Instruction Manual

Solid State Voltage Regulator (SSVR)

Version 1.1 (Dec, 2021)

1. Overview

The solid-state voltage regulator (SSVR) is for manually regulating the AC power on resistive loads. The SSVR kit contains a SSVR, a rheostat, and a dial plate.

Similar to solid state relays (SSR), SSVR also generates heat when electrical current passing it. Each ampere of current produces about 1.5 W of heat. User needs to mount it to a heat conducting metal surface or use heat sink with proper current rating.

The required resistance of the rheostat depends on the voltage and frequency of the power to be regulated. When ordering SSVRs, buyers should select the voltage and frequency of their application to receive proper rheostats. The rheostat will carry the same voltage that it regulates. Wiring should be insulated from contacting metal chassis.

The dial plate is only to provide a reference position of the knob. The scales on the plate does not match exactly with the percentage of the output. The change of the output of the SSVR is not perfectly linear with the change of its input resistance.

The SSVR is for resistive loads only, such as heating elements or candescent lights. It may be used in some simple motor applications. We do not recommend the SSVR for speed-control of AC motors because of phase-angle control will create torque ripple and acoustic noise.

2. Specifications

	SSVR25A	SSVR40A
Maximum voltage	480 VAC	480 VAC
Current rating	25 A	40 A
Output	Triac	
Regulating method	Phase-angle control	
Input rheostat resistance	50 Hz, 220 V: 470 kohm, 60 Hz, 240 V: 330 kohm, 60 Hz, 120 V: 160 kohm	
Rheostat accuracy	+/- 20 kohm	
Rheostat power rating	2 W	
Dimensions	2.25 x 1.75 x 1.25 inch, 57 x 32 x 45 mm	

General Notes

1) Heat sinking is required.
2) For use with resistive loads only.
3) All terminals are at line voltage potential.

3. Wiring

Refer to Figure 1 for how to wire the SSVR with 120 VAC or 240 VAC loads. Please note that ALL TERMINALS ARE AT LINE VOLTAGE POTENTIAL. Please be careful.

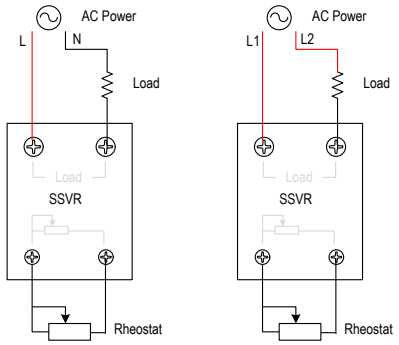

Figure 1. Wire the SSVR with 120 VAC load (left) and 240 VAC load (right).

4. Application Notes

4.1 Power Regulating

The SSVR regulates the output voltage by phase-angle control (phase-cutting). The out voltage to the load (V_L), as well as the power consumed by the load, decreases as the input resistance (R_{in}) increases. The percentage of the power consumed by the load vs. the input resistance is plotted in Figure 2.

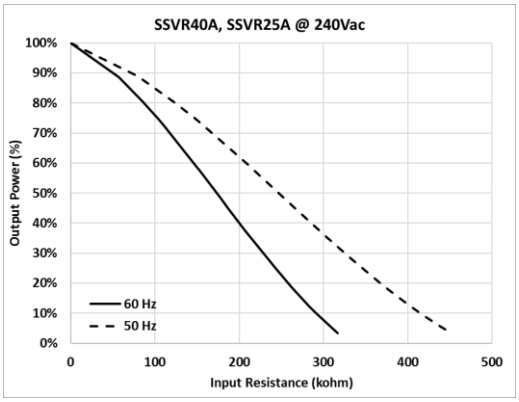

Figure 2 (a). SSVR with 240 VAC power.

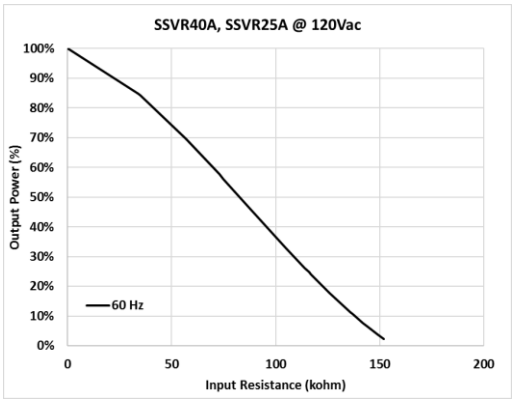

Figure 2 (b). SSVR with 120 VAC power.

Figure 2. Output power percentage vs. input resistance.

4.2 Rheostat

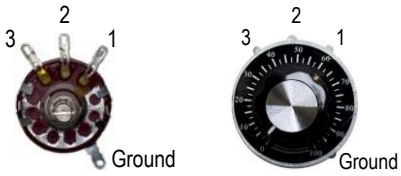

Figure 3. Terminals of the rheostat (left) and a rheostat /dial assembly (right).

The dial plate supplied with the SSVR has 0% scale mark on the lower left corner and the 100% scale on the lower right corner, which requires pin 2 and 3 of the rheostat being used. So as the shaft is turned clockwise, the output power will increase.

