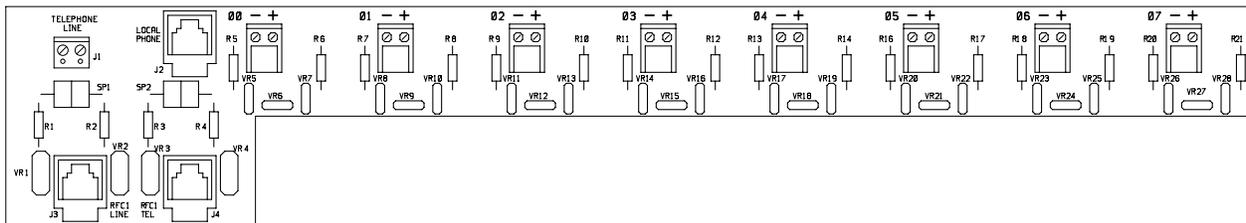


This documentation covers Surge Protector model SP-8 and the telemetry-only version model SP-8/TO.

## Description

The Sine Systems model SP-8 Surge Protector reduces the possibility of damage to the RFC-1 Remote Facilities Control system from high voltage transients generated by lightning and other sources. Using a combination of low-impedance interconnections, gas surge suppressors, metal-oxide varistors, and carbon-film resistors, it provides significant protection against voltage surges from the telephone line, the local telephone, and eight telemetry channels. It is designed to mount directly to the RP-8 Relay Panel with five metal standoffs providing a very low impedance electrical connection to the RFC-1 and RP-8.



The SP-8 package consists of a surge protector board assembly, five metal standoffs, two 24" modular telephone cords and installation instructions with engineering documentation.

Model SP-8/TO is identical to model SP-8 except that it omits the telephone line and local telephone protection. It should be used in systems that have more than one relay panel.

## Electrical Considerations

Without the SP-8 Surge Protector, the electrical potential between the RP-8 panel and all equipment connected to it should be held to within  $\pm 100$  volts during a lightning strike. This is not achievable in many broadcast transmitter installations due to less than ideal grounding.

With the addition of the SP-8 Surge Protector, the peak voltage between the RP-8 panel and the connected equipment can reach up to about  $\pm 4.5$  kilovolts (transient) without damage to the RFC-1 or RP-8. Beyond this level, breakdown occurs between the relay contacts and coils in the control relays and damage usually results.

While 4.5 kilovolts sounds like (and is) a very large surge voltage, it is not uncommon to encounter such conditions in a broadcast installation. For the remote control system, the key to surviving is to connect the RP-8 panel and all the equipment connected to it with a low-impedance connection. The term impedance is crucial here because a low resistance interconnection is not sufficient. A lightning surge contains significant energy over a rather broad spectrum—from DC up to about 4 MHz. Because of this, significant reactance in an interconnection makes it ineffective.

The RP-8 should be installed in a well-grounded metal equipment rack. If this is not possible, install the RP-8 as close to the transmitter as possible and connect the RP-8 panel to the transmitter with a piece of #6 copper wire. A 1/4" bolt and a couple of flat-washers can be used to attach the wire to the RP-8 panel.

In installations where there is a history of extremely strong surges on the telephone line, it is wise to install an inexpensive "sacrificial" telephone-line surge protector ahead of the SP-8. A major strike will reduce the cheap protector to a lump of charcoal, but it will prevent burns and metal vaporization around the line terminals on the SP-8 if it is well grounded.

## Installation



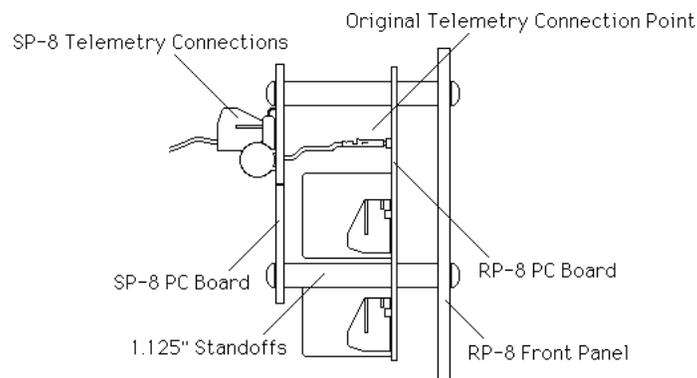
### WARNING!

