


# E6F-A

## Rugged Rotary Encoder

- Absolute model.
- External diameter of 60 mm.
- Resolution of up to 1,024 (10-bit).
- IP65 oil-proof protection.
- Strong shaft.  
Radial: 120 N, Thrust: 50 N



 Be sure to read *Safety Precautions* on page 5.

## Ordering Information

**Encoders** [Refer to *Dimensions* on page 6.]

Power supply voltage	Output configuration	Output code	Resolution (divisions)	Connection method	Model
5 to 12 VDC	NPN open collector	BCD	360	Pre-wired Model	<b>E6F-AB3C 360P/R 2M *2</b>
				Pre-wired Connector Model (2 m)	<b>E6F-AB3C-C 360P/R 2M *2</b>
				Pre-wired Model	<b>E6F-AB5C 360P/R 2M</b>
				Pre-wired Connector Model (2 m)	<b>E6F-AB5C-C 360P/R 2M</b>
12 to 24 VDC	PNP open collector	Gray code	256, 360, 720	Pre-wired Model	<b>E6F-AB5B 360P/R 2M</b>
	NPN open collector			Pre-wired Connector Model (2 m)	<b>E6F-AG5C-C (resolution) 2M *1</b> Example: E6F-AG5C-C 256P/R 2M
	PNP open collector		256, 360, 720, 1,024	Pre-wired Model	<b>E6F-AG5C (resolution) 2M</b> Example: E6F-AG5C 256P/R 2M
			<b>E6F-AG5B (resolution) 2M</b> Example: E6F-AG5B 256P/R 2M		

\*1. The E6F-AG5C-C is designed for connection to Cam Positioners (H8PS).

\*2. Models are also available with 5-m and 10-m cables.

## Accessories (Order Separately)

[Dimensions: Refer to *Accessories* for coupling dimensions and to page 6 for the dimensions of other accessories.]

Name	Model	Remarks
Couplings	<b>E69-C10B</b>	Provided with E6F Pre-wired Models.
	<b>E69-C610B</b>	Different end diameter
	<b>E69-C10M</b>	Metal construction
Servo Mounting Bracket	<b>E69-2</b>	Provided with the product. (Three brackets in a set.)
Extension Cable	<b>E69-DF5</b>	5 m
	<b>E69-DF10</b>	10 m
	<b>E69-DF20</b>	20 m
Models are also available with 15-m and 98-m cables.		

Refer to *Accessories* for details.

## Ratings and Specifications

Item	Model	E6F-AB3C-C	E6F-AB3C	E6F-AB5C-C	E6F-AB5C	E6F-AB5B	E6F-AG5C-C	E6F-AG5C	E6F-AG5B	
Power supply voltage		5 VDC -5% to 12 VDC +10%, ripple (p-p): 5% max.		12 VDC -10% to 24 VDC +15%, ripple (p-p): 5% max.						
Current consumption*1		60 mA max.								
Resolution (pulses/rotation)*2		360					256, 360, 720		256, 360, 720, 1024	
Output code		BCD					Gray code			
Output configuration		NPN open-collector output				PNP open-collector output	NPN open-collector output		PNP open-collector output	
Output capacity		Applied voltage: 30 VDC max. Sink current: 35 mA max. Residual voltage: 0.4 V max. (at sink current of 35 mA)				Source current: 35 mA max. Residual voltage: 0.4 V max. (at source current of 35 mA)	Applied voltage: 30 VDC max. Sink current: 35 mA max. Residual voltage: 0.4 V max. (at sink current of 35 mA)		Source current: 35 mA max. Residual voltage: 0.4 V max. (at source current of 35 mA)	
Maximum response frequency*3		10 kHz					20 kHz			
Logic		Negative logic (high = 0, low = 1)				Positive logic (high = 1, low = 0)	Negative logic (high = 0, low = 1)		Positive logic (high = 1, low = 0)	
Direction of rotation		Output code incremented by CW (as viewed from the end of the shaft)								
Rise and fall times of output		1 μs max. (E6F-AB3C, A□5C: Load voltage: 5 V, Load resistance: 1 kΩ, Output cable: 2 m max.; E6F-A□5B: Power supply voltage: 12 V, Load resistance: 1 kΩ, Output cable: 2 m max.)								
Starting torque		9.8 mN·m max. at room temperature, 14.7 mN·m max. at low temperature								
Moment of inertia		1.5 × 10 <sup>-6</sup> kg·m <sup>2</sup> max.								
Shaft loading	Radial	120 N								
	Thrust	50 N								
Maximum permissible speed		5000 r/min								
Ambient temperature range		Operating: -10 to 70°C (with no icing), Storage: -25 to 80°C (with no icing)								
Ambient humidity range		Operating: 35% to 85% (with no condensation), Storage: 35% to 95% (with no condensation)								
Insulation resistance		20 MΩ min. (at 500 VDC) between current-carrying parts and case								
Dielectric strength		500 VAC, 50/60 Hz for 1 min between current-carrying parts and case								
Vibration resistance		10 to 500 Hz, 1.5-mm double amplitude for 11 min 3 times each in X, Y, and Z directions								
Shock resistance		Destruction: 1,000 m/s <sup>2</sup> 3 times each in X, Y, and Z directions								
Degree of protection		IEC 60529 IP65, in-house standards: oilproof								
Connection method		Connector Models (Standard cable length: 2 m)	Pre-wired Models (Standard cable length: 2 m)	Connector Models (Standard cable length: 2 m)	Pre-wired Models (Standard cable length: 2 m)		Connector Models (Standard cable length: 2 m)	Pre-wired Models (Standard cable length: 2 m)		
Material		Case: Zinc alloy, Main unit: Aluminum, Shaft: SUS420J2, Mounting Bracket: Galvanized iron								
Weight (packed state)		Approx. 500 g								
Accessories		Servo Mounting Bracket, Coupling (provided with Pre-wired Models only), Hexagonal wrench (provided with Pre-wired Models only), Instruction manual								

