

Solid State Relays

Technical Information

Glossary

Terms		Meaning
Circuit functions	Photocoupler Phototriac coupler	Transfers the input signal and insulates inputs and outputs as well.
	Zero cross circuit	A circuit which starts operation with the AC load voltage at close to zero-phase.
	Trigger circuit	A circuit for controlling the triac trigger signal, which turns the load current ON and OFF.
	Snubber circuit	A circuit consisting of a resistor R and capacitor C, which prevents faulty ignition from occurring in the SSR triac by suppressing a sudden rise in the voltage applied to the triac.
Input	Input impedance	The impedance of the input circuit and the resistance of current-limiting resistors used. Impedance varies with the input signal voltage in case of the constant current input method.
	Operating voltage	Minimum input voltage when the output status changes from OFF to ON.
	Reset voltage	Maximum input voltage when the output status changes from ON to OFF.
	Operating voltage	The permissible voltage range within which the voltage of an input signal voltage may fluctuate.
	Rated voltage	The voltage that serves as the standard value of an input signal voltage.
	Input current	The current value when the rated voltage is applied.
Output	Leakage current	The effective value of the current that can flow into the output terminals when a specified load voltage is applied to the SSR with the output turned OFF.
	Load voltage	The effective supply voltage at which the SSR can be continuously energized with the output terminals connected to a load and power supply in series.
	Maximum load current	The effective value of the maximum current that can continuously flow into the output terminals under specified cooling conditions (i.e., the size, materials, thickness of the heat sink, and an ambient temperature radiating condition).
	Minimum load current	The minimum load current at which the SSR can operate normally.
	Output ON voltage drop	The effective value of the AC voltage that appears across the output terminals when the maximum load current flows through the SSR under specified cooling conditions (such as the size, material, and thickness of heat sink, ambient temperature radiation conditions, etc.)
Characteristics	Dielectric strength	The effective AC voltage that the SSR can withstand when it is applied between the input terminals and output terminals of I/O terminals and metal housing (heat sink) for more than 1 minute.
	Insulation resistance	The resistance between the input and output terminals of I/O terminals and metal housing (heat sink) when DC voltage is imposed.
	Operating time	A time lag between the moment a specified signal voltage is imposed to the input terminals and the output is turned ON.
	Release time	A time lag between the moment the imposed signal input is turned OFF and the output is turned OFF.
	Ambient temperature and humidity (operating)	The ranges of temperature and humidity in which the SSR can operate normally under specified cooling, input/output voltage, and current conditions.
	Storage temperature	The temperature range in which the SSR can be stored without voltage imposition.
Others	Inrush current resistance	A current which can be applied for short periods of time to the electrical element.
	Counter-electromotive force	Extremely steep voltage rise which occurs when the load is turned ON or OFF.
	Recommended applicable load	The recommended load capacity which takes into account the safety factors of ambient temperate and inrush current.
	Bleeder resistance	The resistance connected in parallel to the load in order to increase apparently small load currents, so that the ON/OFF of minute currents functions normally.

Precautions and Notes on Correct Use

⚠ WARNING

Do not touch the SSR terminal section (charged section) when the power supply is ON. For SSRs with terminal covers, be sure to attach the cover before use. Touching the charged section may cause electric shock.

Do not touch the SSR or the heat sink either while the power supply is ON, or immediately after the power is turned OFF. The SSR/heat sink will be hot and will cause burns.

Do not touch the SSR LOAD terminal immediately after the power is turned OFF. The internal snubber circuit is charged and may cause electric shock.

- Do not apply excessive voltage or current to the SSR input or output circuits, or SSR malfunction or fire damage may result.
- Do not operate if the screws on the output terminal are loose, or heat generated by a terminal error may result in fire damage.
- Do not obstruct the air flow to the SSR or heat sink, or heat generated from an SSR error may cause the output element to short, or cause fire damage.
- Be sure to conduct wiring with the power supply turned OFF, or electric shock may result.
- Follow the *Correct Use* section when conducting wiring and soldering. If the product is used before wiring or soldering are complete, heat generated from a power supply error may cause fire damage.
- When installing the SSR directly into a control panel so that the panel can be used as a heat sink, use a panel material with low thermal resistance such as aluminum or steel. If a material with high thermal resistance such as wood is used, heat generated by the SSR may cause fire or burning.

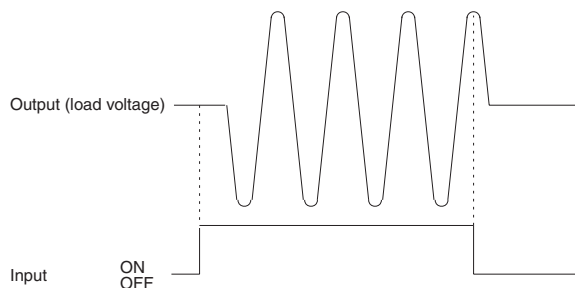
■ Before Using the SSR

Unexpected events may occur before the SSR is used. For this reason it is important to test the SSR in all possible environments. For example, the features of the SSR will vary according to the product being used.

All rated performance values listed in this catalog, unless otherwise stated, are all under the JIS C5442 standard test environment (15° to 30°C, 25% to 85% relative humidity, and 86 to 106 kPa atmosphere). When checking these values on the actual devices, it is important to ensure that not only the load conditions, but also the operating environmental conditions are adhered to.

■ Zero Cross Function

An SSR with a zero cross function operates when the AC load voltage approaches the zero point or its vicinity, and releases when the current reaches the zero point. An SSR with a zero cross function reduces clicking noises that may be generated when the load is turned ON.



■ Life Expectancy (MTTF)

The mean time to failure (MTTF) of SSRs is 100,000 hours, which varies with the operating conditions. To ensure long life and stable operation, take proper countermeasures against extremely high or low operating temperature, heavy fluctuations of ambient temperature, and/or long continuous energization.