**Before installing the SP-8 or SP-8/TO Surge Protector, remove all electrical power to the RP-8 Relay Panel and RFC-1 Remote Facilities Controller. Disconnect the flat cable that connects the RFC-1 and RP-8.**

**The telemetry headers on the SP-8 board have sharp points. Be careful not to stick your fingers on the exposed points.**

**The telephone line screw-terminal connector (J1) is NOT depluggable. It looks similar to the depluggable connectors used elsewhere on the SP-8 but it is not.**

To install the SP-8, remove the RP-8 Relay Panel from the rack (if it is already mounted.) Remove the 8 screw terminal connectors from the telemetry inputs. Remove the four Phillips head screws across the top edge of the back side of the RP-8 panel and the screw on the lower left side. Screw the five 1.125" standoffs supplied with the SP-8 module into these locations. Tighten the standoffs moderately but do not over tighten--the standoffs can break.



Place the SP-8 board over the rear of the RP-8 board and plug each of the sixteen female terminals from the SP-8 board onto the telemetry headers on the RP-8 panel. The right side (red) wire in each pair should connect to the "+" telemetry terminal and the left side (black) wire should connect to the "-" terminal. Mount the SP-8 board to the RP-8 panel using the five screws removed earlier.

After the SP-8 is mounted and the screws are tightened, be sure each of the sixteen terminals is firmly seated on the RP-8 telemetry headers and that the wires do not contact the bottom of the SP-8 PC board except where they are soldered to the board. The drawing above is an end-view of the SP-8/RP-8 assembly.

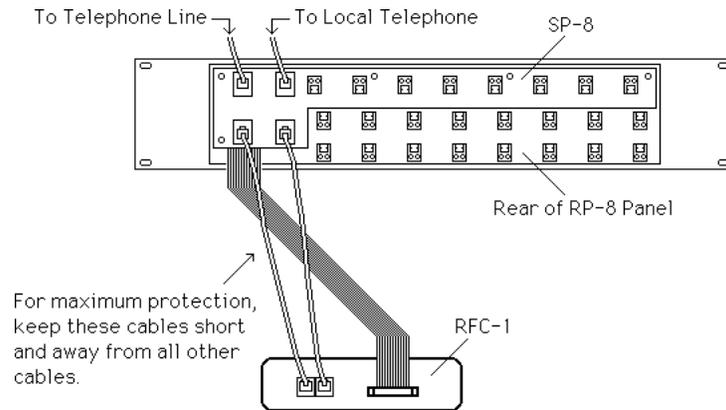
Remount the RP-8 in the equipment rack and reconnect the various telemetry and control connections, the flat cable and the leads from the 12 volt wall-plug transformer. The SP-8 covers the flat cable connector so it is easier to connect this before the RP-8 is remounted.



**WARNING!**

**Mount the RP-8/SP-8 assembly in a metal equipment rack which is electrically connected to earth-ground. This is important not only for the SP-8 to function properly but it is also necessary in order to reduce the risk of electrical shock to operating personnel in the event of a high voltage electrical surge.**

Two, 24 inch modular cords are provided with the SP-8 for connection to the RFC-1. These cords, and the flat cable, should connect to the RFC-1 as directly as possible and should be kept away from all other cables connected to the RP-8. Here is a rear view of the completed assembly:



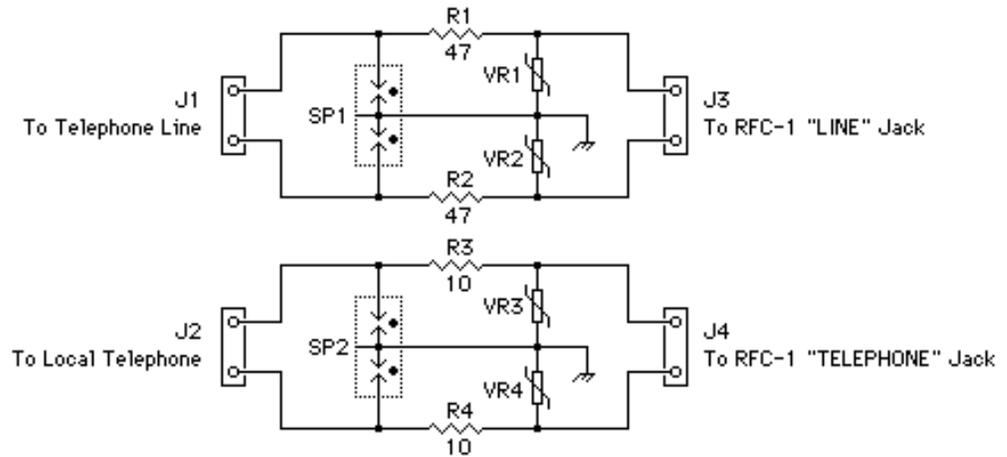
The jack labeled "Local Telephone" should connect only to one telephone that is physically near the RFC-1 system for maximum protection. Extension telephones, especially extension telephones installed at or near tower bases, should connect to the "Line" side.

