

# Digital Temperature Controller E5GN

## Compact, Intelligent Temperature Controllers

- 1/32 DIN sized controller saves panel space, measures just 100 mm deep.
- Accepts thermocouple, platinum RTD, non-contact temperature sensor, and analog temperature inputs.
- Auto-tuning and self-tuning available; functions can be used simultaneously.
- Heating or heating/cooling control.
- Water-resistant construction (NEMA 4X, equivalent to IP66).
- Conforms to UL, CSA, and IEC safety standards as well as CE marking.
- 3-year warranty.



## Ordering Information

Optional communications and event input boards are shown on the following page.

### ■ Standard Temperature Controllers

**Stock Note:** Shaded models are normally stocked.

Size	Power supply voltage	Alarm points	Output	Model	
				Thermocouple input	Platinum RTD input
1/32 DIN 48(W) x 24 (H) x 100(D) mm	100 to 240 VAC	---	Relay	E5GN-RTC AC100-240	E5GN-RP AC100-240
			Voltage (for driving SSR)	E5GN-QTC AC100-240	E5GN-QP AC100-240
		1 (See Note 1)	Relay	E5GN-R1TC AC100-240	E5GN-R1P AC100-240
			Voltage (for driving SSR)	E5GN-Q1TC AC100-240	E5GN-Q1P AC100-240
	24 V AC/DC	---	Relay	E5GN-RTC AC/DC24	E5GN-RP AC/DC24
			Voltage (for driving SSR)	E5GN-QTC AC/DC24	E5GN-QP AC/DC24
1 (See Note 1)	---	Relay	E5GN-R1TC AC/DC24	E5GN-R1P AC/DC24	
		Voltage (for driving SSR)	E5GN-Q1TC AC/DC24	E5GN-Q1P AC/DC24	

- Note: 1. If the heating/cooling function is used, ALM1 will be used for control output; the alarm output will not be available.  
 2. Control output 2 for heating/cooling control is a relay output.

### ■ Temperature Controllers With Communications

**Stock Note:** Shaded models are normally stocked.

Size	Power supply voltage	Communication type	Output	Model	
				Thermocouple input	Platinum RTD input
1/32 DIN 48(W) x 24 (H) x 100(D) mm	100 to 240 VAC	RS-485	Relay	E5GN-R03TC-FLK AC100-240	E5GN-R03P-FLK AC100-240
			Voltage (for driving SSR)	E5GN-Q03TC-FLK AC100-240	E5GN-Q03P-FLK AC100-240
	24 V AC/DC		Relay	E5GN-R03TC-FLK AC/DC24	E5GN-R03P-FLK AC/DC24
			Voltage (for driving SSR)	E5GN-Q03TC-FLK AC/DC24	E5GN-Q03P-FLK AC/DC24

# Specifications

## ■ Ratings

<b>Supply voltage</b>		100 to 240 VAC, 50/60 Hz	24 VAC, 50/60 Hz/24 VDC
<b>Operating voltage range</b>		85% to 110% of rated supply voltage	
<b>Power consumption</b>		7 VA	4 VA/2.5 W
<b>Sensor input</b>		Thermocouple: K, J, T, E, L, U, N, R, S, B Platinum resistance thermometer: Pt100, JPt100 Non-contact temperature sensor: 10 to 70°C, 60 to 120°C, 115 to 165°C, 160 to 260°C Voltage input: 0 to 50 mV	
<b>Control output</b>	<b>Relay output</b>	SPST-NO, 250 VAC, 2 A (resistive load), electrical life: 100,000 operations	
	<b>Voltage output</b>	12 VDC <sup>+15%</sup> / <sub>-20%</sub> (PNP), max. load current: 21 mA, with short-circuit protection circuit	
<b>Alarm output</b>		SPST-NO, 250 VAC, 1 A (resistive load), electrical life: 100,000 operations	
<b>Control method</b>		PID or ON/OFF control	
<b>Setting method</b>		Digital setting using front panel keys	
<b>Indication method</b>		7-segment digital display and single-lighting indicator Character height: PV: 7.0 mm; SV: 3.5 mm	
<b>Ambient operating temperature</b>		-10°C to 55°C (14°F to 131°F) with no condensation or icing	
<b>Storage temperature</b>		-25°C to 65°C (-13°F to 149°F) with no condensation or icing	
<b>Ambient humidity</b>		25% to 85% RH	

