User's Manual

SR50W

Shunt Regulator for 20 to 100 VDC

Version 1.0
5 / 2016
http://www.leadshine.com

Notice

Read this manual carefully before any assembling and using. Incorrect handling of products in this manual can result in injury and damage to persons and machinery. Strictly adhere to the technical information regarding installation requirements.

Record of Revisions

Revision	Date	Description of Release
1.0	*5/2016*	*Initial Release*

Contents

1. Introduction

Modern pulse-width modulation (PWM) motor drives efficiently transfer energy from the power source into the motor to produce high-performance, high-efficiency motion.

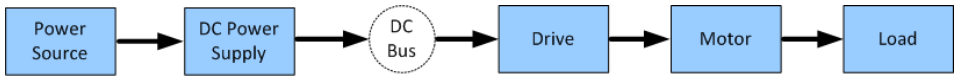

Figure1 Energy flow during normal operation

PWM drives also do a great job returning energy from the motor and load. For a DC-powered system, the bus capacitors (including the drive's internal bus caps and the bus caps of the DC power supply) are the main recipient of regenerated energy. That's OK to an extent, but as the recovered energy charges the bus cap, the bus voltage increases. If it goes too high, the drive or power supply will either shut down unexpectedly, or will be damaged.

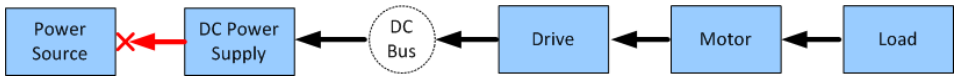

Figure2 Energy flow during regeneration

There are two common approaches to take regenerative energy to a safe place. One is to add a shunt regulator that will dump the power into a resistor. Another is to add enough bus capacitance to safely absorb the energy without exceeding the voltage rating of any components like those of the drives and DC power supply.

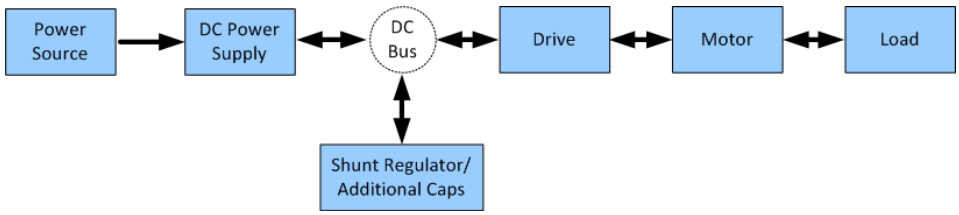

Figure3 Energy flow during normal operation and regeneration with shunt regulator or additional caps

A shunt regulator (SR50W) is a switching device, which uses dissipative elements (resistors) that are switched across the DC bus. The function of the shunt regulator is to regulate the voltage of the DC bus during the period of motor deceleration or emergency stop, whenever the voltage reaches a predetermined level.

The shunt regulator is only active when the voltage exceeds the set level; otherwise, no current passes through the power resistor. The shunt regulator automatically turns the power resistor on and off as necessary to regulate the voltage. It increases system reliability by stabilizing voltage fluctuations, thereby eliminating over-voltage shutdowns or damages.

2. Features

- Provides protection for the stepper & servo drives and regulated power supplies
- Adjustable braking voltage allows a great voltage range to be covered, from 22VDC to 132VDC
- Easy to use and easy for wiring
- I^2T protection for overload
- Compact size

3. Electrical Specifications

- Operating voltage: 20 to 100 V
- Braking voltage settings: 22 to 132 V (adjustable)
- Internal resistor: 10 Ω (external resistor >50Ω @50W if need)
- Peak power dissipation: 1000 W
- Maximum continuous power dissipation: 50 W

4. Environmental Specifications

Cooling		Natural Cooling or Forced cooling
Operating Environment	Environment	Avoid dust, oil fog and corrosive gases
	Ambient Temperature	0 to +45 °C
	Humidity	40%RH to 90%RH
	Vibration	5.9m/s^2 Max
Storage Temperature		-20 °C to 65 °C
Weight		Approx. 300g (10.9 oz)

5. Applications

On multi-axis systems, if the other axes always take power from the supply when a particular axis is regenerating, then the shunt regulator is probably not required during normal operation. However, when there is an emergency, the user usually has to stop all axes immediately or with an extremely high deceleration, a shunt regulator must be used or enough capacitance should be added to protect the components that may damaged by the regeneration.