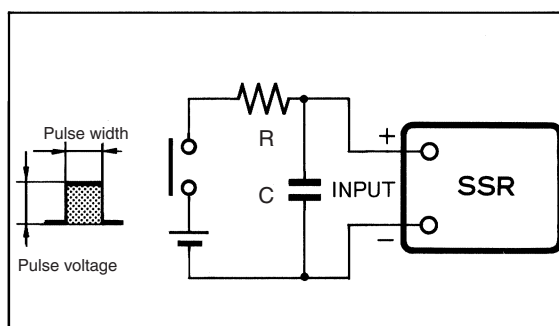
■ Input Circuit

Input Noise

SSRs need only a small amount of power to operate. This is why the input terminals must shut out electrical noise as much as possible. Noise applied to the input terminals may result in malfunction. The following describes measures to be taken against pulse noise and inductive noise.

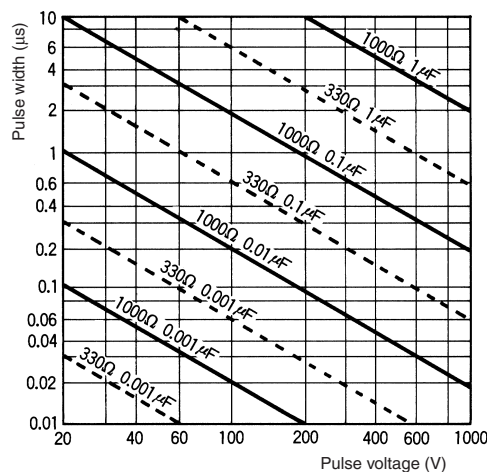
Pulse Noise

A combination of capacitor and resistor can absorb pulse noise effectively. The following is an example of a noise absorption circuit with capacitor C and resistor R connected to an SSR incorporating a photocoupler.



The value of R and C must be decided carefully. The value of R must not be too large or the supply voltage (E) will not be able to satisfy the required input voltage value.

The larger the value of C is, the longer the release time will be, due to the time required for C to discharge electricity.



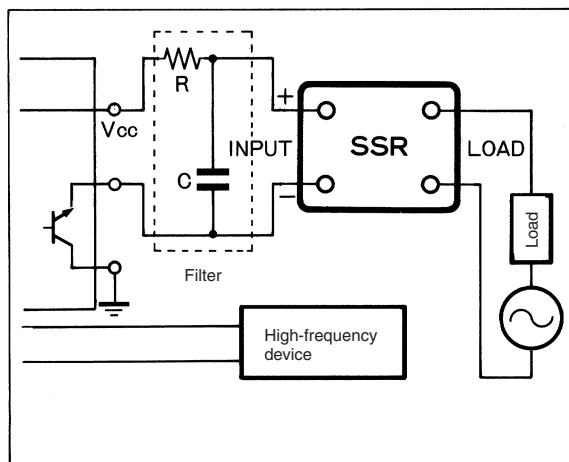
Note: For low-voltage models, sufficient voltage may not be applied to the SSR because of the relationship between C, R, and the internal impedance. When deciding on a value for R, check the input impedance for the SSR.

Inductive Noise

Do not wire power lines alongside the input lines. Inductive noise may cause the SSR to malfunction. If inductive noise is imposed on the input terminals of the SSR, use the following cables according to the type of inductive noise, and reduce the noise level to less than the must release voltage of the SSR.

Twisted-pair wire: For electromagnetic noise
Shielded cable: For static noise

A filter consisting of a combination of capacitor and resistor will effectively reduce noise generated from high-frequency equipment.

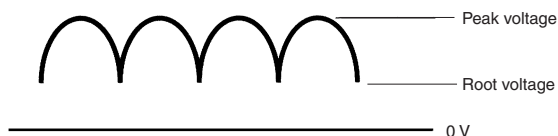


Note: R: 20 to 100 Ω
C: 0.01 to 1 μF

Input Conditions

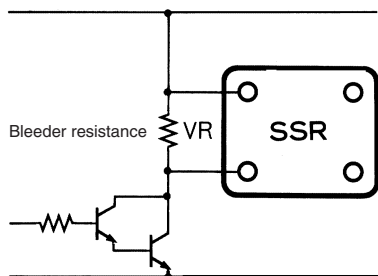
Input Voltage Ripples

When there is a ripple in the input voltage, set the input voltage so that the peak voltage is lower than the maximum operating voltage and the root voltage is above the minimum operating voltage.



Countermeasures for Leakage Current

When the SSR is powered by transistor output, the must release voltage may be insufficient due to leakage current while power is OFF. To counteract this, connect bleeder resistance as shown in the diagram below and set the bleeder resistance so that VR is 0.5 V or less.



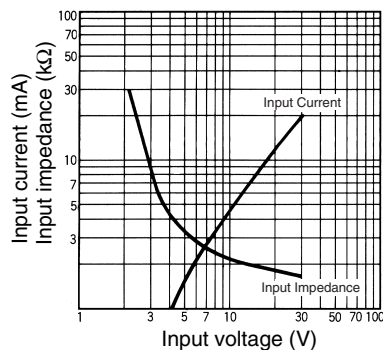
ON/OFF Frequency

The ON/OFF frequency should be set to 10 Hz maximum for AC load switching and 100 Hz maximum for DC load switching. If switching occurs at frequencies exceeding these values, the SSR output will not be able to follow-up.

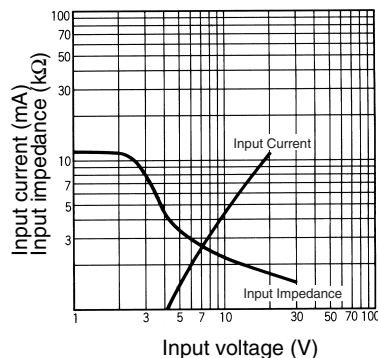
Input Impedance

In SSRs which have wide input voltages (such as G3F and G3H), the input impedance varies according to the input voltage and changes in the input current. For semiconductor-driven SSRs, changes in voltage can cause malfunction of the semiconductor, so be sure to check the actual device before usage. See the following examples.