\*1. An inrush current of approximately 9 A will flow for approximately 5 μs when the power is turned ON.

\*2. The code is as follows:

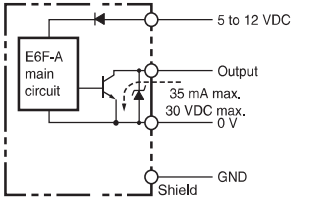
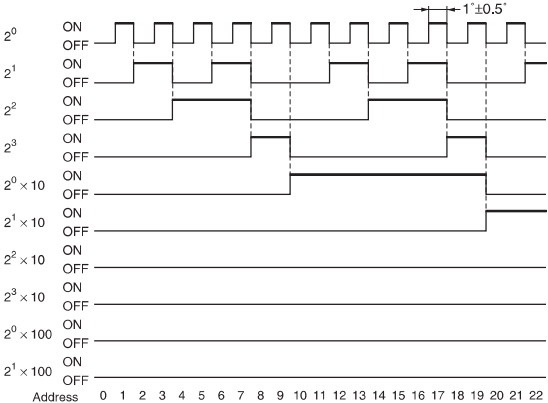
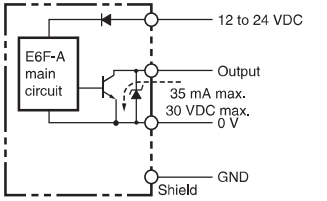
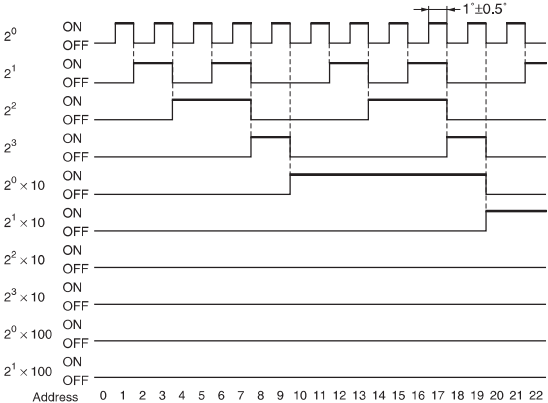
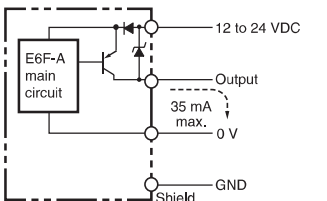
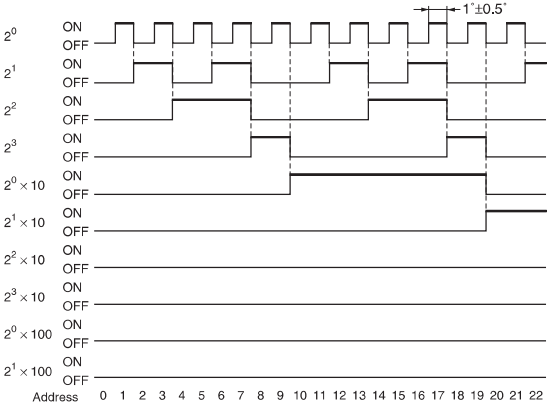
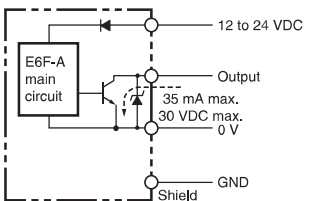
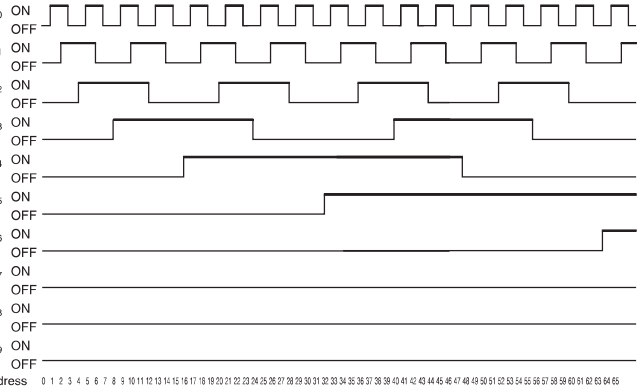
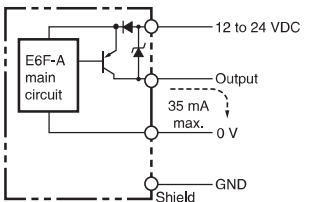
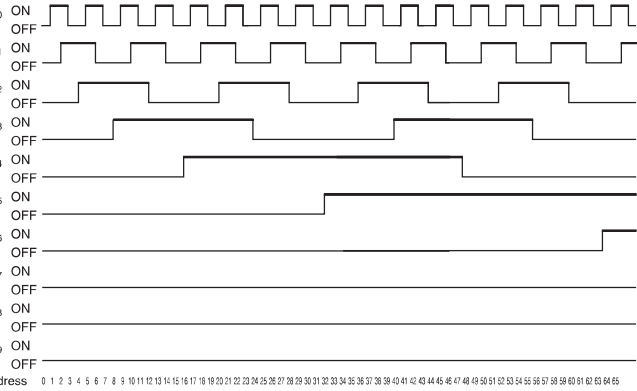
Output code	Resolution	Code No.
BCD	360	0 to 359
	256	0 to 255
Gray code	360	76 to 435 (gray after 76)
	720	152 to 871 (gray after 152)
	1024	0 to 1023

\*3. The maximum electrical response speed is determined by the resolution and maximum response frequency as follows:

$$\text{Maximum electrical response speed (rpm)} = \frac{\text{Maximum response frequency}}{\text{Resolution}} \times 60$$

\* This means that the Rotary Encoder will not operate electrically if its speed exceeds the maximum electrical response speed.

I/O Circuit Diagrams