Usually, excess regeneration energy is produced when a drive brings a large load to a stop or vertical deceleration against the force of gravity or under rapid deceleration (including smaller loads). The need for a shunt regulator is indicated when system faults occur during the deceleration portion of a move. This can be verified by monitoring the power supply voltage on an oscilloscope and looking for voltages that exceed the over voltage rating of the drive. If the excess energy is enough to raise the power supply voltage above the rating of the drive, then a shunt regulator is suggested.

6. Block Diagram

The following diagram shows the SR50W main internal components and how it interfaces with other components in the motion control system of your machine/device. When the DC Bus reaches the braking voltage, the voltage controller turns on the electronic switch, which connects the internal power resistor R (and External power resistor R1 **if need**) across the DC Bus. The power resistor dissipates the energy from the DC Bus. After the bus voltage is reduced to less than the braking voltage setting the resistor is disconnected from the DC bus.

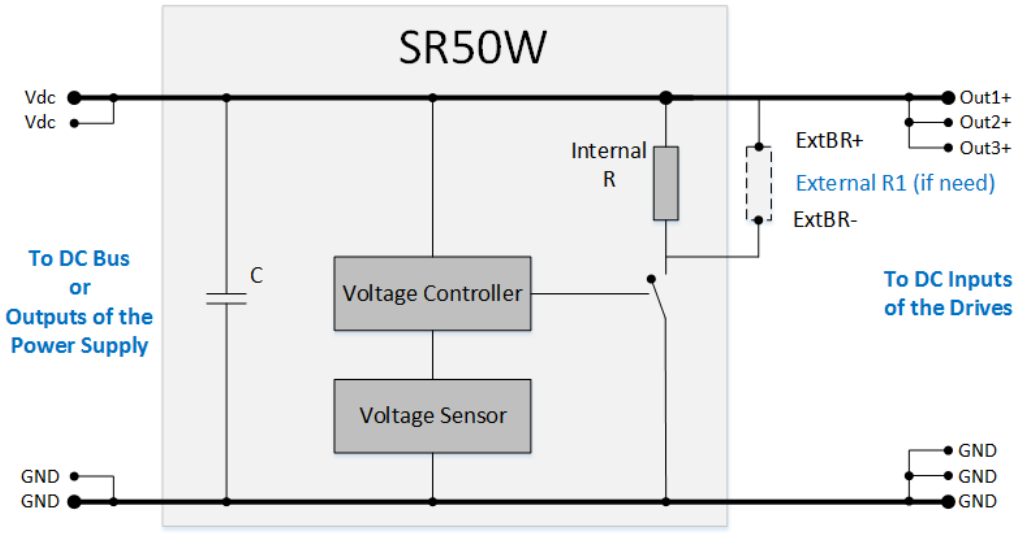

Figure4 SR50W block diagram

7. Connector Location

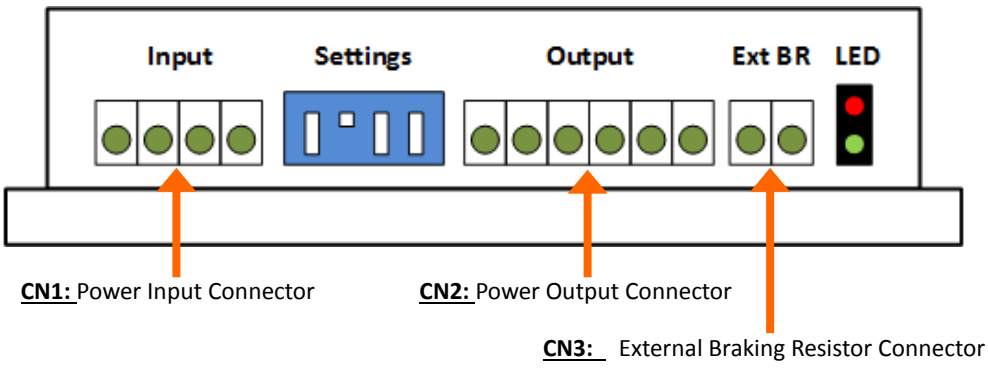

Figure5 SR50W connector location

8. Dimensions

Units: mm 1 inch = 25.4 mm

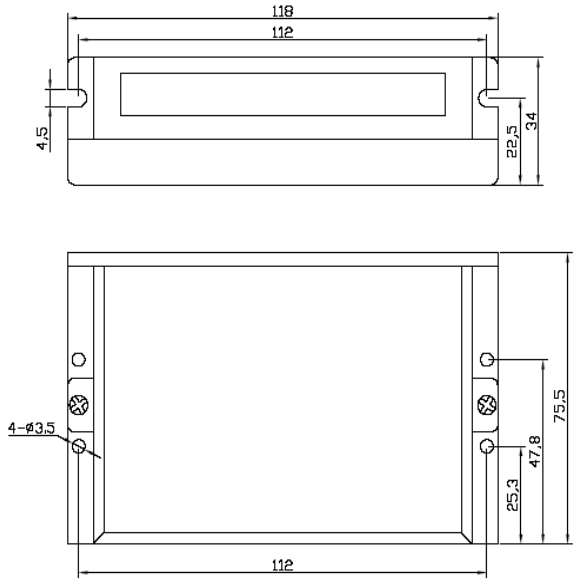

Figure 6 SR50W dimensions

9. Typical Connections