## ■ Characteristics

<b>Indication accuracy</b>	Thermocouple: ±0.5% of indicated value or ±1°C, whichever greater, ±1 digit max. (See Note) Platinum resistance thermometer: ±0.5% of indicated value or ±1°C, whichever greater, ±1 digit max. Analog input: ±0.5% FS±1 digit max. CT input: ±5% FS±1 digit max.		
<b>Hysteresis</b>	0.1 to 999.9 EU (in units of 0.1 EU)		
<b>Proportional band (P)</b>	0.1 to 999.9 EU (in units of 0.1 EU)		
<b>Integral time (I)</b>	0 to 3999 s (in units of 1 s)		
<b>Derivative time (D)</b>	0 to 3999 s (in units of 1 s)		
<b>Control period</b>	1 to 99 s (in units of 1 s)		
<b>Manual reset value</b>	0.0% to 100.0% (in units of 0.1%)		
<b>Alarm setting range</b>	-1999 to 9999 (decimal point position depends on input type)		
<b>Sampling period</b>	500 ms		
<b>Insulation resistance</b>	20 MΩ min. at 500 VDC		
<b>Dielectric strength</b>	2000 VAC, 50 or 60 Hz for 1 min between different charging terminals		
<b>Vibration resistance</b>	10 to 55 Hz, 10 m/s <sup>2</sup> for 2 hours each in X, Y and Z directions		
<b>Shock resistance</b>	300 m/s <sup>2</sup> , 3 times each in 3 axes, 6 directions (relay: 100 m/s <sup>2</sup> )		
<b>Weight</b>	Approx. 90 g; mounting bracket: Approx. 10 g		
<b>Protective structure</b>	Front panel: NEMA4X for indoor use (equivalent to IP66), rear case: IP20, terminals: IP00		
<b>Memory protection</b>	EEPROM non-volatile memory (number of writes: 100,000)		
<b>EMC</b>	Emission Enclosure:	EN55011 Group 1 class A	
	Emission AC Mains:	EN55011 Group 1 class A	
	Immunity ESD:	EN61000-4-2:	4 kV contact discharge (level 2) 8 kV air discharge (level 3)
	Immunity RF-interference:	ENV50140:	10 V/m (amplitude modulated, 80 MHz to 1 GHz) (level 3) 10 V/m (pulse modulated, 900 MHz)
	Immunity Conducted Disturbance:	ENV50141:	10 V (0.15 to 80 MHz) (level 3)
	Immunity Burst:	EN61000-4-4:	2 kV power-line (level 3) 2 kV I/O signal-line (level 4)
<b>Approved standards</b>	UL3121-1, CSA22.2 No. 14, E.B.1402C Conforms to EN50081-2, EN50082-2, EN61010-1 (IEC61010-1)		

**Note:** The indication of K thermocouples in the -200 to 1300°C range, and T and N thermocouples at a temperature of -100°C or less, and U and L thermocouples at any temperature is ±2°C±1 digit maximum. The indication of B thermocouples at a temperature of 400°C or less is unrestricted.  
The indication of R and S thermocouples at a temperature of 200°C or less is ±3°C±1 digit maximum.

## ■ Communications Specifications

Transmission path connection	Multiple points
Communications method (See Note)	RS-485 (two-wire, half duplex)
Synchronization method	Start-stop synchronization
Baud rate	1,200/2,400/4,800/9,600/19,200 bps
Transmission code	ASCII
Data bit length (See Note)	7 or 8 bits
Stop bit length (See Note)	1 or 2 bits
Error detection	Vertical parity (none, even, odd) Frame check sequence (FCS): with SYSMAC WAY Block check character (BCC): with CompoWay/F
Flow control	Not available
Interface (See Note)	RS-485
Retry function	Not available
Communications buffer	40 bytes

Note: The baud rate, data bit length, stop bit length, or vertical parity can be individually set using the communications setting level.

