■ Glossary

Terms		Meaning
Circuit functions	**Photocoupler Photoctriac 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 or I/O terminals and metal housing (heat sink) for more than 1 minute.
	Insulation resistance	The resistance between the input and output terminals or 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 temperature 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.

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-time, continuous energization.

Precautions

WARNING

Do not touch the SSR terminal section (charged section) when the power supply is ON. Touching the charged section may cause electric shock.

Do not touch the SSR LOAD terminal immediately after the power is turned OFF.

- Do not apply excessive voltage or current to the SSR input or output circuits. Otherwise SSR malfunction or fire damage may result.
- Do not obstruct the air flow to the SSR. Otherwise, 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. Otherwise 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.

■ Correct Use

Before Using the SSR

1. 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.
2. 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.

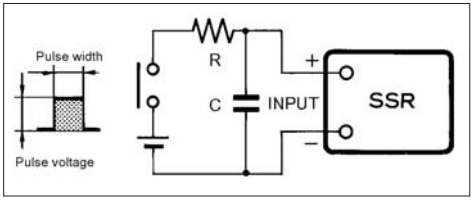
INPUT CIRCUIT

Input Noise

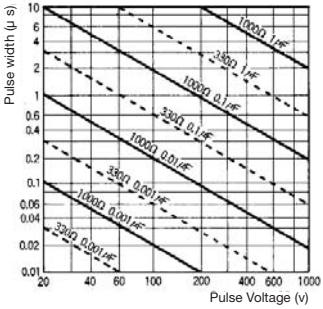
SSRs need only a small amount of power to operate. This is why the input terminals must shut out electrical noise as much as possible. Noise applied to the input terminals may result in malfunction. The following describe measures to be taken against pulse noise and inductive noise.

1. 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.



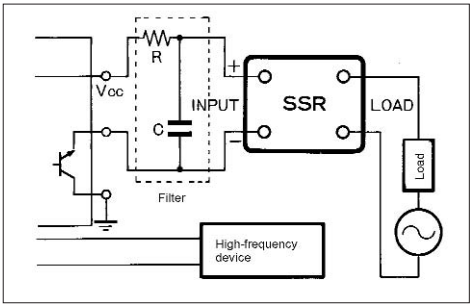
Note: For low-voltage models, sufficient voltage may not be applied to the SSR because of the relationship between C, R, and the internal impedance. When deciding on a value for R, check the input impedance for the SSR.

2. 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 reset 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.

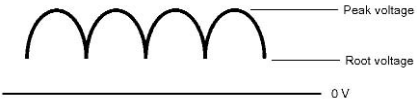


Note: R: 20 to 100 Ω
C: 0.01 to 1 μF

INPUT CONDITIONS

1. Input Voltage Ripples

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



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 to 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 the SSR

If the SSR is stored for an extended period of time, the terminal 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 Unit in locations or by means that will subject it to the vibrations 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

1. 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.
2. Use a rosin-based non-corrosive flux that is compatible with the material of the SSR.

Ultrasonic Cleaning

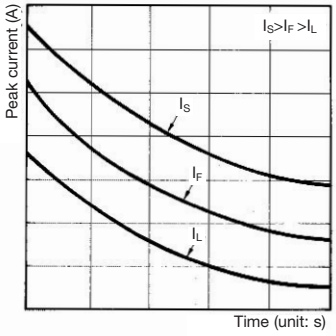
Do not perform ultrasonic cleaning. Performing ultrasonic cleaning after the SSR base has been installed will cause ultrasonic waves to resonate throughout the SSR internal structure, thereby damaging the internal components.

FAIL-SAFE CONCEPT

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 an overcurrent 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.



SSR Life Expectancy

The SSR is not subject to mechanical wear. Therefore, the life expectancy of the SSR depends on the rate of internal component malfunction. See Omron for further details.

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.

HANDLING THE SSR

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 given to the SSR that is dropped varies upon the case, 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/s^2 or more.

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

PCB-MOUNTING SSR

Suitable PCB

1. 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 long-density wiring.

2. PCB Thickness

The PCB may warp due to the size, mounting method, or ambient operating temperature of the PCB or the weight of parts 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.

3. Terminal Hole and Land Diameters

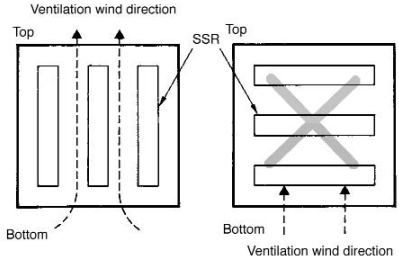
Refer to the following table to select the terminal hole and land diameters based on the SSR mounting dimensions. The land diameter may be smaller if the land is processed with through-hole plating.

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 provision, maintain a space that is as wide as a single SSR.

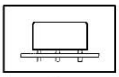
Provide adequate ventilation to the SSRs as shown in the following



Mounting SSR to PCB

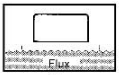
Read the precautions for each model and fully familiarize yourself with the following when mounting the SSR to the PCB.

Step 1
SSR mounting



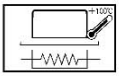
1. Do not bend the terminals to make the SSR self-standing, otherwise the full performance of the SSR may not be possible.
2. Process the PCB properly in accordance with the mounting dimensions.

Step 2
Flux coating



1. The flux applied must be non-corrosive rosin flux, which is suitable to the materialof 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 the flux is on the bottom of the SSR.

Step 3
Preheating

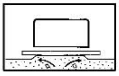


1. Be sure to preheat the SSR to allow better soldering.
2. Preheat the SSR under the following conditions.

Temperature	150° C max.
Time	60-90 secs.

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



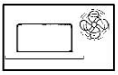
Automatic Soldering

1. Reflow soldering is recommended for maintaining a uniform soldering quality.
   - Solder: JIS Z3282 or H63A
   - Soldering lead temperature: Approx. 210°C max 10 secs
   - Soldering time: Approx. 5 s max. (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 – see recommended Temperature Profile

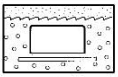
1. After smoothing the tip of the soldering iron, solder the SSR under the following conditions.
   - Solder: JIS Z3282, 1160A, or H63A with rosin-flux-cored solder
   - Soldering iron: 30 to 60 W
   - Soldering temperature: 260°C max.
   - Soldering time: Approx. 5 s max.

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 component.
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 cleaning or dip cleaning is available to the SSR. Do not 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.

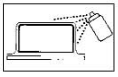
2. Availability of Detergents

Detergent		Availability
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.

Step 7
Coating



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.

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.

Detergent	Availability
Epoxy	OK
Urethane	OK
Silicone	OK