Connect the power supply "Vdc/V+" terminal to the SR50W terminal labeled "Vdc" and the power supply "V-/GND" terminal to the SR50W terminal labeled "GND". Then, connect the SR50W terminal labeled "Out1+/Out2+/Out3+" to the drive terminal "Vdc/V+" and the SR50W terminal labeled "GND" to the drive terminal "V-/GND". The SR50W has a maximum of 3 channels to allow for connecting up to 3 drives individually as shown in figure 7. AWG20 - AWG16 wires are recommended for connections.

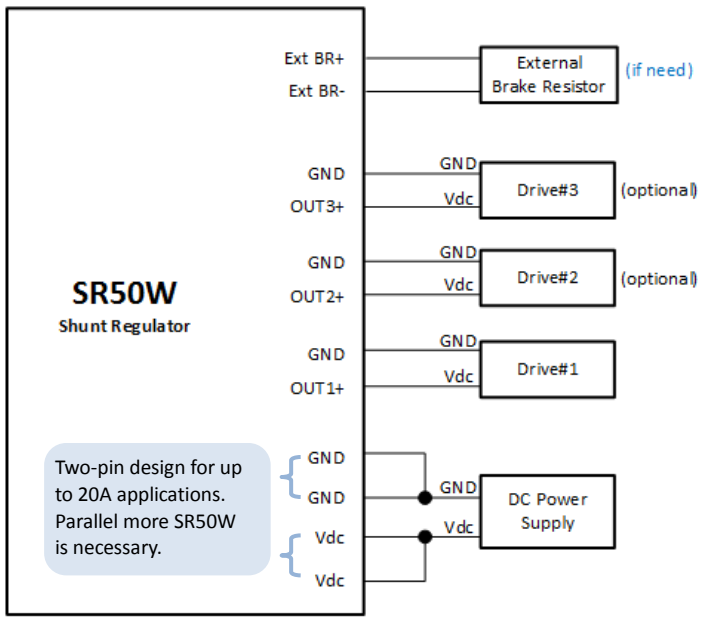

Figure 7 Typical connections

(1) Never power on the power supply before finishing all the connections and configurations.

(2) Make sure the two power supply leads, + & –, are correctly connected to the SR50W and drive's power connectors. Wrong connection may destroy the SR50W and drive, and void their warranty.

(3) Connecting a power supply with output voltage higher than 100VDC could damage the SR50W, and void its warranty.

10. Configuring Braking Voltage

The braking voltage configuration is required. Use the 4-pin DIP switch on the SR50W to configure the braking voltage. After power up, the SR50W will monitor the bus DC voltage automatically. Based on this voltage, and the braking voltage setting to decide the actual braking voltage. For example, if the SR50W power input is 80VDC, and the brake voltage setting is "Vdc+16V", then the actual braking voltage is 96VDC. The default brake voltage setting is "Vdc+2V".