### Input Types (selectable with input jumper connector)

#### Thermocouple

Input (field selectable) (See Notes)	K1	K2	J1	J2	T1	T2	E	L	U1	U2	
Set value	0	1	2	3	4	17	5	6	7	18	
Range	°C	-200 to 1,300	-20.0 to 500.0	-100 to 850	-20.0 to 400.0	-200 to 400	-199.9 to 400.0	0 to 600	-100 to 850	-200 to 400	-199.9 to 400.0
	°F	-300 to 2,300	0.0 to 900.0	-100 to 1,500	0.0 to 750.0	-300 to 700	-199.9 to 700.0	0 to 1,100	-100 to 1,500	-300 to 700	-199.9 to 700

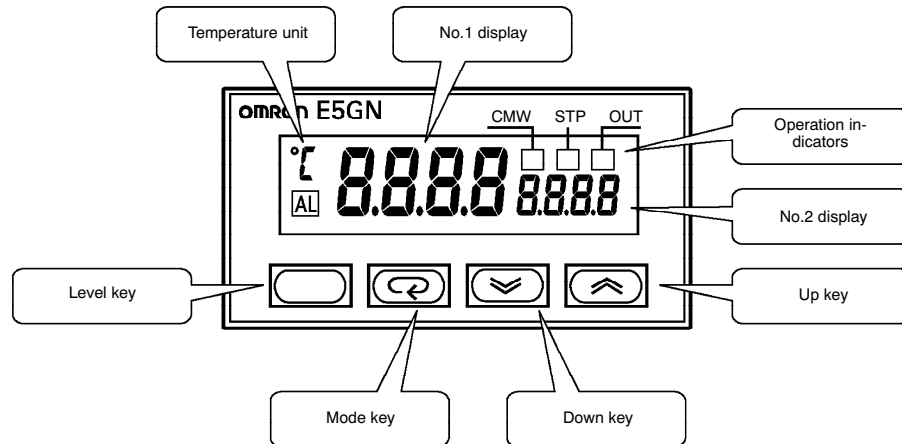
Input (field selectable) (See Notes)	N	R	S	B	K10 to 70°C	K60 to 120°C	K115 to 165°C	K160 to 260°C	0 to 50 mV	
Set value	8	9	10	11	12	13	14	15	16	
Range	°C	-200 to 1,300	0 to 1,700	0 to 1,700	100 to 1,800	0 to 90	0 to 120	0 to 165	0 to 260	-1999 to 9999
	°F	-300 to 2,300	0 to 3,000	0 to 3,000	300 to 3,200	0 to 190	0 to 240	0 to 320	0 to 500	-199.9 to 999.9 (scalable)

Note: 1. Setting number is factory-set to 0 (K1).

#### Platinum Resistance Thermometer (RTD's)

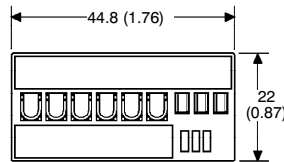
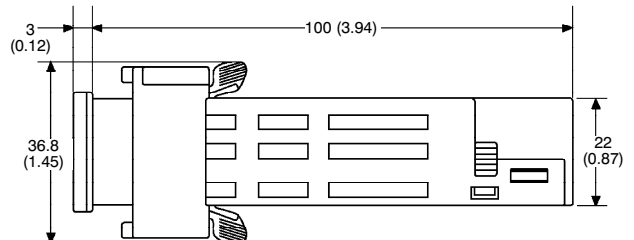
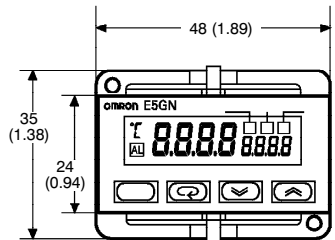
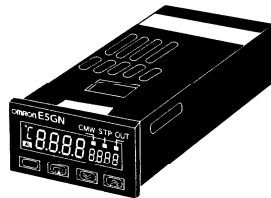
Input (field selectable)	Pt100	Pt100	Pt100	JPt100	JPt100
Set value	0	1	2	3	4
Range °C	-200 to 850	-199.9 to 500.0	0.0 to 100.0	-199.9 to 500.0	0.0 to 100.0
Range °F	-300 to 1500	-199.9 to 900.0	0.0 to 210.0	-199.9 to 900.0	0.0 to 210.0