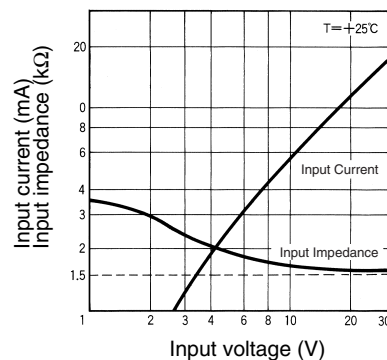
Applicable Input Impedance for a Photocoupler-type SSR without Indicators (Example) G3F, G3H (Without Indicators)



Applicable Input Impedance for a Photocoupler-type SSR with Indicators (Example) G3B, G3F, G3H (With Indicators)



Applicable Input Impedance (Example) G3CN



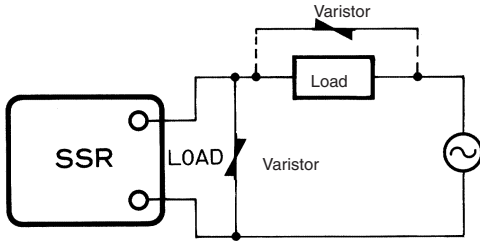
Output Circuit

AC ON/OFF SSR Output Noise Surges

If there is a large voltage surge in the AC current being used by the SSR, the C/R snubber circuit built into the SSR between the SSR load terminals will not be sufficient to suppress the surge, and the SSR transient peak element voltage will be exceeded, causing over-voltage damage to the SSR.

Only the following models have a built-in surge absorbing varistor: G3NA, G3S, G3PA, G3NE, G3NH, G3DZ (some models), G3RZ, and G3FM. When switching an inductive load with any other models, be sure to take countermeasures against surge, such as adding a surge absorbing element.

In the following example, a surge voltage absorbing element has been added.

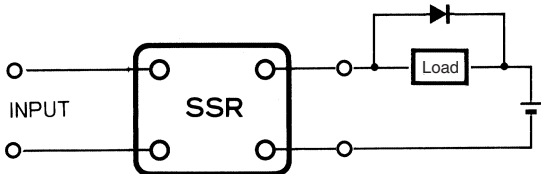


Select an element which meets the conditions in the following table as the surge absorbing element.

Voltage	Varistor voltage	Surge resistance
10 to 120 VAC	240 to 270 V	1,000 A min.
200 to 240 VAC	440 to 470 V	
380 to 480 VAC	820 to 1,000 V	

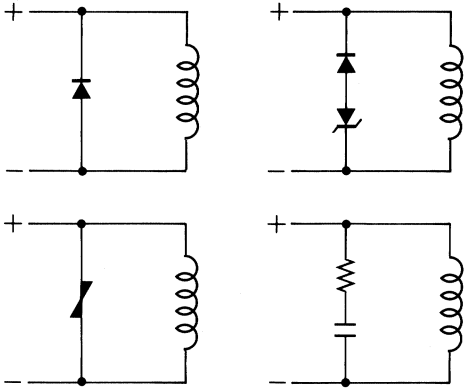
DC ON/OFF SSR Output Noise Surges

When an L load, such as a solenoid or electromagnetic valve, is connected, connect a diode that prevents counter-electromotive force. If the counter-electromotive force exceeds the withstand voltage of the SSR output element, it could result in damage to the SSR output element. To prevent this, insert the element parallel to the load, as shown in the following diagram and table.



As an absorption element, the diode is the most effective at suppressing the counter-electromotive force. The release time for the solenoid or electromagnetic valve will, however, increase. Be sure to check the circuit before use. To shorten the time, connect a Zener diode and a regular diode in series. The release time will be shortened at the same rate that the Zener voltage (Vz) of the Zener diode is increased.

Absorption Element Example				
Absorption element				
Effectiveness	O	O	△	X



(Reference)

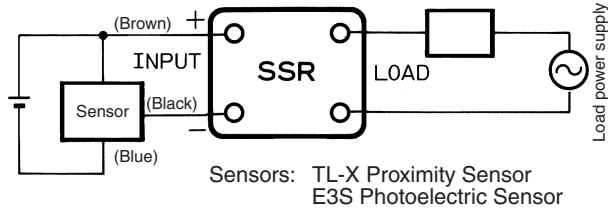
1. Selecting a Diode
 Withstand voltage = $V_{RM} \geq \text{Power supply voltage} \times 2$
 Forward current = $I_f \geq \text{load current}$
2. Selecting a Zener Diode
 Zener voltage =
 $V_z < \text{SSR withstand voltage} - (\text{Power supply voltage} + 2 \text{ V})$
 Zener surge power =
 $P_{RSM} > V_z \times \text{Load current} \times \text{Safety factor (2 to 3)}$

Note: When the Zener voltage is increased (Vz), the Zener diode capacity (P_{RSM}) is also increased.

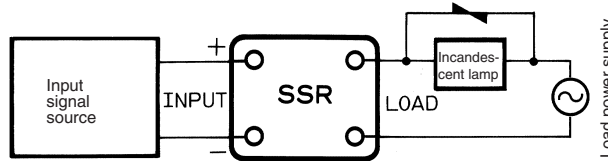
Application Circuit Examples

Connection to Sensors

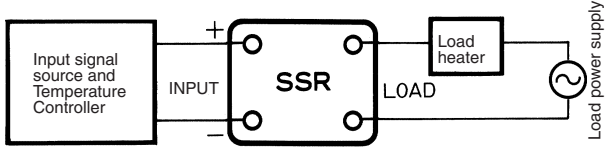
The SSR connects directly to a Proximity Sensor or Photoelectric Sensor.



