Model No. SC-1

Support 877-351-4702

2-10V TO 0-24V SIGNAL CONDITIONER

This manual covers the following products:

SC-1	2-10V to 0-24V Signal Conditioner
TS-01	Temperature senor 40-250°F (4-121°C)

Table of Contents

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Overview

The Roof Top Control Solutions Signal Conditioner is a microprocessor based control that provides a signal conversion from a high impedance 2-10VDC or 4-20mA signal source to drive a 24VDC solenoid. The SC-1 can operate in two modes, selected by a dip switch. "Direct Control(No Limit)" mode simply outputs a 0-24VDC signal to drive a solenoid valve directly proportional to the 2-10VDC input signal. In "Temperature Control(Limit)" the SC-1 acts as a temperature control when used with a TS-01 Temperature Sensor. In this mode the input signal provides a reference temperature, and the internal PID algorithm will automatically drive the valve to achieve the desired discharge temperature. The software provides smooth output control eliminating excessive swings observed with older analog systems. The maximum discharge temperature is limited to 160°F. A 10 second start up delay is standard, and an onboard LED indicates simple diagnostics.

Specifications

Power Requirements	24VAC 50/60Hz 20VA isolated class II transformer
SC-1 Ambient Temperature Limits	
Storage	-40-140°F (-40-60°C)
Operating	-40-140°F (-40-60°C)
TS-01 Ambient Temperature Limits	
Storage	-40-250°F (-40-121°C)
Operating	-40-250°F (-40-121°C)
Accuracy	+/-3°F (1°C)

Installation

All control wiring should be shielded with the shielding grounded at one end only and/or the wiring should be run in separate conduit from any high voltage wires. Interference from these sources could cause control function errors or permanent damage. The SC-1 control should be mounted in a housing free from the elements of weather. Insulated fork terminals are recommended for best contact when attaching wiring to the provided screw terminals. The SC-1 can drive up to a .5 amp 24VDC direct acting solenoid connected at terminals 5 and 6.

Wiring

Direct Control(No Limit)

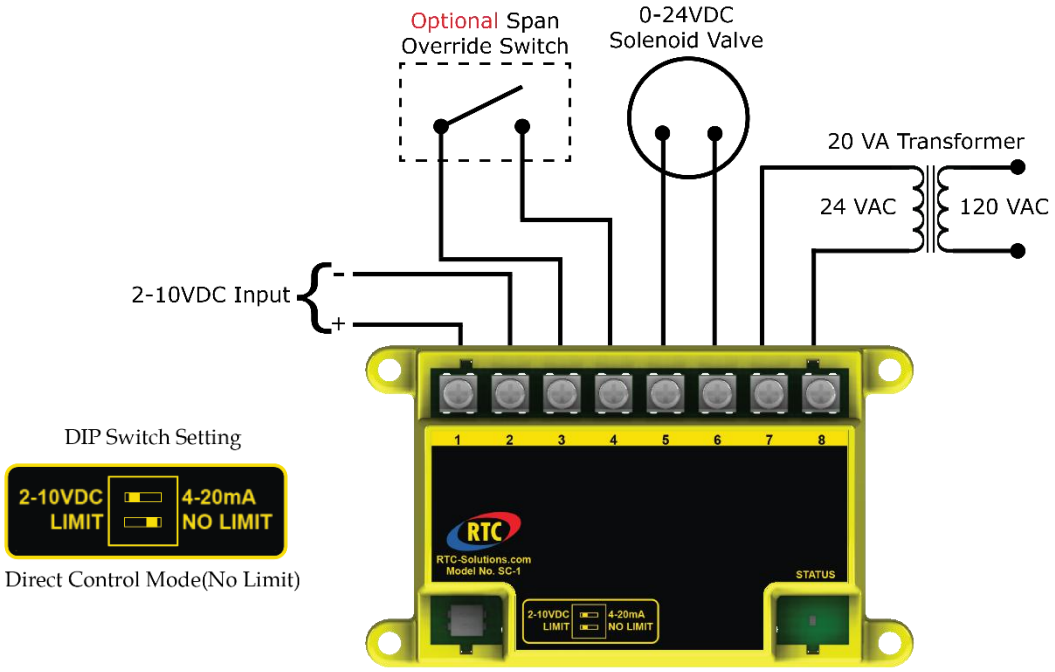

Figure 1 – SC-1 Direct Control Mode(No Limit)

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Temperature Control(Limit)