The "Telephone Line" connection is made with a screw-terminal connector instead of a modular jack. Field experience from earlier SP-8 versions indicated that a modular jack in this location was the weakest link in the protection system. Very strong surges from lightning were found to burn this modular jack right off the PC board. The screw-terminal connector stands a much better chance of survival.

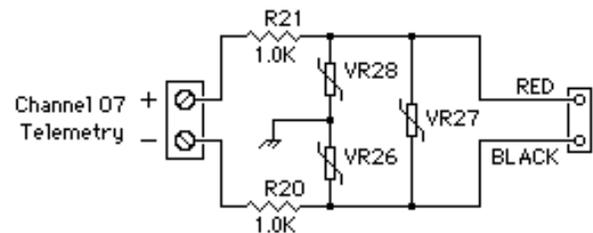
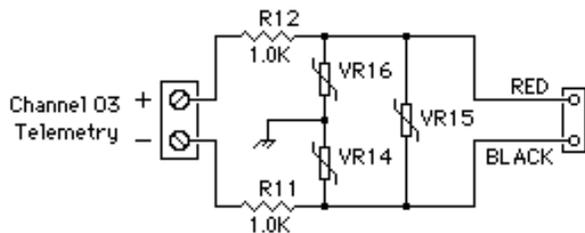
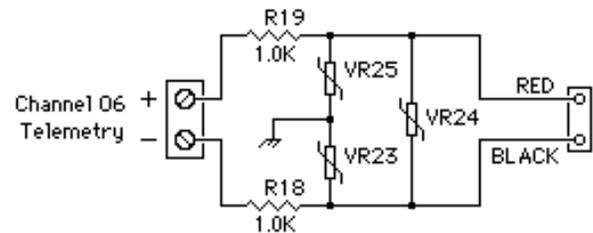
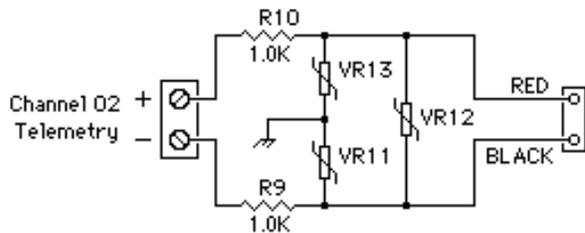
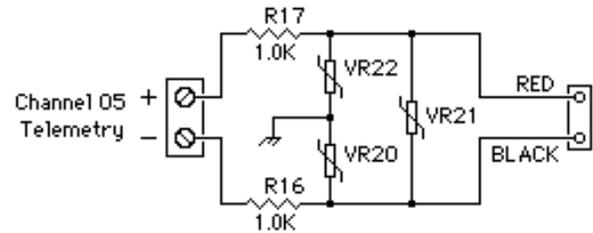
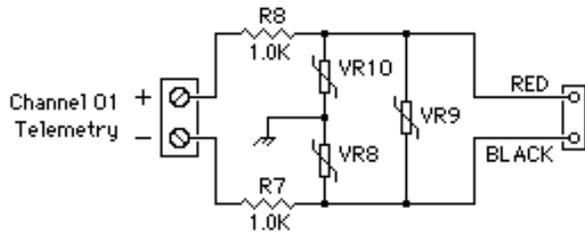
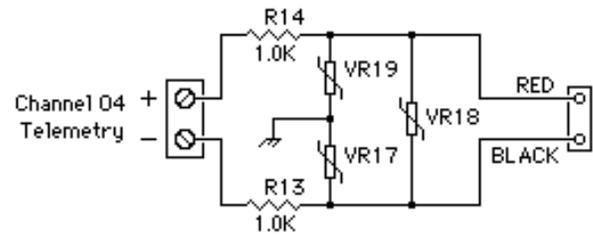
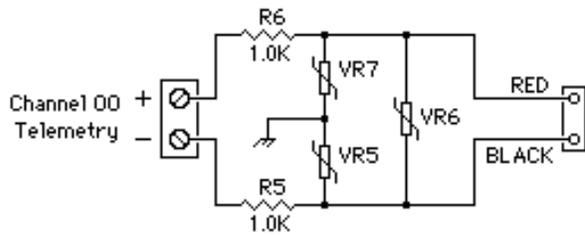
One final note, it is very important to properly connect the telephone line protection. Do not overlook this portion of the installation. The vast majority of damage to remote control systems occurs at the telephone system interface not, as one might expect, at the telemetry interface.