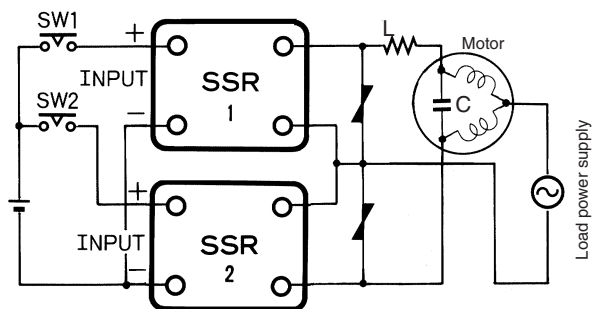
Switching Control of Incandescent Lamps



Temperature Control of Electric Furnaces

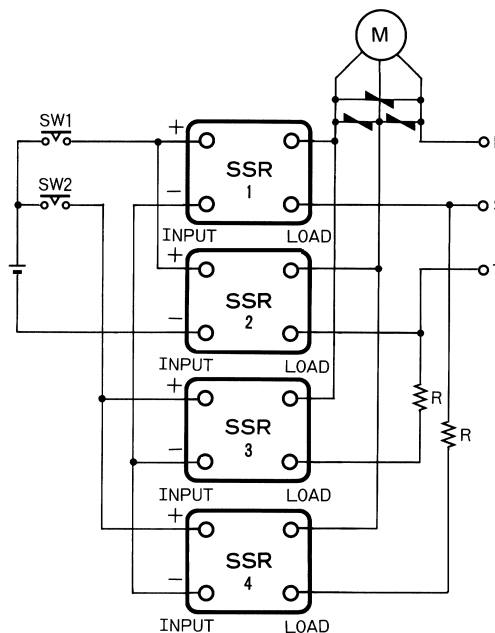


Forward and Reverse Operation of Single-phase Inductive Motors

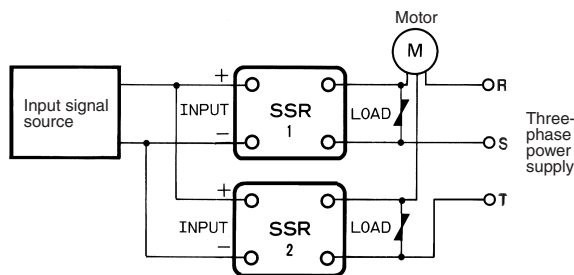


Note: 1. The voltage between the load terminals of either SSR 1 or SSR 2 when turned OFF is approximately twice as high as the supply voltage due to LC coupling. Be sure to use an SSR model with a rated output voltage of at least twice the supply voltage. For example, if the motor operates at a supply voltage of 100 VAC, the SSR must have an output voltage of 200 VAC or higher.

2. Make sure that there is a time lag of 30 ms or more to switch over SW1 and SW2.



ON/OFF Control of Three-phase Inductive Motors



Forward and Reverse Operation of Three-phase Inductive Motors

Make sure that signals input into the individual SSRs are proper if the SSRs are applied to the forward and reverse operation of a three-phase motor. If SW1 and SW2 as shown in the following circuit diagram are switched over simultaneously, a phase short-circuit will result on the load side, which may damage the output elements of the SSRs. This is because the SSR has a triac as an output element that is turned ON until the load current becomes zero regardless of the absence of input signals into the SSR. Therefore, make sure that there is a time lag of 30 ms or more to switch over SW1 and SW2.

The SSR may be damaged due to phase short-circuiting if the SSR malfunctions with noise in the input circuit of a SSR. To protect the SSR from phase short-circuiting damage, a protective resistance R may be inserted into the circuit.

The value of the protective resistance R must be determined according to the withstanding inrush current of the SSR. For example, the G3NA-220B withstands an inrush current of 220 A. The value of the protective resistance R is obtained from the following.

$$R > 220 \text{ V} \times \sqrt{2}/200\text{A} = 1.4 \Omega$$

Considering the circuit current and weld time, insert the protective resistance into the side that reduces the current consumption.

Obtain the consumption power of the resistance from the following.

$$P = I^2R \times \text{Safety factor}$$

(I = Load current, R = Protective resistance, Safety factor = 3 to 5)

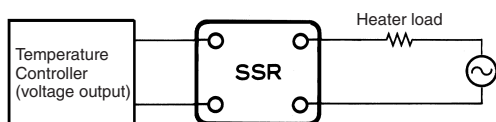
Selecting an SSR for Different Loads

The following provides examples of the inrush currents for different loads.

AC Load and Inrush Current						
Load	Solenoid	Incandescent lamp	Motor	Relay	Capacitor	Resistive load
Inrush current/Normal current	Approx. 10 times	Approx. 10 to 15 times	Approx. 5 to 10 times	Approx. 2 to 3 times	Approx. 20 to 50 times	1
Waveform						

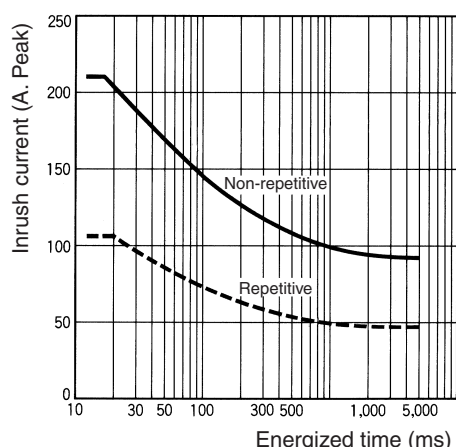
Heater Load (Resistive Load)

A resistive load has no inrush current. The SSR is generally used together with a voltage-output temperature controller for heater ON/OFF switching. When using an SSR with the zero cross function, most generated noise is suppressed. This type of load does not, however, include all-metal and ceramic heaters. Since the resistance values at normal temperatures of all-metal and ceramic heaters are low, an overcurrent will occur in the SSR, causing damage. For switching of all-metal and ceramic heaters, select a Power Controller (G3PX, consult your OMRON representative) with a long soft-start time, or a constant-current switch.



Lamp Load

A large inrush current flows through incandescent lamps, halogen lamps, and similar devices (approx. 10 to 15 times higher than the rated current). Select an SSR so that the peak value of inrush current does not exceed half the inrush current resistance of the SSR. Refer to "Repetitive" (indicated by the dashed line) shown in the following figure. When a repetitive inrush current of greater than half the inrush current resistance is applied, the output element of the SSR may be damaged.



Motor Load

When a motor is started, an inrush current of 5 to 10 times the rated current flows and the inrush current flows for a longer time than for a lamp or transformer. In addition to measuring the startup time of the motor or the inrush current during use, ensure that the peak value of the inrush current is less than half the inrush current resistance when selecting an SSR. The SSR may be damaged by counter-electromotive force from the motor. Be sure to install overcurrent protection for when the SSR is turned OFF.