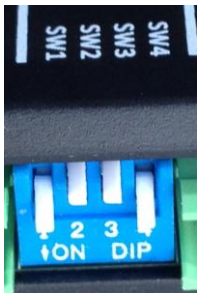

Figure 8 DIP switch for braking voltage configuration

Refer to Table 1 for available braking voltage settings.

Braking Voltage	SW1	SW2	SW3	SW4
Vdc+2V	ON	ON	ON	ON
Vdc+4V	OFF	ON	ON	ON
Vdc+6v	ON	OFF	ON	ON
Vdc+8V	OFF	OFF	ON	ON
Vdc+10V	ON	ON	OFF	ON
Vdc+12V	OFF	ON	OFF	ON
Vdc+14V	ON	OFF	OFF	ON
Vdc+16V	OFF	OFF	OFF	ON
Vdc+18V	ON	ON	ON	OFF
Vdc+20V	OFF	ON	ON	OFF
Vdc+22V	ON	OFF	ON	OFF
Vdc+24V	OFF	OFF	ON	OFF
Vdc+26V	ON	ON	OFF	OFF
Vdc+28V	OFF	ON	OFF	OFF
Vdc+30V	ON	OFF	OFF	OFF
Vdc+32V	OFF	OFF	OFF	OFF

Table 1 Braking voltage settings

Notes: The following conditions must be absolutely considered when adjusting the braking voltage.

1. The braking voltage must be higher than the nominal voltage of the power supply in use.
2. The braking voltage has to be lower than the over-voltage threshold of the drive(s) in use.

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11.LED Status

The SR50W uses two LEDs to indicate the different status during the operation.

Green LED: ***Solid Green*** when powered on and shunt regulator is ready.

Green LED: ***Blinks periodically*** means that shunt regulator is dissipating excess regeneration energy.

Red LED: ***Blinks 3 times periodically*** means that I^2T protection function is active or over-temperature deactivation is enabled. When this happens, an external brake resistor or parallel more SR50W is required.