# Nomenclature



# Dimensions

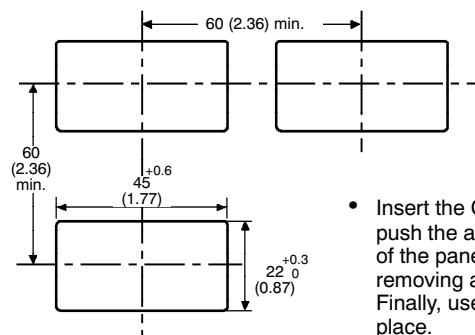
Unit: mm (inch)



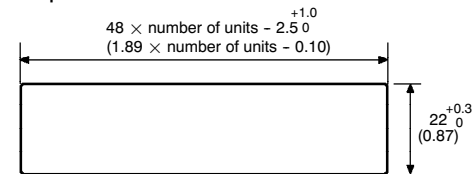
\* When carrying out maintenance on the E5GN, only the terminal plate can be drawn out with the terminal leads still attached.

## Panel Cutout

Mounted Separately



Group Mounted

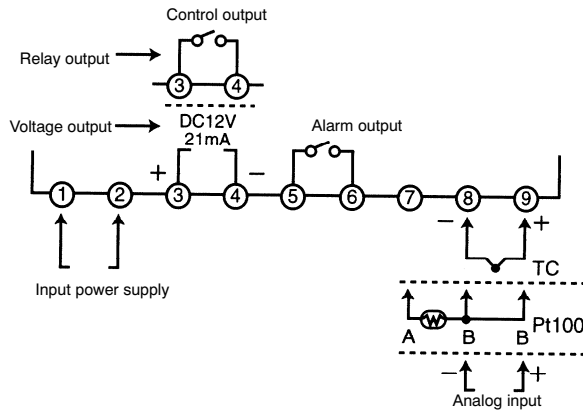


Mounting separately does not allow waterproofing.

- Insert the Controller through the hole in the panel from the front and push the adapter on from the rear. Push the adapter up to the back of the panel ensuring that the controller is pushed all the way in, removing any gap between the Controller, panel, and adapter. Finally, use the two screws on the adapter to secure the unit in place.
- To mount the E5GN so that it is waterproof, insert the waterproof packing onto the E5GN.
- When two or more E5GN Controllers are mounted, make sure that the surrounding temperature does not exceed the allowable operating temperature ranges in the specifications.

# Wiring Terminals

- The voltage output (control output) is not electrically insulated from the internal circuits. When using a grounding thermocouple, do not connect the control output terminals to the ground. If the control output terminals are connected to the ground, errors will occur in the measured temperature values as a result of leakage current.
- Standard insulation is applied to the power supply I/O sections. If reinforced insulation is required, connect the input and output terminals to a device without any exposed current-carrying parts or to a device with standard insulation suitable for the maximum operating voltage of the power supply I/O section.



Two input power supplies are available:  
100 to 240 VAC or 24 VAC/VDC (no polarity).

# Precautions

## ■ General Precautions




The user must operate the product according to the performance specifications described in the operation manuals.

Before using the product under conditions which are not described here or applying the product to nuclear control systems, railroad systems, aviation systems, vehicles, combustion systems, medical equipment, amusement machines, safety equipment, and other systems, machines, and equipment that may have a serious influence on lives and property if used improperly, consult your OMRON representative.










Make sure that the ratings and performance characteristics of the product are sufficient for the systems, machines, and equipment, and be sure to provide the systems, machines, and equipment with double safety mechanisms.


## ■ Safety Precautions


### Definition of Precautionary Information

-  **DANGER** Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.
-  **WARNING** Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
-  **Caution** Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury, or property damage.