Model	Output Circuits	Output mode
<p><b>E6F-AB3C</b> <b>E6F-AB3C-C</b></p>	 <p>Note: The circuit is the same for all bit outputs. Each E6F-A Rotary Encoder has one main circuit.</p>	<p>Direction of rotation: CW (as viewed from end of shaft)</p> 
<p><b>E6F-AB5C</b> <b>E6F-AB5C-C</b></p>	 <p>Note: The circuit is the same for all bit outputs. Each E6F-A Rotary Encoder has one main circuit.</p>	<p>Direction of rotation: CW (as viewed from end of shaft)</p> 
<p><b>E6F-AB5B</b></p>	 <p>Note: The circuit is the same for all bit outputs. Each E6F-A Rotary Encoder has one main circuit.</p>	<p>Direction of rotation: CW (as viewed from end of shaft)</p> 
<p><b>E6F-AG5C</b> <b>E6F-AG5C-C</b></p>	 <p>Note: The circuit is the same for all bit outputs. Each E6F-A Rotary Encoder has one main circuit.</p>	<p>Direction of rotation: CW (as viewed from end of shaft)</p> <p>Output transistor</p> 
<p><b>E6F-AG5B</b></p>	 <p>Note: The circuit is the same for all bit outputs. Each E6F-A Rotary Encoder has one main circuit.</p>	<p>Direction of rotation: CW (as viewed from end of shaft)</p> <p>Output transistor</p> 