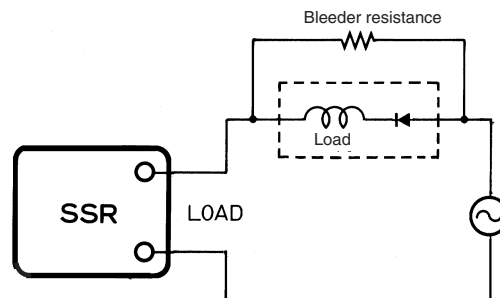
Transformer Load

When the SSR is switched ON, an energizing current of 10 to 20 times the rated current flows through the SSR for 10 to 500 ms. If there is no load in the secondary circuit, the energizing current will reach the maximum value. Select an SSR so that the energizing current does not exceed half the inrush current resistance of the SSR.

Half-wave Rectifying Circuit

AC electromagnetic counters and solenoids have built-in diodes, which act as half-wave rectifiers. For these types of loads, a half-wave AC voltage does not reach the SSR output. For SSRs with the zero cross function, this can cause them not to turn ON. Two methods for counteracting this problem are described below.

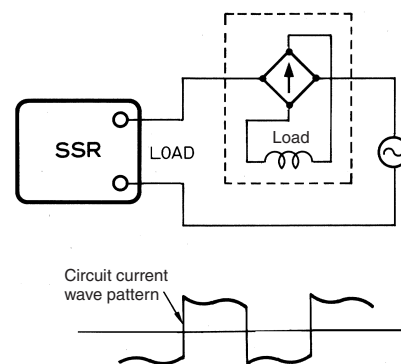
- Connect a bleeder resistance with approximately 20% of the SSR load current.



- Use SSRs without the zero cross function.

Full-wave Rectified Loads

AC electromagnetic counters and solenoids have built-in diodes, which act as full-wave rectifiers. The load current for these types of loads has a rectangular wave pattern, as shown in the following diagram.



Accordingly, AC SSRs use a triac (which turns OFF the element only when the circuit current is 0 A) in the output element. If the load current waveform is rectangular, it will result in an SSR reset error. When switching ON and OFF a load whose waves are all rectified, use a -V model or Power MOS FET Relay.

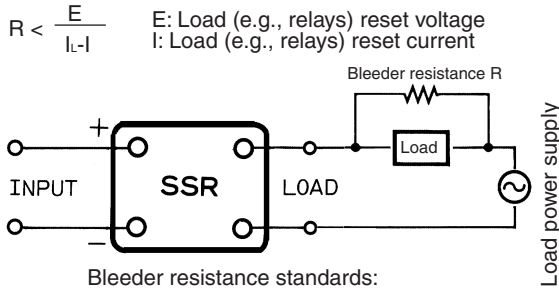
- V-model SSRs: G3F-203SL-V, G3H-203SL-V
- Power MOS FET Relay: G3DZ, G3RZ, G3FM

Small-capacity Loads

Even when there is no input signal to the SSR, there is a small leakage current (I_L) from the SSR output (LOAD). If this leakage current is larger than the load release current, the SSR may fail to reset.

Connect a bleeder resistance R in parallel to increase the SSR switching current.

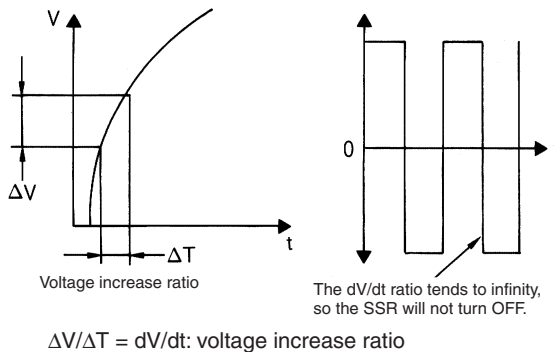
Load (e.g., relays) release voltage
Load (e.g., relays) release current



Bleeder resistance standards:
100-VAC power supply, 5 to 10 kΩ, 3 W
200-VAC power supply, 5 to 10 kΩ, 15 W

Inverter Load

Do not use an inverter-controlled power supply as the load power supply for the SSR. Inverter-controlled waveforms become rectangular, so the dV/dt ratio is extremely large and the SSR may fail to reset. An inverter-controlled power supply may be used on the input side provided the effective voltage is within the normal operating voltage range of the SSR.



Capacitive Load

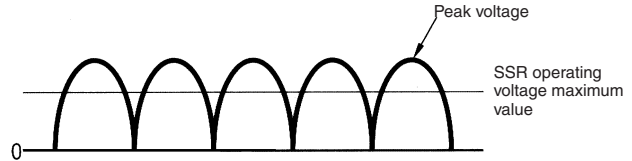
The supply voltage plus the charge voltage of the capacitor is applied to both ends of the SSR when it is OFF. Therefore, use an SSR model with an input voltage rating twice the size of the supply voltage.

Limit the charge current of the capacitor to less than half the peak inrush current value allowed for the SSR.

Load Power Supply

Rectified Currents

If a DC load power supply is used for full-wave or half-wave rectified AC currents, make sure that the peak load current does not exceed the maximum usage load power supply of the SSR. Otherwise, over-voltage will cause damage to the output element of the SSR.



Operating Frequency for AC Load Power Supply

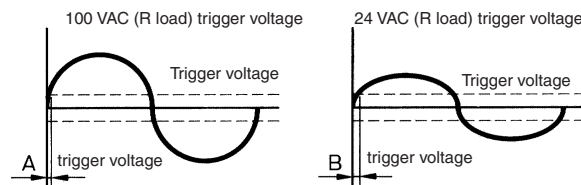
The operating frequency range for an AC load power supply is 47 to 63 Hz.

Low AC Voltage Loads

If the load power supply is used under a voltage below the minimum operating load voltage of the SSR, the loss time of the voltage applied to the load will become longer than that of the SSR operating voltage range. See the following load example. (The loss time is $A < B$.)

Before operating the SSR, make sure that this loss time will not cause problems.