### Installation Precautions

-  **WARNING** Do not attempt to take any Temperature Controller apart while the power is applied. Doing so may result in electric shock.
-  **WARNING** Do not touch any of the terminals or terminal blocks while the power is being supplied. Doing so may result in electric shock.
-  **WARNING** Do not allow pieces of metal or wire cuttings to get inside the Temperature Controller. Failure to do so may result in malfunction, electric shock or fire.
-  **WARNING** Do not attempt to disassemble, repair, or modify the Temperature Controller. Any attempt to do so may result in malfunction, fire, or electric shock.
-  **Caution** Do not use the Temperature Controller in locations subject to flammable gases. Doing so may result in an explosion.
-  **Caution** The switching capacity and switching conditions will have a great effect on the longevity of the output relays. Use the Temperature Controller within the rated load and do not use the Temperature Controller beyond the number of operations specified under electrical life. Using the Temperature Controller beyond its electrical life may result in contact welding or burning.
-  **Caution** Do not use the Temperature Controller at loads greater than the rated value. Doing so may result in burning or other damage.
-  **Caution** Use a power supply voltage within the specified range. Failure to do so may result in burning or other damage.
-  **Caution** Tighten the terminal screws to the following torques:  
 E5AN, E5EN, E5CN: 0.74 to 0.90 N•m  
 E5GN: Terminals 1 to 6: 0.23 to 0.25 N•m  
 Terminals 7 to 9: 0.12 to 0.14 N•m  
 Failure to tighten terminal screws to the correct torque may result in fire or malfunction.

 **Caution** Make settings for the Temperature Controller that are suitable for the controlled system. Failure to do so may cause unexpected operation resulting in damage to equipment or personal injury.

 **Caution** Prepare a circuit with an overheating prevention alarm and take other safety measures to ensure safe operation in the event of a malfunction. Loss of operational control due to malfunction may result in a serious accident.

## ■ Operating Environment Precautions

-  **Caution** In order to ensure the safe operation, observe the following precautions.
  - Do not use the Temperature Controller in the following places:
    - Locations exposed to radiated heat from heating devices
    - Locations subject to direct sunlight
    - Locations subject to temperatures or humidity outside the range specified in the specifications
    - Locations subject to condensation as the result of severe changes in temperature
    - Locations subject to corrosive or flammable gases
    - Locations subject to dust (especially iron dust) or salts
    - Locations subject to exposure to water, oil, or chemicals
    - Locations subject to shock or vibration
  - Use and store the Temperature Controller within the rated temperature and humidity specified for each model. When two or more Temperature Controllers are mounted horizontally close to each other or vertically next to one another, the internal temperature will increase due to heat radiated by the Temperature Controllers and the service life will decrease. In such a case, forced cooling by fans or other means of air ventilation will be required to cool down the Temperature Controllers. When providing forced cooling, however, be careful not to cool down the terminal sections alone to avoid measurement errors.
  - Allow enough space around the Temperature Controller to ensure proper heat dissipation. Do not block the ventilating holes.
  - Check polarities and orientation when connecting terminals. Not doing so may result in malfunction.
  - When wiring the E5AN, E5EN, or E5CN, use crimp terminals with the specified dimensions (M3.5, width 7.2 mm max.).
  - When wiring the E5GN, use cables of a thickness AWG24 (0.205 mm<sup>2</sup>) to AWG14 (2.081 mm<sup>2</sup>) for terminals 1 to 6 and use cables of a thickness AWG28 (0.081 mm<sup>2</sup>) to AWG22 (0.326 mm<sup>2</sup>) for terminals 7 to 9. The exposed current-carrying part to be inserted into terminals must be 5 to 6 mm.
  - Do not use empty terminals.
  - To avoid inductive noise, keep the wiring for the Temperature Controller's terminal board away from power cables carry high voltages or large currents. Also, do not wire power lines together with or parallel to Temperature Controller wiring. Using shielded lines to separate pipes and ducts is recommended. Attach surge absorbers or noise filters to peripheral devices that may generate noise, such as inductance devices (e.g., motors, transformers, solenoids, magnetic coils etc.). If using a noise filter with the power supply, in addition to confirming the voltage and the current, mount the power supply as near as possible to the Temperature Controller. Set up the Temperature Controller, along with its power supply, as far away as possible from devices that generate strong, high-frequency waves (high-frequency welders, high-frequency machines etc.) and devices that generate surges.
  - Set up the power supply so that the voltage will reach the rated voltage within 2 seconds after turning ON.
  - Allow at least 30 minutes for the Temperature Controller to warm up.
  - When using auto-tuning, turn ON power for the load (e.g., heater) at the same time as or before supplying power to the Temperature Controller. If power is turned ON for the Temperature