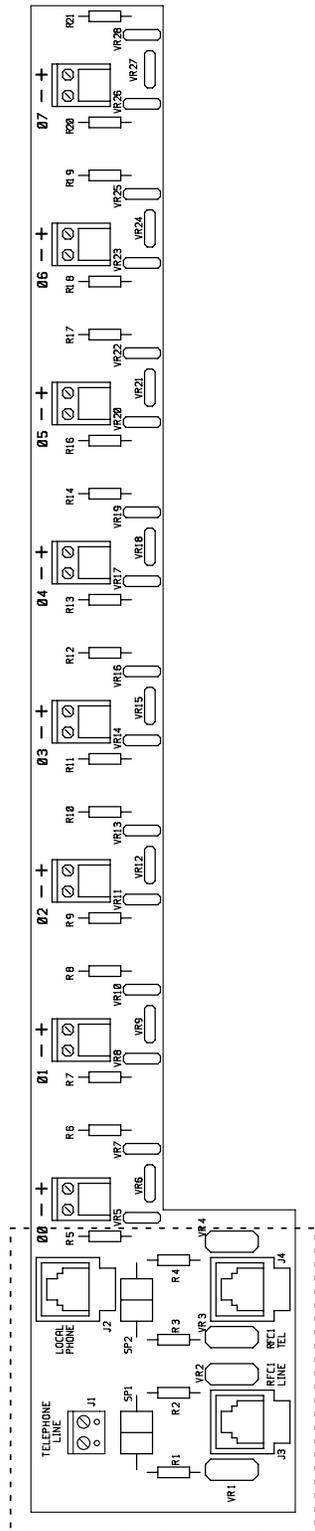
## Parts List

<u>Location</u>	<u>Description</u>
R1, R2	resistor, carbon-film, 1/2 watt, 5%, 47 ohms
R3, R4	resistor, carbon-film, 1/2 watt, 5%, 10 ohms
R7-R21	resistor, carbon-film, 1/2 watt, 5%, 1.0K ohms
VR6, 9, 12, 15, 18, 21, 24, 27	metal-oxide varistor, 14 VDC, Panasonic ERZ-C07DK180 or equivalent
VR5, 7, 8, 10, 11, 13, 14, 16,	metal-oxide varistor, 85 VDC, Panasonic ERZ-C07DK101U or equivalent
VR17, 19, 20, 22, 23, 25, 26, 27	metal-oxide varistor, 85 VDC, Panasonic ERZ-C07DK101U or equivalent
VR1, 2, 3, 4	metal-oxide varistor, 300 VDC, Panasonic ERZ-C10DK361U or equivalent
SP1, 2	surge arrestor, Siemens T61-C350 or equivalent
mounting hardware	standoff, male-female, 1.125" hex x 4-40



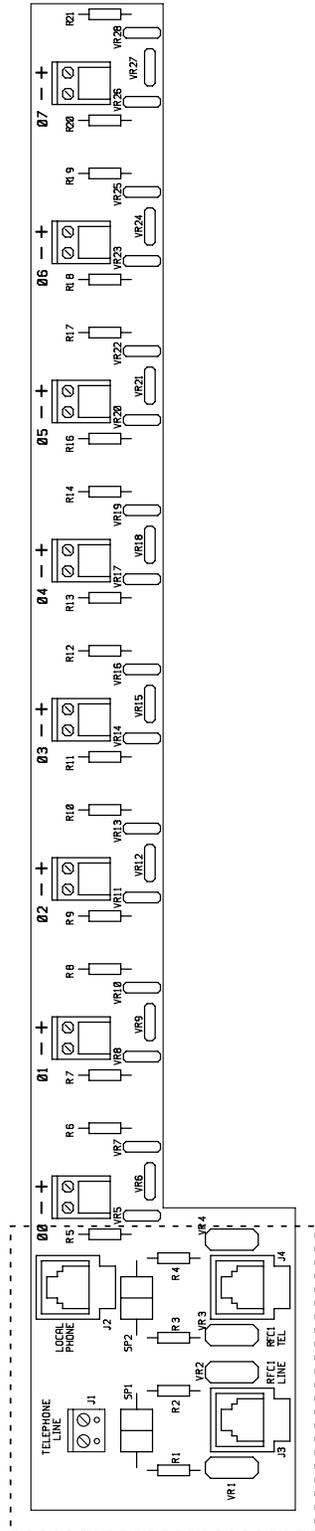
Components above this line not used on SP-8/TO





not used on SP-8/TO

Component Locations  
SP-8 & SP-8/TO



not used on SP-8/TO

Component Locations  
SP-8 & SP-8/TO