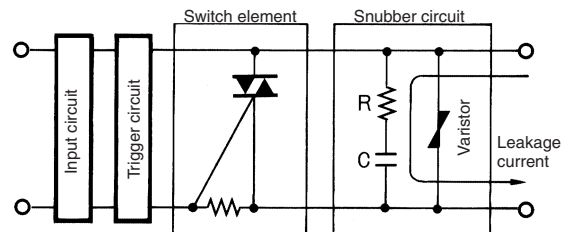
If the load voltage falls below the trigger voltage, the SSR will not turn ON, so be sure to set the load voltage to 24 VAC minimum. (Except for the G3PA-VD and G3NA-2□□B.)



Operation

Leakage Current

A leakage current flows through a snubber circuit in the SSR even when there is no power input. Therefore, always turn OFF the power to the input or load and check that it is safe before replacing or wiring the SSR.



■ Safety Considerations

Error Mode

The SSR is an optimum relay for high-frequency switching and high-speed switching, but misuse or mishandling of the SSR may damage the elements and cause other problems. The SSR consists of semiconductor elements, and will break down if these elements are damaged by surge voltage or overcurrent. Most faults associated with the elements are short-circuit malfunctions, whereby the load cannot be turned OFF.

Therefore, to provide a safety feature for a control circuit using an SSR, design a circuit in which a contactor or circuit breaker on the load power supply side will turn OFF the load when the SSR causes an error. Do not design a circuit that turns OFF the load power supply only with the SSR. For example, if the SSR causes a half-wave error in a circuit in which an AC motor is connected as a load, DC energizing may cause overcurrent to flow through the motor, thus burning the motor. To prevent this from occurring, design a circuit in which a circuit breaker stops overcurrent to the motor.

Location	Cause	Result
Input area	Overvoltage	Input element damage
Output area	Overvoltage	Output element damage
	Overcurrent	
Whole Unit	Ambient temperature exceeding maximum	Output element damage
	Poor heat radiation	

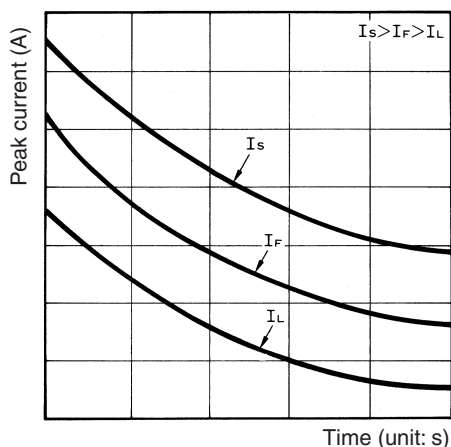
SSR Mounting Panel Quality

If G3NA or G3NE SSRs are to be mounted directly onto the control panel, without the use of a heat sink, be sure to use a panel material with low thermal resistance, such as aluminum or steel. Do not mount the SSR on a panel with high thermal resistance, such as a panel coated with paint. Doing so will decrease the radiation efficiency of the SSR, causing heat damage to the SSR output element. Do not mount the SSR on a panel made of wood or any other flammable material. Otherwise the heat generated by the SSR will cause the wood to carbonize, and may cause a fire.

Overcurrent Protection

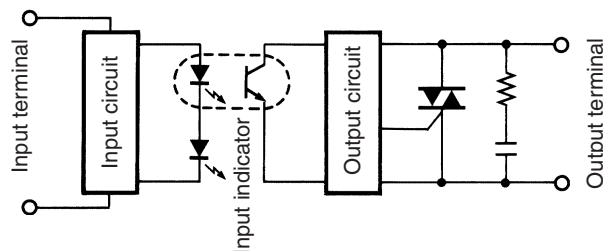
A short-circuit current or an overcurrent flowing through the load of the SSR will damage the output element of the SSR. Connect a quick-break fuse in series with the load as a short-circuit protection measure.

Design a circuit so that the protection coordination conditions for the quick-break fuse satisfy the relationship between the SSR surge resistance (I_S), quick-break fuse current-limiting feature (I_F), and the load inrush current (I_L), shown in the following chart.



Operation Indicator

The operation indicator turns ON when current flows through the input circuit. It does not indicate that the output element is ON.



■ SSR Life Expectancy

The SSR is not subject to mechanical wear. Therefore, the endurance of the SSR depends on the rate of internal component malfunction. For example, the rate for the G3M-202P is 321 Fit (1 Fit = $10^{-9} = \lambda$ (malfunctions/operation)). The MTTF calculated from this value is as follows:

$$MTTF = 321/\lambda_{60} = 3.12 \times 10^6 \text{ (operations)}$$

The effects of heat on the solder also need to be considered in estimating the total life expectancy of the SSR. The solder deteriorates due to heat-stress from a number of causes. OMRON estimates that the SSR begins to malfunction due to solder deterioration approximately 10 years after it is first installed.

■ Operation and Storage Environment Precautions

Operation and Storage Locations

Do not operate or store the Relay in locations subject to direct sunlight or ultraviolet rays. Otherwise the resin will deteriorate, thereby causing cracks and other damage to the case. Do not operate or store the Relay in locations subject to exposure to water or chemicals. Otherwise rust, corrosion, and deterioration of the resin will occur.

Extended Storage of SSR

If the SSR is stored for an extended period of time, the terminals will be exposed to the air, reducing its solderability due to such effects as oxidation. Therefore, when installing a Relay onto a board after a long time in storage, check the state of the solder before use. Also, take preventive measures so that the terminals will not be exposed to water, oil, or solvents while they are stored.

Vibration and Shock

Do not subject the SSR to excessive vibration or shock. Otherwise the SSR will malfunction and may cause damage to the internal components.

To prevent the SSR from abnormal vibration, do not install the SSR in locations or by means that will subject it to vibration from other devices, such as motors.

Solvents

Do not allow the SSR to come in contact with solvents such as thinners or gasoline. Doing so will dissolve the markings on the SSR.

Oil

Do not allow the SSR terminal cover to come in contact with oil. Doing so will cause the cover to crack and become cloudy.

PCB SSR Soldering

SSRs must be soldered at 260°C within five seconds. For models, however, that conform to separate conditions, perform soldering according to the specified requirements.

Use a rosin-based non-corrosive flux that is compatible with the material of the SSR.