## Connection Specifications

### Connector Models\*

Model	E6F-AB3C-C/ -AB5C-C		E6F-AG5C-C	
	Output signal		Output signal	
	10-bit (360)	8-bit (256)	9-bit (360)	10-bit (720)
1	2 <sup>0</sup>	Connected internally	Not connected	2 <sup>9</sup>
2	2 <sup>1</sup>		2 <sup>8</sup>	2 <sup>8</sup>
3	2 <sup>2</sup>	2 <sup>5</sup>	2 <sup>5</sup>	2 <sup>5</sup>
4	2 <sup>3</sup>	2 <sup>1</sup>	2 <sup>1</sup>	2 <sup>1</sup>
5	2 <sup>0</sup> × 10	2 <sup>0</sup>	2 <sup>0</sup>	2 <sup>0</sup>
6	2 <sup>1</sup> × 10	2 <sup>7</sup>	2 <sup>7</sup>	2 <sup>7</sup>
7	2 <sup>2</sup> × 10	2 <sup>4</sup>	2 <sup>4</sup>	2 <sup>4</sup>
8	2 <sup>3</sup> × 10	2 <sup>2</sup>	2 <sup>2</sup>	2 <sup>2</sup>
9	2 <sup>9</sup> × 100	2 <sup>3</sup>	2 <sup>3</sup>	2 <sup>3</sup>
10	2 <sup>1</sup> × 100	2 <sup>6</sup>	2 <sup>6</sup>	2 <sup>6</sup>
11	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)	

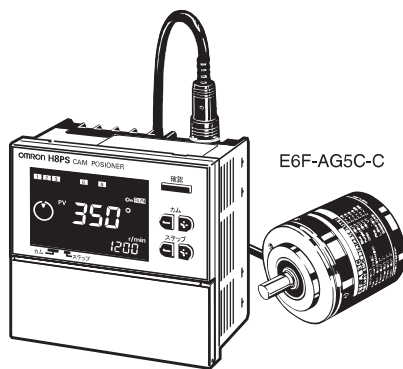
\* Connector: RP13A-12PD-13SC (Hirose Electric Co., Ltd.)  
Note: Normally connect GND to 0 V or to an external ground.

### Pre-wired Model

Model	E6F-AB3C/ -AB5C/-AB5B		E6F-AG5C/-AG5B	
	Output signal		Output signal	
	10-bit (360)	8-bit (256)	9-bit (360)	10-bit (720,1024)
Brown	2 <sup>0</sup>	2 <sup>0</sup>	2 <sup>0</sup>	2 <sup>0</sup>
Orange	2 <sup>1</sup>	2 <sup>1</sup>	2 <sup>1</sup>	2 <sup>1</sup>
Yellow	2 <sup>2</sup>	2 <sup>2</sup>	2 <sup>2</sup>	2 <sup>2</sup>
Green	2 <sup>3</sup>	2 <sup>3</sup>	2 <sup>3</sup>	2 <sup>3</sup>
Blue	2 <sup>0</sup> × 10	2 <sup>4</sup>	2 <sup>4</sup>	2 <sup>4</sup>
Purple	2 <sup>1</sup> × 10	2 <sup>5</sup>	2 <sup>5</sup>	2 <sup>5</sup>
Gray	2 <sup>2</sup> × 10	2 <sup>6</sup>	2 <sup>6</sup>	2 <sup>6</sup>
White	2 <sup>3</sup> × 10	2 <sup>7</sup>	2 <sup>7</sup>	2 <sup>7</sup>
Pink	2 <sup>9</sup> × 100	Not connected	2 <sup>8</sup>	2 <sup>8</sup>
Light blue	2 <sup>1</sup> × 100	Not connected	Not connected	2 <sup>9</sup>
---	Shield (ground)		Shield (ground)	
Red	-AB3C: 5 to 12 VDC, -AB5C: 12 to 24 VDC		12 to 24 VDC	
Black	0 V (common)		0 V (common)	