Controller before turning ON power for the load, auto-tuning will not be performed properly and optimum control will not be achieved.

- In order that power can be turned OFF in an emergency by the person operating the Temperature Controller, install the appropriate switches and circuit breakers and label them accordingly.
- With the E5AN, E5EN, or E5CN, when drawing out the Temperature Controller body, do not touch or apply excessive force. After the body is drawn out do not touch the terminals or electronic parts. When inserting, make sure that electronic parts do not come in contact with the case.
- When the terminal block for the E5GN is detached, do not touch or apply excessive force to any electronic parts.
- Use alcohol to clean the Temperature Controller. Do not use thinner or other solvent-based substances.

## Correct Use

### Service Life

Use the Temperature Controller within the following temperature and humidity ranges:

Temperature: -10°C to 55°C (with no icing or condensation)

Humidity: 25% to 85%

When the Temperature Controller is installed inside a control panel, ensure that the temperature around the Temperature Controller, not the temperature around the control panel, does not exceed 55°C.

The service life of relays used for the control output or alarm output largely varies depending on switching conditions. Be sure to confirm their performance under actual operating conditions and do not use them beyond the allowable number of switching operations. If they are used in a deteriorated condition, insulation between circuits may be damaged and, as a result, the Temperature Controller itself may be damaged or burnt.

The service life of electronic devices such as Temperature Controllers is determined not only by the number of switching operations of relays but also by the service life of internal electronic components. Component service life is affected by the ambient temperature: the higher the temperature becomes, the shorter the service life becomes and, the lower the temperature becomes, the longer the service life becomes. Therefore, the service life can be extended by lowering the temperature of the Temperature Controller using fans or other means of air ventilation. When providing forced cooling, however, be careful not to cool down the terminals sections alone to avoid measurement errors.

### Measurement Accuracy

When extending or connecting the thermocouple lead wire, be sure to use compensating wires that match the thermocouple types.

When extending or connecting the lead wire of the platinum resistance thermometer, be sure to use wires that have low resistance.

When wiring the platinum resistance thermometer to the Temperature Controller, keep the wire route as short as possible. Separate this wiring away from the power supply wiring and load wiring to avoid inductive or other forms of noise.

Mount the Temperature Controller so that it is horizontally level.

### Waterproofing

The degree of protection is as shown below. Sections without any specification on their degree of protection or those with IP□□ have

not been waterproofed.

Front panel: NEMA 4X indoor use (equivalent to IP66)

Rear case: IP20

Terminal section: IP00

### Operating Precautions

It takes approximately four seconds for the outputs to turn ON from the moment the power is turned ON. Due consideration must be given to this time when incorporating Temperature Controllers in a sequence circuit.

When using auto-tuning, supply power to the load (e.g., heater) at the same time as or before supplying power to the Temperature Controller. If power is turned ON for the Temperature Controller before turning ON power for the load, auto-tuning will not be performed properly and optimum control will not be achieved.

When starting operation after the Temperature Controller has warmed up, turn OFF the power and then turn it ON again at the same time as turning ON power for the load. (Instead of turning the Temperature Controller OFF and ON again, switching from STOP mode to RUN mode can also be used in this case.)

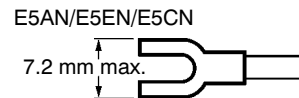
If the Temperature Controller is used close to radios, television sets or wireless devices it may affect reception.

In the case of Temperature Controllers with alarm outputs, alarm output may not be generated properly when an abnormality occurs in the device. It is suggested that a separate alarm device be incorporated in the system.