Ultrasonic Cleaning

Do not perform ultrasonic cleaning. Performing ultrasonic cleaning after the SSR base has been installed will cause ultrasonic waves to resonate throughout the SSR internal structure, thereby damaging the internal components.

Handling the SSRs

Do Not Drop

The SSR is a high-precision component. Do not drop the SSR or subject it to excessive vibration or shock regardless of whether the SSR is mounted or not.

The maximum vibration and shock that an SSR can withstand varies with the model. Refer to the relevant datasheet.

The SSR cannot maintain its full performance capability if the SSR is dropped or subjected to excessive vibration or shock resulting in possible damage to its internal components.

The impact of shock applied to the SSR that is dropped varies, and depends on the floor material, the angle of collision with the floor, and the dropping height. For example, if a single SSR is dropped on a plastic tile from a height of 10 cm, the SSR may receive a shock of 1,000 m/s² or more.

Handle SSRs in in-line packages with the same care and keep them free from excessive vibration or shock.

PCB-mounting SSRs

Suitable PCBs

PCB Material

PCBs are classified into epoxy PCBs and phenol PCBs. The following table lists the characteristics of these PCBs. Select one, taking into account the application and cost. Epoxy PCBs are recommended for SSR mounting in order to prevent the solder from cracking.

Item	Epoxy		Phenol
	Glass epoxy	Paper epoxy	Paper phenol
Electrical characteristics	High insulation resistance. Highly resistive to moisture absorption.	Inferior to glass epoxy but superior to paper phenol PCBs.	New PCBs are highly insulation-resistive but easily affected by moisture absorption and cannot maintain good insulation performance over a long time.
Mechanical characteristics	The dimensions are not easily affected by temperature or humidity. Ideal for through-hole or multi-layer PCBs.	Inferior to glass epoxy but superior to paper phenol PCBs.	The dimensions are easily affected by temperature or humidity. Not suitable for through-hole PCBs.
Economical efficiency	Expensive	Rather expensive	Inexpensive
Application	Applications that require high reliability.	Applications that may require less reliability than those for glass epoxy PCBs but require more reliability than those of paper phenol PCBs.	Applications in comparatively good environments with low-density wiring.

PCB Thickness

The PCB may warp due to the size, mounting method, or ambient operating temperature of the PCB or the weight of components mounted to the PCB. Should warping occur, the internal mechanism of the SSR on the PCB will be deformed and the SSR may not provide its full capability. Determine the thickness of the PCB by taking the material of the PCB into consideration.

Terminal Hole and Land Diameters

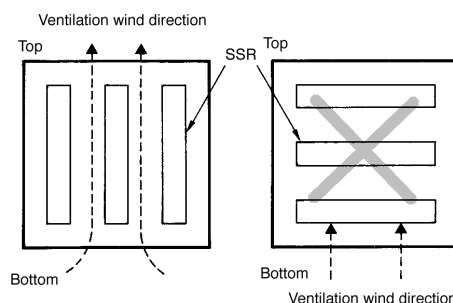
Refer to the following table to select the terminal hole and land diameters based on the SSR mounting dimensions. The land diameter may be smaller if the land is processed with through-hole plating.

Hole dia. (mm)		Minimum land dia. (mm)
Nominal value	Tolerance	
0.6	±0.1	1.5
0.8		1.8
1.0		2.0
1.2		2.5
1.3		2.5
1.5		3.0
1.6		3.0
2.0		3.0

Mounting Space

The ambient temperature around the sections where the SSR is mounted must be within the permissible ambient operating temperature. If two or more SSRs are mounted closely together, the SSRs may radiate excessive heat. Therefore, make sure that the SSRs are separated from one another at the specified distance provided in the datasheet. If there is no such specification, maintain a space that is as wide as a single SSR.

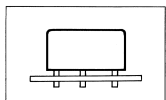
Provide adequate ventilation to the SSRs as shown in the following diagram.



Mounting SSR to PCB

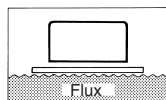
Read the precautions for each model and fully familiarize yourself with the following information when mounting the SSR to the PCB.

Step 1 SSR mounting



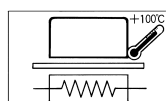
1. Do not bend the terminals to make the SSR self-standing, otherwise the full performance of the SSR may not be possible.
2. Process the PCB properly according to the mounting dimensions.

Step 2 Flux coating



1. The flux must be a non-corrosive rosin flux, which is suitable to the material of the SSR.
Apply alcohol solvent to dissolve the flux.
2. Make sure that all parts of the SSR other than the terminals are free of the flux. The insulation resistance of the SSR may be degraded if there is flux on the bottom of the SSR.

Step 3 Preheating

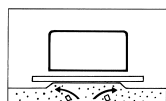


1. Be sure to preheat the SSR to allow better soldering.
2. Preheat the SSR under the following conditions.

Temperature	100°C max.
Time	1 min max.

3. Do not use the SSR if it is left at high temperature over a long time. This may change the characteristics of the SSR.

Step 4 Soldering

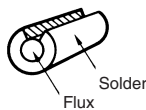


Automatic Soldering

1. Flow soldering is recommended for maintaining a uniform soldering quality.
 - Solder: JIS Z3282 or H63A
 - Soldering temperature: Approx. 260°C
 - Soldering time: Approx. 5 s (Approx. 2 s for first time and approx. 3 s for second time for DWS)
 - Perform solder level adjustments so that the solder will not overflow on the PCB.

Manual Soldering

1. After smoothing the tip of the soldering iron, solder the SSR under the following conditions.
 - Solder: JIS Z3282, 1160A, or H63A with rosin-flux-cored solder
 - Soldering iron: 30 to 60 W
 - Soldering temperature: 280°C to 300°C
 - Soldering time: Approx. 3 s
2. As shown in the above illustration, solder with a groove for preventing flux dispersion.

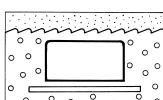


Step 5 Cooling



1. After soldering the SSR, be sure to cool down the SSR so that the soldering heat will not deteriorate the SSR or any other components.
2. Do not dip the SSR into cold liquid, such as a detergent, immediately after soldering the SSR.