## Connection Example

### H8PS Cam Positioner Connection



### Ordering Information

Model
H8PS-8A
H8PS-8AP
H8PS-8AF
H8PS-8AFP
H8PS-16A
H8PS-16AP
H8PS-16AF
H8PS-16AFP
H8PS-32A
H8PS-32AP
H8PS-32AF
H8PS-32AFP

### Specifications

Rated voltage	24 VDC
Cam precision	0.5° (for 720 resolution), 1° (for 256/360 resolution)
No. of output points	8-point output type: 8 cam outputs, 1 RUN output, 1 pulse output 16-point output type: 16 cam outputs, 1 RUN output, 1 pulse output 32-point output type: 32 cam outputs, 1 RUN output, 1 pulse output
Encoder response	RUN mode, test mode: 256/360 resolution ... 1,600 r/min max. (1,200 r/min when advance compensation is set for four cams or more) 720 resolution ..... 800 r/min max. (600 r/min when advance compensation is set for four cams or more)
Additional functions	<ul style="list-style-type: none"> <li>• Origin compensation (zeroing)</li> <li>• Rotation direction switching</li> <li>• Angle display switching</li> <li>• Teaching</li> <li>• Pulse output</li> <li>• Angle/number of rotations display switching</li> <li>• Puncture *</li> <li>• Angle advance</li> <li>• Number of rotations alarm output</li> <li>• Setting with support software (order separately) *</li> </ul>

Note: For 16-point and 32-point output types only

### Programmable Controller Connection

Connection is possible with the CQM1H-CPU51 and CQM1H-ABB21.

For details, refer to *Connection to Peripheral Devices*.

Refer to the *CQM1H Programmable Controller Catalog (P050)* for details on the CQM1H Programmable Controller.

## Safety Precautions

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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 the Encoder under ambient conditions that exceed the ratings.

● **Adjustment**

**Reading the Output Code**

Read the code after the LSB (output  $2^0$ ) of the code changes for the E6F-AB3C and E6F-AB3C-C.

● **Wiring**

Spurious pulses may be generated when power is turned ON and OFF. Wait at least 0.1 s after turning ON the power to the Encoder before using the connected device, and stop using the connected device at least 0.1 s before turning OFF the power to the Encoder. Also, turn ON the power to the load only after turning ON the power to the Encoder.

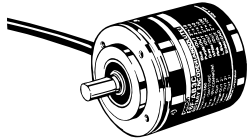
(Unit: mm)

## Dimensions

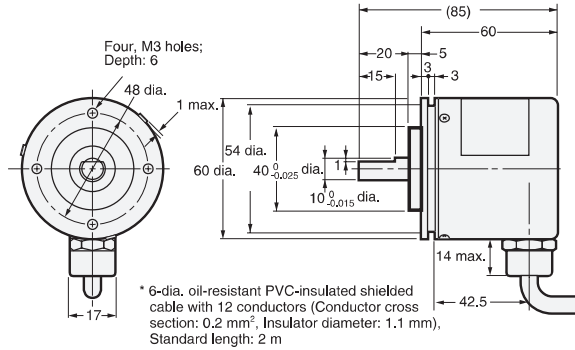
Tolerance class IT16 applies to dimensions in this datasheet unless otherwise specified.

### Encoder

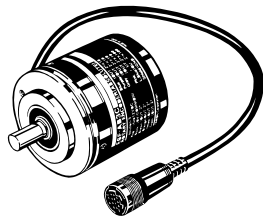
E6F-AB3C  
E6F-AB5C  
E6F-AG5C  
E6F-AG5B  
E6F-AB5B



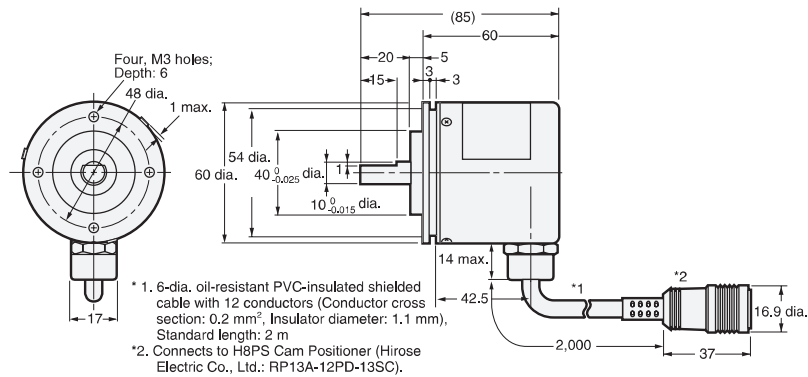
The E69-C10B Coupling is provided.