To ensure proper performance, parameters of the Temperature Controllers are set to default values before they are shipped. Change these parameters depending on actual applications. If left unchanged, the Temperature Controller will operate under the default settings.

### Crimp Terminal Connection

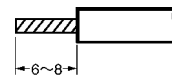
Use crimp terminals that match M3.5 screws. M3.5 x 8 self-rising screws are used.



Be careful not to excessively tighten the terminals screws.

### Soldering Connection

The self-rising screws provide easy soldering connection. Strip the lead wire by a length of 6 to 8 mm and properly treat the terminal tip.







## Certain Terms and Conditions of Sale

1. **Offer; Acceptance.** These terms and conditions (these "Terms") are deemed part of all catalogs, manuals or other documents, whether electronic or in writing, relating to the sale of goods or services (collectively, the "Goods") by Omron Electronics LLC and its subsidiary companies ("Seller"). Seller hereby 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. Please contact your Omron representative to confirm any additional terms for sales from your Omron company.
2. **Prices.** All prices stated are current, subject to change without notice by Seller. Buyer agrees to pay the price in effect at time of shipment.
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 Seller's payment terms and (ii) Buyer has no past due amounts owing to Seller.
4. **Orders.** Seller will accept no order less than \$200 net billing.
5. **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 Goods.
6. **Taxes.** All taxes, duties and other governmental charges (other than general real property and income taxes), including any interest or penalties thereon, imposed directly or indirectly on Seller or required to be collected directly or indirectly by Seller for the manufacture, production, sale, delivery, importation, consumption or use of the Goods sold hereunder (including customs duties and sales, excise, use, turnover and license taxes) shall be charged to and remitted by Buyer to Seller.
7. **Financial.** If the financial position of Buyer at any time becomes unsatisfactory to Seller, Seller reserves the right to stop shipments or require satisfactory security or payment in advance. If Buyer fails to make payment or otherwise comply with these Terms or any related agreement, Seller may (without liability and in addition to other remedies) cancel any unshipped portion of Goods sold hereunder and stop any Goods in transit until Buyer pays all amounts, including amounts payable hereunder, whether or not then due, which are owing to it by Buyer. Buyer shall in any event remain liable for all unpaid accounts.
8. **Cancellation; Etc.** Orders are not subject to rescheduling or cancellation unless Buyer indemnifies Seller fully against all costs or expenses arising in connection therewith.
9. **Force Majeure.** Seller shall not be liable for any delay or failure in delivery resulting from causes beyond its control, including earthquakes, fires, floods, strikes or other labor disputes, shortage of labor or materials, accidents to machinery, acts of sabotage, riots, delay in or lack of transportation or the requirements of any government authority.
10. **Shipping; Delivery.** Unless otherwise expressly agreed in writing by Seller:
  - a. Shipments shall be by a carrier selected by Seller;
  - 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 Goods shall be FOB shipping point (unless otherwise stated in writing by Seller), at which point title to and all risk of loss of the Goods shall pass from Seller to Buyer, provided that Seller shall retain a security interest in the Goods until the full purchase price is paid by Buyer;
  - d. Delivery and shipping dates are estimates only.
  - e. Seller will package Goods as it deems proper for protection against normal handling and extra charges apply to special conditions.
11. **Claims.** Any claim by Buyer against Seller for shortage or damage to the Goods occurring before delivery to the carrier must be presented in writing to Seller within 30 days of receipt of shipment and include the original transportation bill signed by the carrier noting that the carrier received the Goods from Seller in the condition claimed.
