for 1 min between carry parts and case							
<b>Vibration resistance</b>	Destruction: 10 to 55 Hz, 1.5-mm double amplitude for 2 hrs each in X, Y, and Z directions							
<b>Shock resistance</b>	Destruction: 1,000 m/s <sup>2</sup> 3 times each in X, Y, and Z directions							
<b>Degree of protection</b>	IEC IP65 (JEM water-/oil-proof IP65f) (See note 4.)							
<b>Connection method</b>	Connector (standard cable length: 2 m)	Prewired (standard cable length: 2 m)	Connector (standard cable length: 2 m)	Prewired (standard cable length: 2 m)	Connector (standard cable length: 2 m)	Prewired (standard cable length: 2 m)	Connector (standard cable length: 2 m)	Prewired (standard cable length: 2 m)
<b>Weight (packed)</b>	Approx. 500 g							
<b>Accessories</b>	Servo Mounting Brackets and instruction sheet							

**Note 1.** An inrush current of approximately 9 A flows for approximately 0.5 μs right after the E6F-A is turned ON.

**2.** Codes are shown in the following table.

Output code	Resolution	Code No.
BCD	360	0 to 359
Grey binary	256	0 to 255
	360	76 to 435 (grey after 76)
	720	152 to 871 (grey after 152)
	1,024	0 to 1,023

**3.** The maximum electrical response revolution is determined by the resolution and maximum response frequency as follows:  
Maximum electrical response frequency (r/min) = Maximum response frequency/resolution × 60  
This means that the E6F-A will not operate electrically if its revolution exceeds the maximum electrical response revolution.

**4.** JEM1030: Applicable from 1991.

# Output Circuits

Model	Output circuits	Output mode
E6F-AB3C E6F-AB3C-C	<p>Note: The circuit is the same for all bit outputs.</p>	<p>Rotation direction: CW (as viewed from end of shaft)</p> <p><math>1^{\circ} \pm 0.5^{\circ}</math></p>
E6F-AB5C E6F-AB5C-C	<p>Note: The circuit is the same for all bit outputs.</p>	
E6F-AB5B	<p>Note: The circuit is the same for all bit outputs.</p>	
E6F-AG5C E6F-AG5C-C	<p>Note: The circuit is the same for all bit outputs.</p>	<p>Rotation direction: CW (as viewed from end of shaft)</p> <p>Output transistor</p>
E6F-AG5B	<p>Note: The circuit is the same for all bit outputs.</p>	

# Connection Specifications

## ■ Connector Encoders

Pin No.	E6F-AB3C-C/-AB5C-C	E6F-AG5C-C
	Output signal: 10-bit (360)	Output signal: 8-bit (256)
1	$2^0$	Connected internally.
2	$2^1$	
3	$2^2$	$2^5$
4	$2^3$	$2^1$
5	$2^0 \times 10$	$2^0$
6	$2^1 \times 10$	$2^7$
7	$2^2 \times 10$	$2^4$
8	$2^3 \times 10$	$2^2$
9	$2^0 \times 100$	$2^3$
10	$2^1 \times 100$	$2^6$
11	Shield (ground)	Shield (ground)
12	-AB3C-C: 5 to 12 VDC, -AB5C-C: 12 to 24 VDC	12 to 24 VDC
13	0 V (common)	0 V (common)

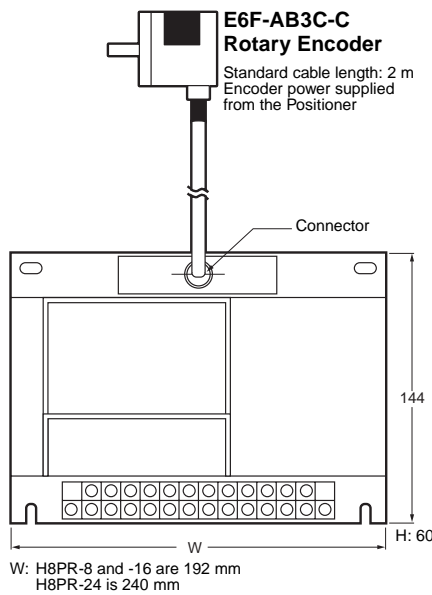
**Note:** Connector: PR13A-12PD-13SC (Hirose Electric Co., Ltd.)