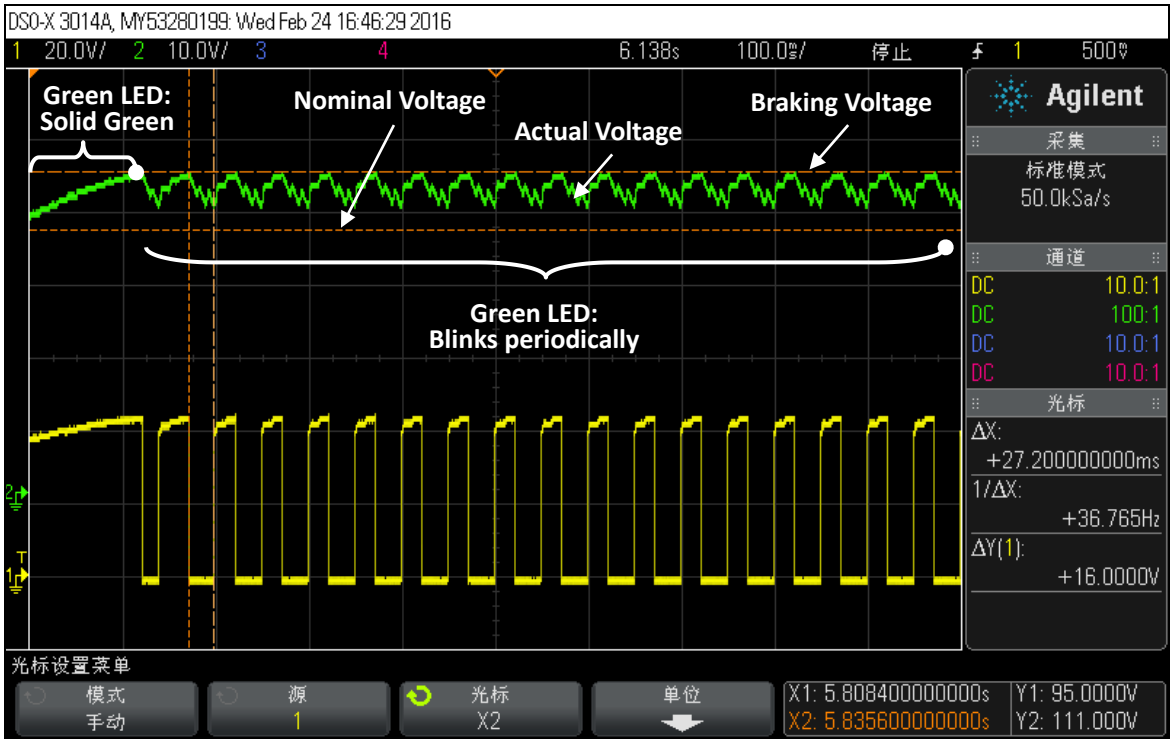

Figure 9 Normal dissipation

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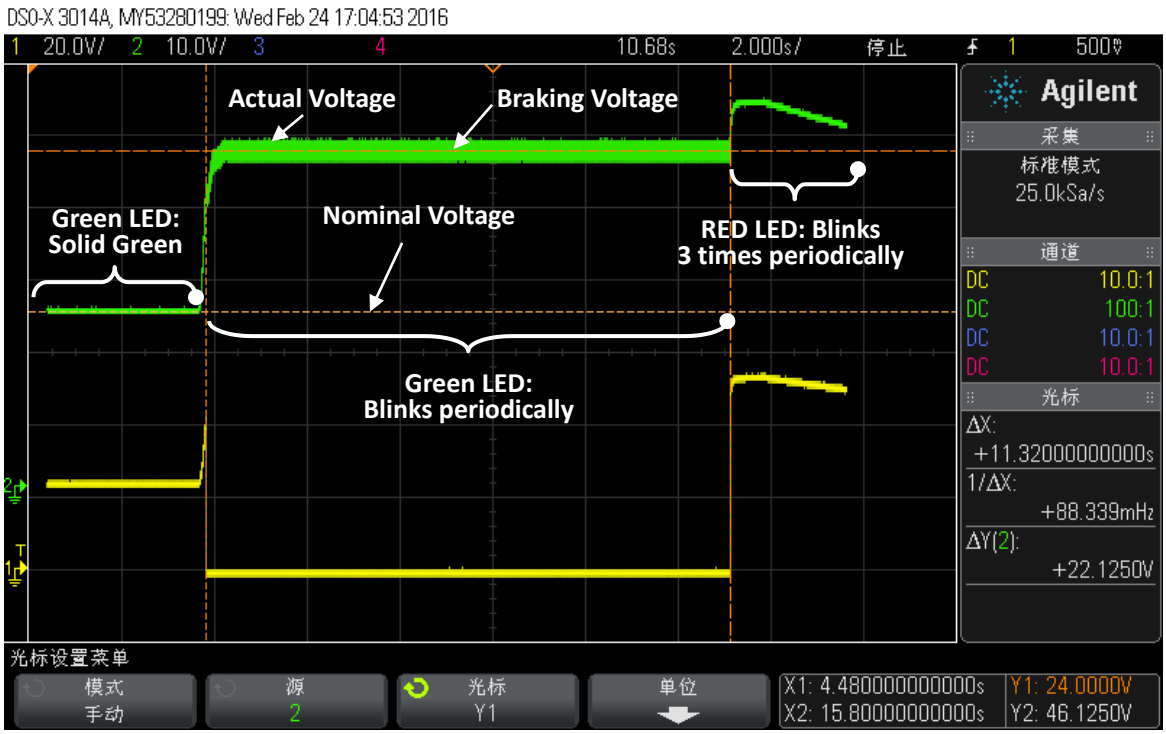

Figure 10 I^2T protection for overload

Note:

Once the I^2T protection function is active or over-temperature deactivation is enabled, the supply voltage cannot be limited anymore. If the shunt regulator fails it must be guaranteed that the drive or the entire system is put into a safe operating state.

Appendix A: Warranty Information

The SR50W shunt regulator comes with 12-month limited warranty under proper use. Contact your SR50W supplier first for warranty service. If your SR50W was bought through Leadshine or one of its subsidiaries, contact us directly.

Contact Us

Contact Leadshine HQ, Leadshine USA Inc., or your local authorized Leadshine distributors for sales, technical support, and other services.

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