12. **Warranties.** (a) **Exclusive Warranty.** Seller's exclusive warranty is that the Goods will be free from defects in materials and workmanship for a period of twelve months from the date of sale by Seller (or such other period expressed in writing by Seller). Seller disclaims all other warranties, express or implied. (b) **Limitations.** SELLER MAKES NO WARRANTY OR REPRESENTATION, EXPRESS OR IMPLIED, ABOUT NON-INFRINGEMENT, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OF THE GOODS. BUYER ACKNOWLEDGES THAT IT ALONE HAS DETERMINED THAT THE GOODS WILL SUITABLY MEET THE REQUIREMENTS OF THEIR INTENDED USE. Seller further disclaims all warranties and responsibility of any type for claims or expenses based on infringement by the Goods or otherwise of any intellectual property right. (c) **Buyer Remedy.** Seller's sole obligation hereunder shall be to replace (in the form originally shipped with Buyer responsible for labor charges for removal or replacement thereof) the non-complying Good or, at Seller's election, to repay or credit Buyer an amount equal to the purchase price of the Good; provided that in no event shall Seller be responsible for warranty, repair, indemnity or any other claims or expenses regarding the Goods unless Seller's analysis confirms that the Goods were properly handled, stored, installed and maintained and not subject to contamination, abuse, misuse or inappropriate modification. Return of any goods by Buyer must be approved in writing by Seller before shipment. Seller shall not be liable for the suitability or unsuitability or the results from the use of Goods in combination with any electrical or electronic components, circuits, system assemblies or any other materials or substances or environments. Any advice, recommendations or information given orally or in writing, are not to be construed as an amendment or addition to the above warranty.
13. **Damage Limits; Etc.** SELLER SHALL NOT BE LIABLE FOR SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES, LOSS OF PROFITS OR PRODUCTION OR COMMERCIAL LOSS IN ANY WAY CONNECTED WITH THE GOODS, WHETHER SUCH CLAIM IS BASED IN CONTRACT, WARRANTY, NEGLIGENCE OR STRICT LIABILITY. Further, in no event shall liability of Seller exceed the individual price of the Good on which liability is asserted.
14. **Indemnities.** Buyer shall indemnify and hold harmless Seller, its affiliates and its employees from and against all liabilities, losses, claims, costs and expenses (including attorney's fees and expenses) related to any claim, investigation, litigation or proceeding (whether or not Seller is a party) which arises or is alleged to arise from Buyer's acts or omissions under these Terms or in any way with respect to the Goods. Without limiting the foregoing, Buyer (at its own expense) shall indemnify and hold harmless Seller and defend or settle any action brought against Seller to the extent that it is based on a claim that any Good made to Buyer specifications infringed intellectual property rights of another party.
15. **Property; Confidentiality.** The intellectual property embodied in the Goods is the exclusive property of Seller and its affiliates and Buyer shall not attempt to duplicate it in any way without the written permission of Seller. Notwithstanding any charges to Buyer for engineering or tooling, all engineering and tooling shall remain the exclusive property of Seller. All information and materials supplied by Seller to Buyer relating to the Goods are confidential and proprietary, and Buyer shall limit distribution thereof to its trusted employees and strictly prevent disclosure to any third party.
16. **Miscellaneous.** (a) **Waiver.** No failure or delay by Seller in exercising any right and no course of dealing between Buyer and Seller shall operate as a waiver of rights by Seller. (b) **Assignment.** Buyer may not assign its rights hereunder without Seller's written consent. (c) **Amendment.** These Terms constitute the entire agreement between Buyer and Seller relating to the Goods, and no provision may be changed or waived unless in writing signed by the parties. (d) **Severability.** If any provision hereof is rendered ineffective or invalid, such provision shall not invalidate any other provision. (e) **Setoff.** Buyer shall have no right to set off any amounts against the amount owing in respect of this invoice. (f) As used herein, "including" means "including without limitation".

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1. **Suitability of Use.** Seller shall not be responsible for conformity with any standards, codes or regulations which apply to the combination of the Good in the Buyer's application or use of the Good. At Buyer's request, Seller will provide applicable third party certification documents identifying ratings and limitations of use which apply to the Good. This information by itself is not sufficient for a complete determination of the suitability of the Good 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 this Good, nor is it intended to imply that the uses listed may be suitable for this Good:
  - (i) Outdoor use, uses involving potential chemical contamination or electrical interference, or conditions or uses not described in this document.
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2. **Programmable Products.** Seller shall not be responsible for the user's programming of a programmable Good, or any consequence thereof.
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**ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.**

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

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