## ■ Prewired Encoders

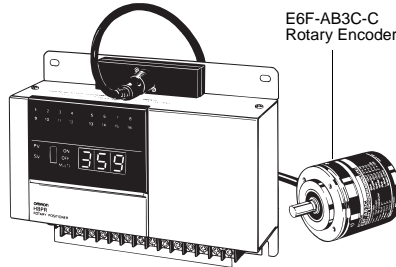
Cable color	E6F-AB3C/-AB5C/-AB5B	E6F-AG5C/-AG5B		
	Output signal: 10-bit (360)	Output signal: 8-bit (256)	Output signal: 9-bit (360)	Output signal: 10-bit (720 and 1,024)
<b>Brown</b>	$2^0$	$2^0$	$2^0$	$2^0$
<b>Orange</b>	$2^1$	$2^1$	$2^1$	$2^1$
<b>Yellow</b>	$2^2$	$2^2$	$2^2$	$2^2$
<b>Green</b>	$2^3$	$2^3$	$2^3$	$2^3$
<b>Blue</b>	$2^0 \times 10$	$2^4$	$2^4$	$2^4$
<b>Purple</b>	$2^1 \times 10$	$2^5$	$2^5$	$2^5$
<b>Grey</b>	$2^2 \times 10$	$2^6$	$2^6$	$2^6$
<b>White</b>	$2^3 \times 10$	$2^7$	$2^7$	$2^7$
<b>Pink</b>	$2^0 \times 100$	Not connected	$2^8$	$2^8$
<b>Light blue</b>	$2^1 \times 100$	Not connected	Not connected	$2^9$
--	Shield (ground)	Shield (ground)		
<b>Red</b>	-AB3C: 5 to 12 VDC, -AB5C and -AB5B: 12 to 24 VDC	12 to 24 VDC		
<b>Black</b>	0 V (common)	0 V (common)		

# Connection Examples

## ■ Connection to H8PR Rotary Positioners



**Simplified Key Switch  
H8PR-8, -16, and -24  
Rotary Positioners**



**Note:** The distance between H8PR and E6F-AB3C-C may be extended to 30 m (including accessory cable).

### Models

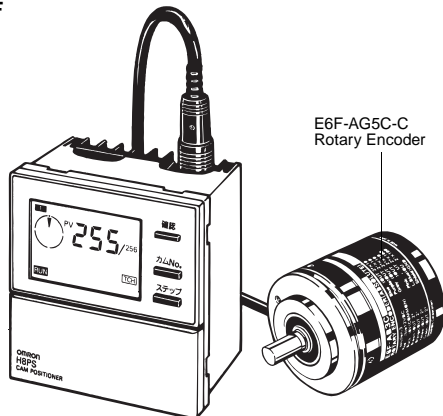
Model	Applicable model
H8PR-8	E6F-AB3C-C
H8PR-16	
H8PR-24	

### Specifications

<b>Rated voltage</b>	100 to 240 VAC
<b>Cam precision</b>	1° (360 divisions per revolution)
<b>No. of output points</b>	H8PR-8: 8 H8PR-16: 16 H8PR-24: 24
<b>Encoder response</b>	833 r/min
<b>Additional functions</b>	<ul style="list-style-type: none"> <li>• Origin compensation (zeroing)</li> <li>• Rotation direction switching</li> <li>• Initial angle specification</li> <li>• Angle Teaching</li> <li>• Retentive memory for power interruptions (10 years min.)</li> </ul>

## ■ Connection to H8PS Cam Positioners

**H8PS-8A and -8AF  
Cam Positioners**



**Note:** The distance between H8PS and E6F-AG5C-C may be extended to 100 m (including accessory cable).

### Models

Model	Applicable model
H8PS-8A	E6F-AG5C-C
H8PS-8AF	

### Specifications

<b>Rated voltage</b>	24 VDC
<b>Cam precision</b>	1.4° (256 divisions per revolution)
<b>No. of output points</b>	Cam output: 8 Output during RUN: 1 Rotary output: 1
<b>Encoder response</b>	330 r/min
<b>Additional functions</b>	<ul style="list-style-type: none"> <li>• Origin compensation (zeroing)</li> <li>• Rotation direction switching</li> <li>• Angle display switching</li> <li>• Teaching</li> </ul>

## ■ Connection to Programmable Controllers

The E6F-A can be connected to the CQM1-CPU44-E.

# Operation and Installation

**⚠ WARNING**

This products is not designed or rated for ensuring safety of persons.  
Do not use it for such purpose.

## ■ Precautions for Correct Use

- Do not impose voltages exceeding the rated voltage on the E6F-A, otherwise the E6F-A may be damaged.
- Be sure that the wiring of the E6F-A, including the polarity, is correct. The E6F-A may be damaged if wired incorrectly.
- Do not short the load of the E6F-A, otherwise the E6F-A may be damaged.
- Turn OFF the E6F-A while wiring. Wiring while the power supply is turned ON could result in burning of the output circuit if the output cable touches the power supply.
- Do not wire power lines or high-tension lines along with the power supply lines of the E6F-A, otherwise the E6F-A may be damaged or malfunction.