E6F-AB3C-C  
E6F-AB5C-C  
E6F-AG5C-C



The E69-C10B Coupling is sold separately.

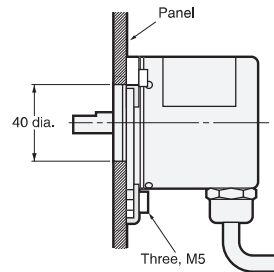
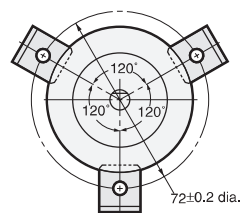
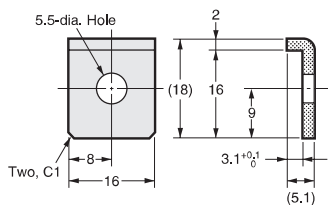


### Accessories (Order Separately)

#### Servo Mounting Bracket

E69-2

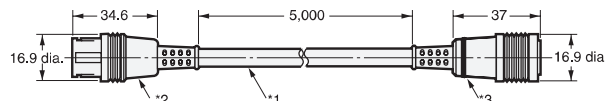
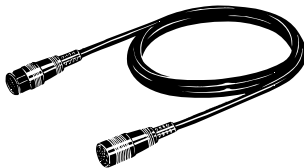
Mounting Bracket Installation



Note: Provided with the product.

#### Extension Cable

E69-DF5



\*1. 6-dia. shielded cable with 12 conductors (Conductor cross section: 0.2 mm<sup>2</sup>, Insulator diameter: 1.1 mm), Standard length: 5 m  
\*2. Connects to connector on E6F-AB<sub>3/5</sub>C-C or E6F-AG5C-C.  
\*3. Connects to H8PS Cam Positioner.

Note: 1. The E69-DF5 (5 m) is also available with the following cable lengths: 10 m, 15 m, 20 m, and 98 m.  
2. Cable can be extended to 100 m when the H8PS Cam Positioner is connected.

#### Couplings

E69-C10B  
E69-C610B  
E69-C10M

Refer to *Accessories* for details.

# Terms and Conditions of Sale

1. **Offer; Acceptance.** These terms and conditions (these "Terms") are deemed part of all quotes, agreements, purchase orders, acknowledgments, price lists, catalogs, manuals, brochures and other documents, whether electronic or in writing, relating to the sale of products or services (collectively, the "Products") by Omron Electronics LLC and its subsidiary companies ("Omron"). Omron objects to any terms or conditions proposed in Buyer's purchase order or other documents which are inconsistent with, or in addition to, these Terms.
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3. **Discounts.** Cash discounts, if any, will apply only on the net amount of invoices sent to Buyer after deducting transportation charges, taxes and duties, and will be allowed only if (i) the invoice is paid according to Omron's payment terms and (ii) Buyer has no past due amounts.
4. **Interest.** Omron, at its option, may charge Buyer 1-1/2% interest per month or the maximum legal rate, whichever is less, on any balance not paid within the stated terms.
5. **Orders.** Omron will accept no order less than \$200 net billing.
6. **Governmental Approvals.** Buyer shall be responsible for, and shall bear all costs involved in, obtaining any government approvals required for the importation or sale of the Products.
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  - b. Such carrier shall act as the agent of Buyer and delivery to such carrier shall constitute delivery to Buyer;
  - c. All sales and shipments of Products shall be FOB shipping point (unless otherwise stated in writing by Omron), at which point title and risk of loss shall pass from Omron to Buyer; provided that Omron shall retain a security interest in the Products until the full purchase price is paid;
  - d. Delivery and shipping dates are estimates only; and
  - e. Omron will package Products as it deems proper for protection against normal handling and extra charges apply to special conditions.
12. **Claims.** Any claim by Buyer against Omron for shortage or damage to the Products occurring before delivery to the carrier must be presented in writing to Omron within 30 days of receipt of shipment and include the original transportation bill signed by the carrier noting that the carrier received the Products from Omron in the condition claimed.
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17. **Export Controls.** Buyer shall comply with all applicable laws, regulations and licenses regarding (i) export of products or information; (ii) sale of products to "forbidden" or other proscribed persons; and (iii) disclosure to non-citizens of regulated technology or information.
18. **Miscellaneous.** (a) **Waiver.** No failure or delay by Omron in exercising any right and no course of dealing between Buyer and Omron shall operate as a waiver of rights by Omron. (b) **Assignment.** Buyer may not assign its rights hereunder without Omron's written consent. (c) **Law.** These Terms are governed by the law of the jurisdiction of the home office of the Omron company from which Buyer is purchasing the Products (without regard to conflict of law principles). (d) **Amendment.** These Terms constitute the entire agreement between Buyer and Omron relating to the Products, and no provision may be changed or waived unless in writing signed by the parties. (e) **Severability.** If any provision hereof is rendered ineffective or invalid, such provision shall not invalidate any other provision. (f) **Setoff.** Buyer shall have no right to set off any amounts against the amount owing in respect of this invoice. (g) **Definitions.** As used herein, "including" means "including without limitation"; and "Omron Companies" (or similar words) mean Omron Corporation and any direct or indirect subsidiary or affiliate thereof.