Step 6 Cleaning



1. Refer to the following table for the selection of the cleaning method and detergent.

Detergent

Boiling or dip cleaning is possible for the SSR. Do not perform ultrasonic cleaning or cut the terminals, otherwise the internal parts of the SSR may be damaged. Make sure that the temperature of the detergent is within the permissible ambient operating temperature of the SSR.

2. Applicability of Detergents

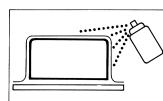
Detergent		Applicability
Chlorine detergent	Perochine Chlorosolder Trichloroethylene	OK
Aqueous detergent	Indusco Holys Pure water (pure hot water)	OK
Alcohol	IPA Ethanol	OK
Others	Paint thinner Gasoline	NG

Note: 1. Contact your OMRON representatives before using any other detergent. Do not apply Freon TMC, paint thinner, or gasoline to any SSR.

2. The space between the SSR and PCB may be not be adequately cleaned with a hydrocarbon or alcohol detergent.

Actions are being taken worldwide to stop the use of CFC-113 (chlorofluorocarbon) and 1.1.1 trichloroethane. Your understanding and cooperation are highly appreciated.

Step 7 Coating



1. Do not fix the whole SSR with resin, otherwise the characteristics of the SSR may change.
2. The temperature of the coating material must be within the permissible ambient operating temperature range.

Coating

Type	Applicability
Epoxy	OK
Urethane	OK
Silicone	OK

Terms and Conditions of Sale

1. Offer; Acceptance. These terms and conditions (these "Terms") are deemed part of all quotations, acknowledgments, invoices, purchase orders and other documents, whether electronic or in writing, relating to the sale of products or services (collectively, the "Products") by Omron Electronic Components LLC ("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.
2. Prices; Payment. All prices stated are current, subject to change without notice by Seller. Buyer agrees to pay the price in effect at time of shipment. Payments for Products received are due net 30 days unless otherwise stated in the invoice.
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. Currencies. If the prices quoted herein are in a currency other than U.S. dollars, Buyer shall make remittance to Seller at the then current exchange rate most favorable to Seller and which is available on the due date; provided that if remittance is not made when due, Buyer will convert the amount to U.S. dollars at the then current exchange rate most favorable to Seller available during the period between the due date and the date remittance is actually made.
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 Products.
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 Products 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 Products sold hereunder and stop any Products 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:
 1. Shipments shall be by a carrier selected by Seller;
 2. Such carrier shall act as the agent of Buyer and delivery to such carrier shall constitute delivery to Buyer;
 3. All sales and shipments of Products shall be FOB shipping point (unless otherwise stated in writing by Seller), at which point title to and all risk of loss of the Products shall pass from Seller to Buyer, provided that Seller shall retain a security interest in the Products until the full purchase price is paid by Buyer;
 4. Delivery and shipping dates are estimates only.
 5. Seller will package Products 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 Products 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 Products from Seller in the condition claimed.
12. Warranties. (a) Exclusive Warranty. Seller's exclusive warranty is that the Products 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 PRODUCTS. BUYER ACKNOWLEDGES THAT IT ALONE HAS DETERMINED THAT THE PRODUCTS 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 Products 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 Product or, at Seller's election, to repay or credit Buyer an amount equal to the purchase price of the Product; provided that in no event shall Seller be responsible for warranty, repair, indemnity or any other claims or expenses regarding the Products unless Seller's analysis confirms that the Products were properly handled, stored, installed and maintained and not subject to contamination, abuse, misuse or inappropriate modification. Return of any Products 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 Products 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 to the above warranty.
13. Limitation on Liability; Etc. SELLER SHALL NOT BE LIABLE FOR SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES, LOSS OF PROFITS OR PRODUCTION OR COMMERCIAL LOSS IN ANY WAY CONNECTED WITH THE PRODUCTS, 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 Product 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 Products. 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 Product made to Buyer specifications infringed intellectual property rights of another party.
15. Property; Confidentiality. The intellectual property embodied in the Products 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 supplied by Seller to Buyer relating to the Products 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) Law. These Terms are governed by Illinois law (without regard to conflict of law principles). Federal and state courts in Illinois shall have exclusive jurisdiction for any dispute hereunder. (d) Amendment. These Terms constitute the entire agreement between Buyer and Seller 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".

Certain Precautions on Specifications and Use

1. **Suitability for Use.** Seller shall not be responsible for conformity with any standards, codes or regulations which apply to the combination of the Product in Buyer's application or use of the Product. At Buyer's request, Seller 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) 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.
 - (iii) Use in consumer products or any use in significant quantities.
 - (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 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.
2. **Programmable Products.** Seller shall not be responsible for the user's programming of a programmable product, or any consequence thereof.
3. **Performance Data.** Performance data given in this publication is provided as a guide for the user in determining suitability and does not constitute a warranty. It may represent the result of Seller's test conditions, and the users must correlate it to actual application requirements. Actual performance is subject to Seller'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 Seller representative at any time to confirm actual specifications of purchased Product.
5. **Errors and Omissions.** The information in this publication has been carefully checked and is believed to be accurate; however, no responsibility is assumed for clerical, typographical or proofreading errors, or omissions.
6. **RoHS Compliance.** Where indicated, our products currently comply, to the best of our knowledge as of the date of this publication, with the requirements of the European Union's Directive on the Restriction of certain Hazardous Substances ("RoHS"), although the requirements of RoHS do not take effect until July 2006. These requirements may be subject to change. Please consult our website for current information.

Complete "Terms and Conditions of Sale" for product purchase and use are on Omron's website at www.components.omron.com – under the "About Us" tab, in the Legal Matters section.

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.

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

OMRON®

**OMRON ELECTRONIC
COMPONENTS LLC**

55 E. Commerce Drive, Suite B
Schaumburg, IL 60173

847-882-2288

OMRON CANADA, INC.

885 Milner Avenue
Toronto, Ontario M1B 5V8

416-286-6465

OMRON ON-LINE

Global - <http://www.omron.com>

USA - <http://www.components.omron.com>

Canada - <http://www.omron.ca>