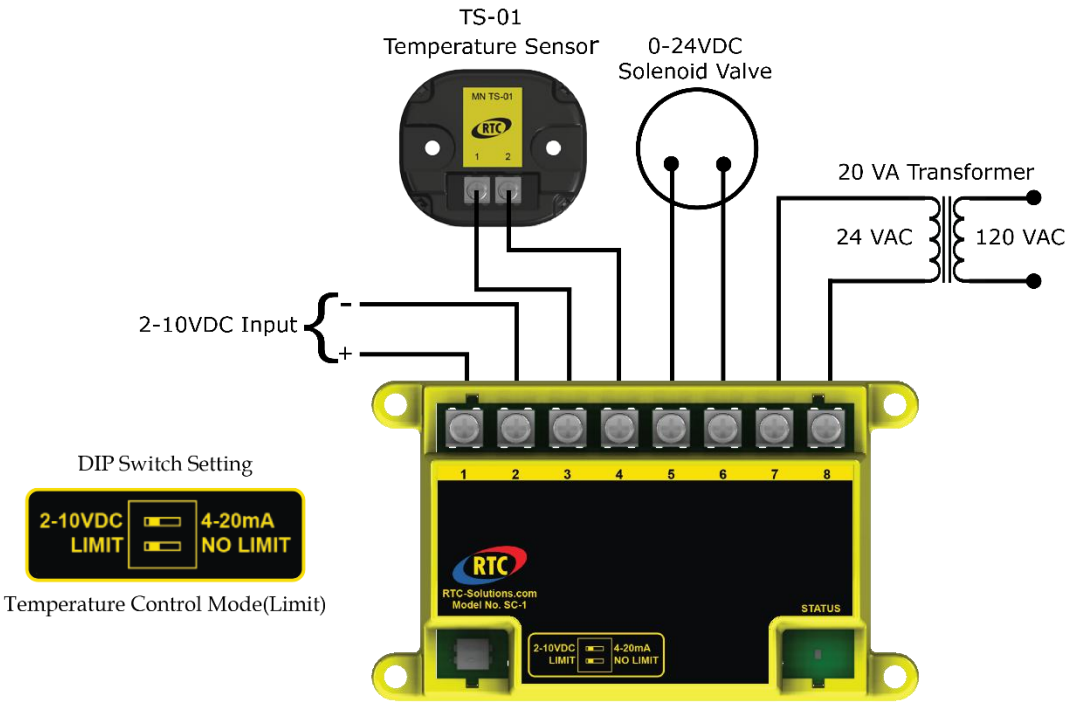

Figure 2 – SC-1 Wiring Temperature Control Mode(Limit)

Operation

Direct Control Mode(No Limit)
In Direct Control Mode(No Limit) the SC-1 outputs a 0-24VDC signal to drive a solenoid valve directly proportional to the 2-10VDC or 4-20mA input signal. In Direct Control Mode(No Limit) you can configure the control for two speed applications by shorting terminals 3 and 4. When shorted the control will output 50% and when open the control will output 100%. The SC-1 comes set to Direct Control Mode(No Limit) by default.

2V Input = 0V Output
10V Input = ~24V Output
10V Input = ~12V Output when 3 and 4 are shorted

Temperature Control Mode(Limit)
In Temperature Control Mode(Limit) the SC-1 acts as a temperature control when used with a TS-01 Sensor. The 2-10VDC or 4-20mA input signal provides a reference temperature, and the internal PID algorithm will automatically drive the valve to achieve the desired discharge temperature. The maximum discharge temperature is limited to 160°F when in Temperature Control Mode(Limit).

The scale for voltage to temperature conversion in this mode is
2VDC = 40°F
10VDC = 160°F
Or F° = (V signal – 2V)/8V*120°F + 40°F

4-20mA
By selecting 4-20mA with a dip switch this allows you to supply a 4-20mA signal source at terminals 1 and 2 to drive a 24VDC solenoid valve. The 4-20mA selection is less susceptible to electrical noise.

DIP Switch Setting

Direct Control Mode(No Limit)

Sequence of operation
Upon applying power to the SC-1 control the 10 second start up delay will begin indicated by a slow blinking green LED (about once every 2 seconds) on the face of the control. After the start up delay has completed, the LED will repeatedly blink green 2-4 times depending on the mode you have the control set to. By default the SC-1 is set to Direct Control Mode(No Limit). At this time the control will begin modulating the output as required. Any system errors are indicated by various LED codes described in Figure 3 below.

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Troubleshooting

The SC-1 control provides some diagnostics via the on board LED labeled "STATUS". A system fault is indicated by various LED codes described in Figure 3. They usually indicate improper voltage or that the sensor is either disconnected, shorted or improperly wired. Check all connections per the included wiring diagrams. The sensor can be tested with an Ohmmeter by removing the wires from the SC-1 control and measuring across the device. The device should measure between 12.8K and 7K OHMS depending on the temperature. If there is a fault light and the sensor measures the proper resistance then the control may be damaged. If there is no fault light but the system is not modulating properly you may check the control output by repeating the start up procedure and measuring terminals 5 and 6 on the SC-1 as stated below.

LED Code	Meaning	Solution
Blinking Green	10 Second Startup Delay	N/A
Double Blinking Green	Normal Run/Limit Mode	N/A
Triple Blinking Green	Normal Run/No Limit Mode 100%	N/A
Quadruple Blinking Green	Normal Run/No Limit Mode 50%	N/A
Triple Blinking Red	Low or High Input Voltage	Measure voltage at terminals 1 and 2 for a 2-10VDC input. Anything < 1.5V and > 11V will trigger and error
Double Blinking Red	Sensor Short(Limit Mode)	Remove wires 3 and 4 and measure resistance across the sensor. Compare resistance to chart.
Blinking Red	Sensor Open(No Limit Mode)	Remove wires 3 and 4 and measure resistance across the sensor. Compare resistance to chart.

Figure 3 – LED Code Chart

Measuring the Control Output

Remove the wire from terminal number 4 on the SC-1 control and measure the voltage across terminals 5 and 6 with a voltmeter. The meter should read from 20 to 24 Volts.

DFTS and DFTD Resistance chart

		Sensor Resistance	Dial Resistance				
Temp °F	**Temp °C**	**40-250**	**40-90**	**80-130**	**120-170**	**160-210**	**200-250**
40	4.4	11210	11250				
50	10.0	11020	11050				
60	15.6	10826	10850				
70	21.1	10630	10650				
80	26.7	10433	10450	10380			
90	32.2	10234	10250	10180			
100	37.8	10034		9980			
110	43.3	9830		9780			
120	48.9	9624		9580	9590		
130	54.4	9413		9380	9390		
140	60.0	9199			9190		
150	65.6	8983			8990		
160	71.1	8766			8790	8700	
170	76.7	8550			8590	8500	
180	82.2	8337				8300	
190	87.8	8130				8100	
200	93.3	7930				7900	8060
210	98.9	7740				7700	7860
220	104.4	7560					7660
230	110.0	7393					7460
240	115.6	7237					7260
250	121.1	7095					7060

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