## Certain Precautions on Specifications and Use

1. **Suitability of Use.** Omron Companies shall not be responsible for conformity with any standards, codes or regulations which apply to the combination of the Product in the Buyer's application or use of the Product. At Buyer's request, Omron will provide applicable third party certification documents identifying ratings and limitations of use which apply to the Product. This information by itself is not sufficient for a complete determination of the suitability of the Product in combination with the end product, machine, system, or other application or use. Buyer shall be solely responsible for determining appropriateness of the particular Product with respect to Buyer's application, product or system. Buyer shall take application responsibility in all cases but the following is a non-exhaustive list of applications for which particular attention must be given:
  - (i) Outdoor use, uses involving potential chemical contamination or electrical interference, or conditions or uses not described in this document.
  - (ii) Use in consumer products or any use in significant quantities.
  - (iii) 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.
  - (iv) Systems, machines and equipment that could present a risk to life or property. Please know and observe all prohibitions of use applicable to this Product.
 NEVER USE THE PRODUCT FOR AN APPLICATION INVOLVING SERIOUS RISK TO LIFE OR PROPERTY OR IN LARGE QUANTITIES WITHOUT ENSURING THAT THE SYSTEM AS A WHOLE HAS BEEN DESIGNED TO ADDRESS THE RISKS, AND THAT THE OMRON'S PRODUCT IS PROPERLY RATED AND INSTALLED FOR THE INTENDED USE WITHIN THE OVERALL EQUIPMENT OR SYSTEM.
2. **Programmable Products.** Omron Companies shall not be responsible for the user's programming of a programmable Product, or any consequence thereof.
3. **Performance Data.** Data presented in Omron Company websites, catalogs and other materials 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 user must correlate it to actual application requirements. Actual performance is subject to the Omron's Warranty and Limitations of Liability.
4. **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 part 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 part numbers may be assigned to fix or establish key specifications for your application. Please consult with your Omron's representative at any time to confirm actual specifications of purchased Product.
5. **Errors and Omissions.** Information presented by Omron Companies has been checked and is believed to be accurate; however, no responsibility is assumed for clerical, typographical or proofreading errors or omissions.



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**OMRON CANADA, INC. • HEAD OFFICE**

Toronto, ON, Canada • 416.286.6465 • 866.986.6766  
[www.omron247.com](http://www.omron247.com)

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São Paulo, SP, Brasil • 55.11.2101.6300 • [www.omron.com.br](http://www.omron.com.br)

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**OMRON EUROPE B.V.** Wegalaan 67-69, NL-2132 JD, Hoofddorp, The Netherlands. Tel: +31 (0) 23 568 13 00 Fax: +31 (0) 23 568 13 88 [www.industrial.omron.eu](http://www.industrial.omron.eu)