## ■ Application

### Mounting

#### Mounting Procedure

1. Insert the shaft into the Coupling.  
Do not secure the Coupling and the shaft with screws at this stage.
2. Secure the E6F-A.  
Refer to the following table for the maximum insertion lengths of the shaft into the Coupling.

Coupling	Insertion length
E69-C10B	7.1 mm
E69-C610B	
E69-C10M	10.5 mm

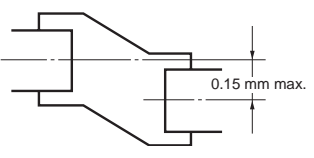
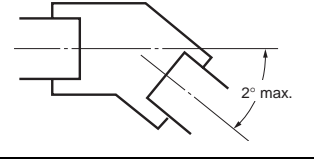
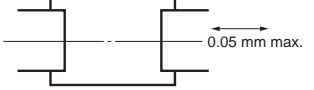
3. Secure the Coupling.

Coupling	Tightening torque
E69-C10B	0.44 N·m
E69-C610B	
E69-C10M	3.5 N·m

4. Connect the power and I/O lines.  
Turn OFF the E6F-A when connecting the lines.
5. Turn ON the E6F-A and check the output.

### Mounting Information

- Be careful not to allow water, oil, or other substances to be sprayed on the E6F-A.
- The E6F-A consists of high-precision components. Handle the E6F-A with utmost care and do not drop it, otherwise malfunctioning may result.
- When the E6F-A is to be used in reversing, pay utmost attention to the mounting direction of the E6F-A, and to the direction of increment and decrement rotation.
- To match phase Z of the E6F-A to the origin of the device to be connected to the E6F-A, confirm the phase-Z output when connecting the device.
- Do not impose an excessive load on the shaft if the shaft is connected to a gear.
- If the E6F-A is mounted with screws, the tightening torque must not exceed 0.49 N·m.
- When using a Coupling, mount within the following tolerances.

<b>Eccentricity tolerance</b>	
<b>Declination tolerance</b>	
<b>Displacement tolerance in the shaft direction</b>	

- If the eccentricity or declination value exceeds the tolerance, an excessive load imposed on the shaft may damage the E6F-A or shorten the life of the E6F-A.

### Adjustments: Reading Output Codes

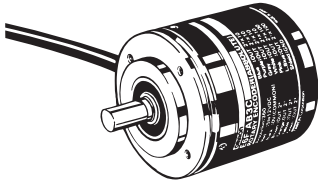
- When reading the output code of the E6F-AB3C or E6F-AB3C-C, read the code only after the LSB (2<sup>0</sup> output) has changed.

# Dimensions

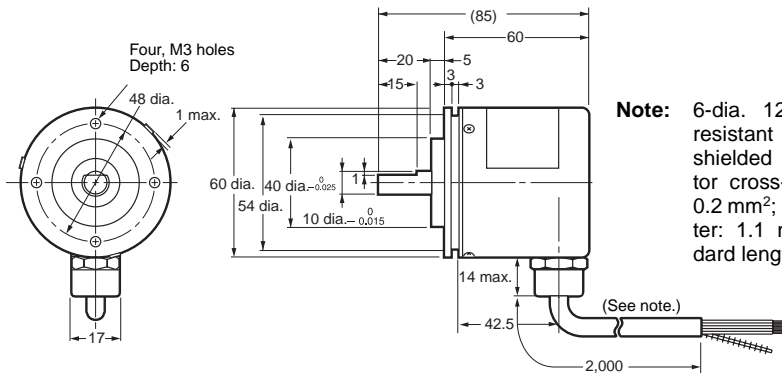
(Unit: mm)

## Rotary Encoders

E6F-AB3C  
E6F-AB5C  
E6F-AG5C  
E6F-AG5B  
E6F-AB5B

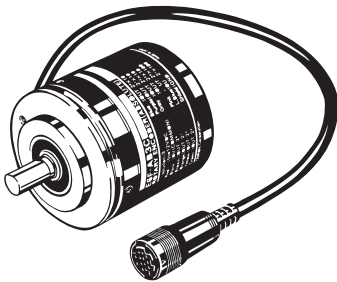


E69-C10B Coupling is included.