Wire pin 2 and 3 with the two input pins on the SSVR (please refer to Figure 4 for wiring). Turn the shaft clockwise all the way until it stops. The resistance between pin 2 and 3 (R_{23}) should equal to zero. Apply the knob to the shaft, put the white mark line to the lower right corner. Tighten the set screw with a flat head screw driver, and then match the 100% scale line with the white mart on the knob.

(Note: The scales on the dial plate doesn't match perfectly with the rotation span of the rheostat's shaft. Please use the scales as a rough reference. In this case, if the knob is turned counter-clockwise all the way until it stops, the white marker line will point roughly to the 10% scale.)

4.3 Application Example

In this application example, we use the a 40A SSVR (SSVR40A) to adjust the power to a 500 W heating element powered by US 60 Hz, 240 VAC. The rheostat is 330 kohm. The left two pins on the rheostat (2 and 3) were connected to the input pins of the SSVR. The relationship between the input resistance (R_{23}, the resistance between pin 2 and 3 of the rheostat) and the output power percentage on the heating element is shown in the plot in Figure 3.

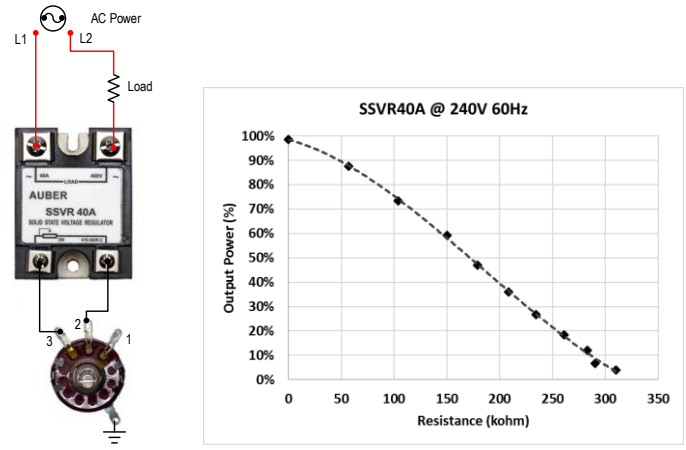

Figure 3. Using a SSVR40A to control the power on a heating element. A schematic wiring diagram is shown on the left; the power vs resistance plot is shown on the right.

Appendix

Technical Talk -- How Does It Work?

The SSVR regulates the output voltage by phase-angle control. In this method, the AC power control is achieved by advancing or delaying the firing point at which the SCR will be turned on at each half-cycle. The Figure 4 shows a waveform of which the SCR is fired a certain phase-angle. The original AC sine wave is overlaid with the phase-angle controlled waveform in Figure 5. This is how most of the light dimmer works. Phase-angle control is used for fast responding loads such as tungsten-filament lamps or heating elements. Because of the sharp cut off, there is a potential electromagnetic interference (EMI or RFI) if there are inductive devices on the power line. Some of the inductive devices cannot be controlled by this method.

The SSVR is an economical solution for power control. It does not provide a perfect linear adjustment on the output power. For user requires linear adjustment, please consider Auber's DSPR series power regulators.

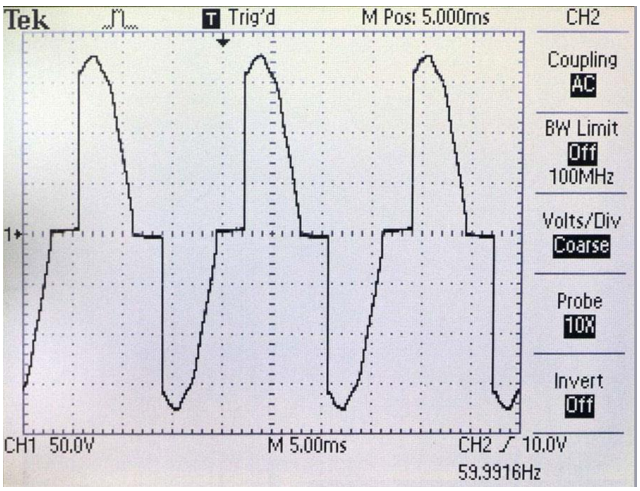

Figure 4. SSVR and TRIAC use phase-angle firing to regulate the power.

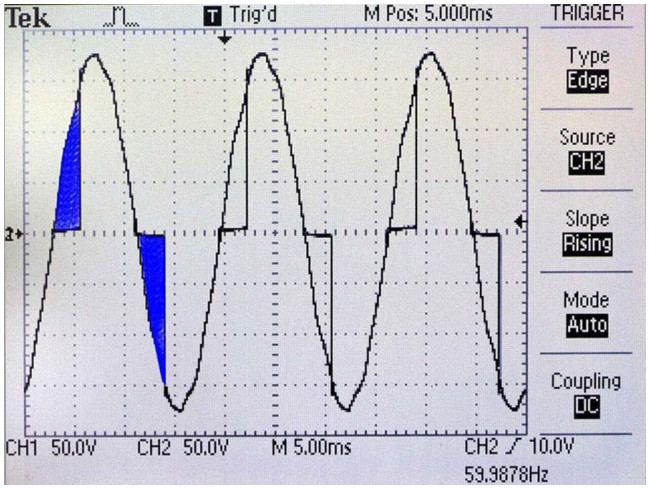

Figure 5. Original AC sine wave is overlaid with SSVR output waveform. The blue colored area shows the power output that has been blocked.

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