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Automation Components

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A solid state relay (SSR) is an electronic device that switches loads on or off when an external voltage or signal is applied to its control terminals. The lack of moving parts in an SSR allows it to switch much faster than electromechanical relays while avoiding the creation of electrical arcs. Solid state relays are also silent, so users won't be subjected to the annoying noise associated with electromechanical relays. Furthermore, because SSRs have no moving parts or contacts that can wear out, they last much longer and require less maintenance than electromechanical relays.

SSRs are used in a wide variety of applications where quick, silent switching is advantageous. Some of these industries include: plastics/rubber, food and beverage, processing, packaging, HVAC, semiconductor, oil/gas, transportation, conveyors, power or energy systems, printing, laboratory, kiln/oven, lighting, medical/pharmaceutical, and motion control. Below are some beneficial technical tips on selecting the best monitoring device for your machinery.

1 How will your SSR be mounted/installed?

SSRs are available in a few mounting configurations. Printed circuit board (PCB) mount SSRs are limited in load size due to electrical creepage and clearance distance, and heat-dissipation constraints.

Chassis mount SSRs are often installed to a back panel of an electrical cabinet, but may also mount directly to a metal surface within a machine or appliance. Typically, the SSR can be mounted without a heat sink if the load is under 5A, or under 8A if the mounting surface is an unpainted metal plate. To achieve the desired maximum SSR output rating, a heat sink must be properly sized and installed, along with the SSR. Well established SSR manufacturers like Carlo Gavazzi offer an online **Heat Sink Selector** tool.

Engineers who don't want to worry about properly sizing and mounting a heat sink can opt for an SSR with an integrated heat sink. These typically snap directly onto DIN rail and are ready to wire up and use. Many of the more advanced SSRs, such as those enabling proportional control, are available in this design. It is also easier to obtain agency approvals with SSRs with integrated heat sinks, which are typically cUL listed, and also carry horsepower ratings.

2 How many poles do you wish to switch?

When selecting an SSR, you will need to know how many poles (or lines of voltage) are to be switched to the load. If your application uses a DC load, you'll need a one-pole DC Switching SSR. For a single-phase AC load, you'll need a one-pole AC Switching SSR. For three-phase AC loads, you'll need to determine if you want to switch all three poles to the load, or if you can get by with only switching two poles. This can then be achieved with a two-pole or three-pole three-phase switching SSR.

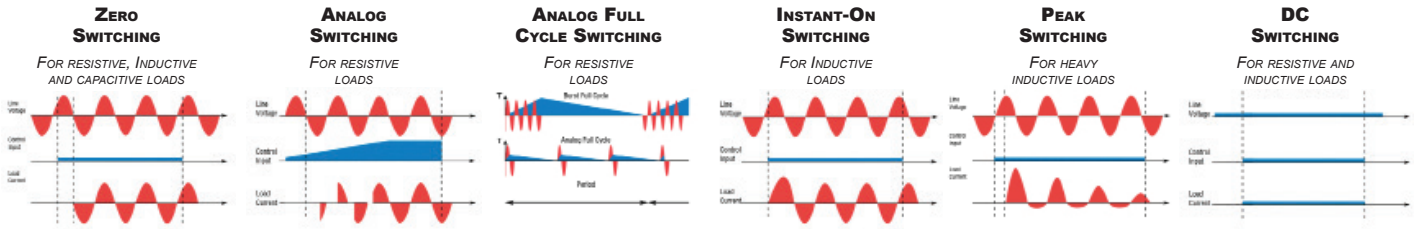
3 What type of load do you have?

Each common load type (resistive, inductive, or capacitive) will function better with certain types of SSRs. **Resistive loads** convert electrical energy to heat or light (as in heating elements, incandescent light bulbs, and power resistors). This type of load is best controlled with a **Zero Switching** SSR, where the output is activated at the first zero crossing of the load voltage sine wave, (typically under 8.33 mS). Proportional control can also be achieved with an **Analog Switching** SSR which has an internal circuit that controls phase angle and can provide an output that is proportional to the input signal, which can typically be 0 or 4 to 20mA, 0 or 1 to 5VDC or 0 to 10VDC. Typically Analog Switching SSRs are offered in various levels of input and/or output sophistication.

Inductive loads are typically resist changes in current, such as solenoids, pump/fan motors, or coils. An **Instant On** SSR is ideal for these types of loads. Instant On SSRs activate immediately after the application of a control voltage (typically less than 0.35 mS). Transformers are the heaviest type of inductive loads, and should be switched with **Peak Switching** SSRs. With these SSRs, the output is activated at the first peak of the line voltage (and close to the zero crossing point of the current) of the SSR.

As more applications gravitate towards DC voltage and **DC loads**, a **DC Switching** SSR will be required. Many renewable energy applications and LED lighting applications require DC switching technology.

Capacitive loads are less common, they resist changes in voltage and are partially found in rapid charge/discharge situations like cardiac defibrillators and flashbulbs. These loads also work well with a Zero Switching SSR.



4 What is your load voltage and current?

You will need to determine the maximum AC or DC voltage and current for your load. These variables are typically found on the specification of your motor, heater, or other device. For AC loads, SSRs usually switch one phase at 120 or 240 VAC, or for three phase applications: 208, 240, 480, or 600 VAC. Also factor in any potential power sags or surges in the application location when determining the minimum and maximum load voltage. DC loads are going to be powered by DC voltage.

For motors, you will need to know the maximum horsepower or kilowatt rating at the respective voltage of your application. Check for these specs on the motor nameplate.

5 What is the control voltage or input signal to turn on the SSR?

Next you'll need to determine another kind of voltage, the pick-up voltage that is required to energize your load and its turn off voltage (at which your load will de-energize). These are the critical control voltages for your SSR, and are usually found on your load's spec sheet. Unlike electromechanical relays or contactors which typically are controlled by a fixed voltage, SSRs have input ranges, either VDC, VAC, or dual VAC/VDC.

If you wish to proportionally control your load, you'll need some additional specs to choose the proper SSR. Proportional control is typically done with a 0-5, 1-5 or 0-10 VDC input or 4-20 mA control signal. Be sure to consult with an SSR manufacturer like Carlo Gavazzi to determine the optimum output-switching type for your load and application, as it can get a bit sophisticaled. Proportional output types include phase angle, distributed full cycle, burst full cycle, soft start, and burst full cycle with soft start.

6 What is the ambient temperature where the SSR will be installed?

The maximum SSR current rating depends upon the ambient temperature where it will be installed. Heightened temperatures can reduce the SSR's current rating. Many SSRs are mounted on a chassis and require a heat sink to optimize their performance. You will need to know the ambient temperature, as well as the mounting orientation upfront, to properly ensure the right type of heat sink is specified. Highly competent SSR manufacturers provide online tools to help match single or multiple SSRs with the appropriate heat sink. With DIN rail-mountable SSRs, the heat sink is already integrated, and the ratings are typically listed on the side of the device or datasheet for various ambient temperatures. Keep in mind that higher ambient temperatures will require you to de-rate the current rating of the SSR.

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