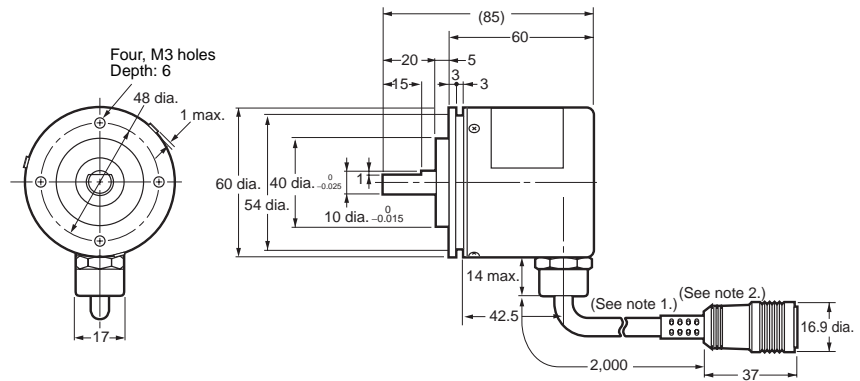


**Note:** 6-dia. 12-conductor oil-resistant PVC insulated shielded cable, (conductor cross-sectional area: 0.2 mm<sup>2</sup>; insulator diameter: 1.1 mm dia.), standard length of 2 m

E6F-AB3C-C  
E6F-AG5C-C



E69-C10B Coupling is sold separately.



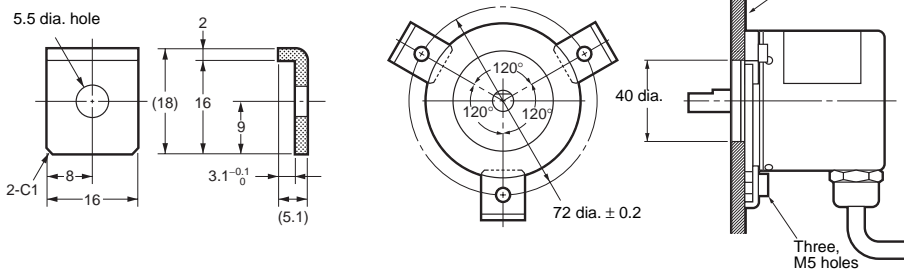
**Note 1.** 6-dia. 12-conductor oil-resistant PVC insulated shielded cable, (conductor cross-sectional area: 0.2 mm<sup>2</sup>; insulator diameter: 1.1 mm dia.), standard length of 2 m  
**2.** Connector for H8PR Rotary Positioner and H8PS Cam Positioner.

## Accessories (Order Separately)

### Servo Mounting Bracket

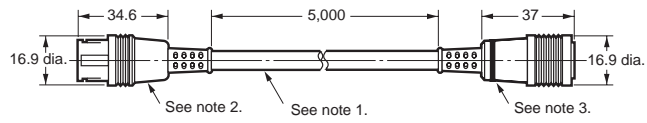
E69-2 (Included with Encoder)

When Mounted



## Extension Cable

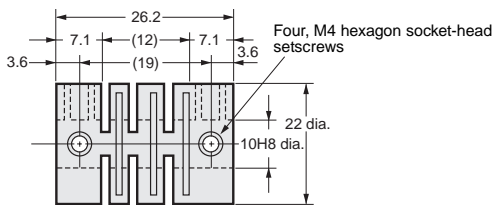
### E69-DF5



- Note:**
1. 6-dia. 12-conductor shielded cable (cross-sectional area: 0.2 mm<sup>2</sup>; insulator diameter: 1.1 mm dia.), standard length of 5 m
  2. Connect to the E6F-AB3C-C or E6F-AG5C-C Connector.
  3. Connect to the H8PR Rotary Positioner or H8PS Cam Positioner.
  4. The cable length can be extended to up to 30 m between the H8PR and E6F-AB3C-C and up to 100 m between the H8PS and E6F-AG5C-C (including accessory cable). Cables of 10 m, 15 m, 20 m, and 98 m are also available in addition to the E69-DF5 (5 m).

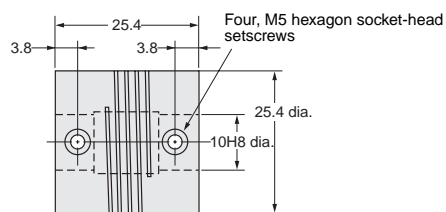
## Couplings

### E69-C10B



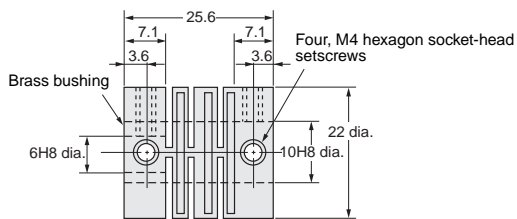
Material: Glass-reinforced PBT

### E69-C10M



Material: Extra-super duralumin

### E69-C610B (Different End Diameter)



Material: Glass-reinforced PBT

## **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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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 product.

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 document.
- 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 PRODUCT IS PROPERLY RATED AND INSTALLED FOR THE INTENDED USE WITHIN THE OVERALL EQUIPMENT OR SYSTEM.

## **PERFORMANCE DATA**

Performance data given in this document 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.

## **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 product 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.

## **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.

## **PROGRAMMABLE PRODUCTS**

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

**ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.**

To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Cat. No. E283-E1-02

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

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