



# NetSure™ SM-TEMP Temperature Concentrator

## Installation and User Manual

Specification Number: 547490

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### **Technical Support Site**

If you encounter any installation or operational issues with your product, check the pertinent section of this manual to see if the issue can be resolved by following outlined procedures.

Visit <https://www.vertiv.com/en-us/support/> for additional assistance.

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## Admonishments Used in this Document



**DANGER!** Warns of a hazard the reader **will** be exposed to that will **likely** result in death or serious injury if not avoided. (ANSI, OSHA)



**WARNING!** Warns of a potential hazard the reader **may** be exposed to that **could** result in death or serious injury if not avoided. This admonition is not used for situations that pose a risk only to equipment, software, data, or service. (ANSI)



**CAUTION!** Warns of a potential hazard the reader **may** be exposed to that **could** result in minor or moderate injury if not avoided. (ANSI, OSHA) This admonition is not used for situations that pose a risk only to equipment, data, or service, even if such use appears to be permitted in some of the applicable standards. (OSHA)



**ALERT!** Alerts the reader to an action that **must be avoided** in order to protect equipment, software, data, or service. (ISO)



**ALERT!** Alerts the reader to an action that **must be performed** in order to prevent equipment damage, software corruption, data loss, or service interruption. (ISO)



**FIRE SAFETY!** Informs the reader of fire safety information, reminders, precautions, or policies, or of the locations of fire-fighting and fire-safety equipment. (ISO)



**SAFETY!** Informs the reader of general safety information, reminders, precautions, or policies not related to a particular source of hazard or to fire safety. (ISO, ANSI, OSHA)

# **Important Safety Instructions**

## **Safety Admonishments Definitions**

Definitions of the safety admonishments used in this document are listed under “Admonishments Used in this Document” on page iv.

## **Safety and Regulatory Statements**

Refer to Section 4154 (provided with your customer documentation) for Safety and Regulatory Statements.

## **Déclarations de Sécurité et de Réglementation**

Reportez-vous à la Section 4154 (fourni avec les documents de votre client) pour les déclarations de sécurité et de réglementation.

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# 1 Description

This document provides specification, installation, and operational information for the Vertiv™ NetSure™ SM-TEMP Temperature Concentrator that is designed for use in both -48V and +24V systems.

Vertiv™ NetSure™ Power Systems can be operated in conjunction with one or more battery and/or ambient temperature probes. With a battery probe installed and connected, the power system is designed to automatically increase or decrease output voltage as battery temperature decreases or increases, respectively. This maintains an optimum charge voltage to the battery with respect to temperature, thereby extending battery life.

Each SM-TEMP module receives temperature inputs from up to 8 solid-state temperature sensors (AD592B type). These are the same temperature sensors currently connected to the temperature inputs of the SCU, SCU+, ACU, ACU+, and NCU controllers.

The SM-TEMP module provides a 125 kbps CAN output of the temperature of all connected sensors. There are address DIP switches to allow up to eight (8) SM-TEMP modules to operate concurrently on the same CAN bus.

The SM-TEMP module provides an analog output of the average or the maximum (DIP switch configurable) of the temperatures of the connected sensors. The output is a current source providing 1  $\mu$ A/K. The output is compatible with the temperature port input of the SCU, SCU+, ACU, ACU+, and NCU controllers. When multiple SM-TEMP modules are used, the analog output of only one of the SM-TEMP modules is connected to the controller's temperature port input.

When used with an ACU+ (version 3.02 or later) or NCU, in lieu of connecting the analog output of the SM-TEMP module to an ACU+ or NCU temperature port input, the SM-TEMP module can simply be connected at the end of the ACU+ or NCU CAN bus. Via the CAN bus, the ACU+ or NCU reads each temperature probe from each SM-TEMP module.

## 2 Specifications

### 2.1 Electrical

- Input Voltage:  $\pm$ 18-60 volts DC
- Input Current: 0.1 Amps
- Input Protection: Internal 3 ampere fuse, not user replaceable. An external 1-1/3 ampere fuse should be user-provided in the ungrounded input conductor.

### 2.2 Environmental

- Operating Ambient Temperature Range:  
-40°C to +70°C (-40°F to +149°F)
- Temperature Measurement Range:  
-25°C to +105°C (-13°F to +221°F)
- Storage Ambient Temperature Range:  
-40°C to +85°C (-40°F to +185°F)
- Humidity: Capable of operating in an ambient relative humidity range of 0% to 95%, non-condensing
- Altitude: Will operate at any elevation between sea level and 10,000 ft.

## 2.3 Accessories



**NOTE!** This information is provided for reference. Refer to power system documentation when ordering these accessories.

### **Battery Temperature Probes**

Temperature probe kits are ordered separately.

3.3 meter – P/N 556155

10.3 meter – P/N 552992

### **Optional Temperature Probes**

#### **Features**

Up to two (2) temperature probes can be connected to the IB2 (controller Interface Board). Up to two (2) additional temperature probes can be connected to the optional EIB (controller Extended Interface Board). Any combination of the four (4) temperature probes can be programmed to monitor ambient temperature and/or battery temperature. In addition, the SM-TEMP can be cascaded up to (8) units, connecting up to (64) additional temperature probes. In total, a maximum of (68) probes can be connected via ACU+ or NCU monitoring. A temperature probe set to monitor battery temperature can also be used for the rectifier battery charge temperature compensation feature, or the battery charge temperature compensation feature can be programmed to use the average or highest value of all battery temperature probes.

The battery charge temperature compensation feature allows the controller to automatically increase or decrease the output voltage of the system to maintain battery float current as battery temperature decreases or increases, respectively. Battery life can be extended when an optimum charge voltage to the battery with respect to temperature is maintained. A temperature probe set to monitor battery temperature can also be used for the BTRM (Battery Thermal Runaway Management) feature. The BTRM feature lowers output voltage when a high temperature condition exists to control against battery thermal runaway.

A temperature probe used for battery charge temperature compensation or BTRM (Battery Thermal Runaway Management) should also be mounted on the negative post of a battery cell.

A temperature probe programmed to monitor ambient temperature should be mounted in a convenient location, away from direct sources of heat or cold.

- The temperature sensor end of the probe contains a tab with a 5/16" clearance hole for mounting.

#### **Restrictions**

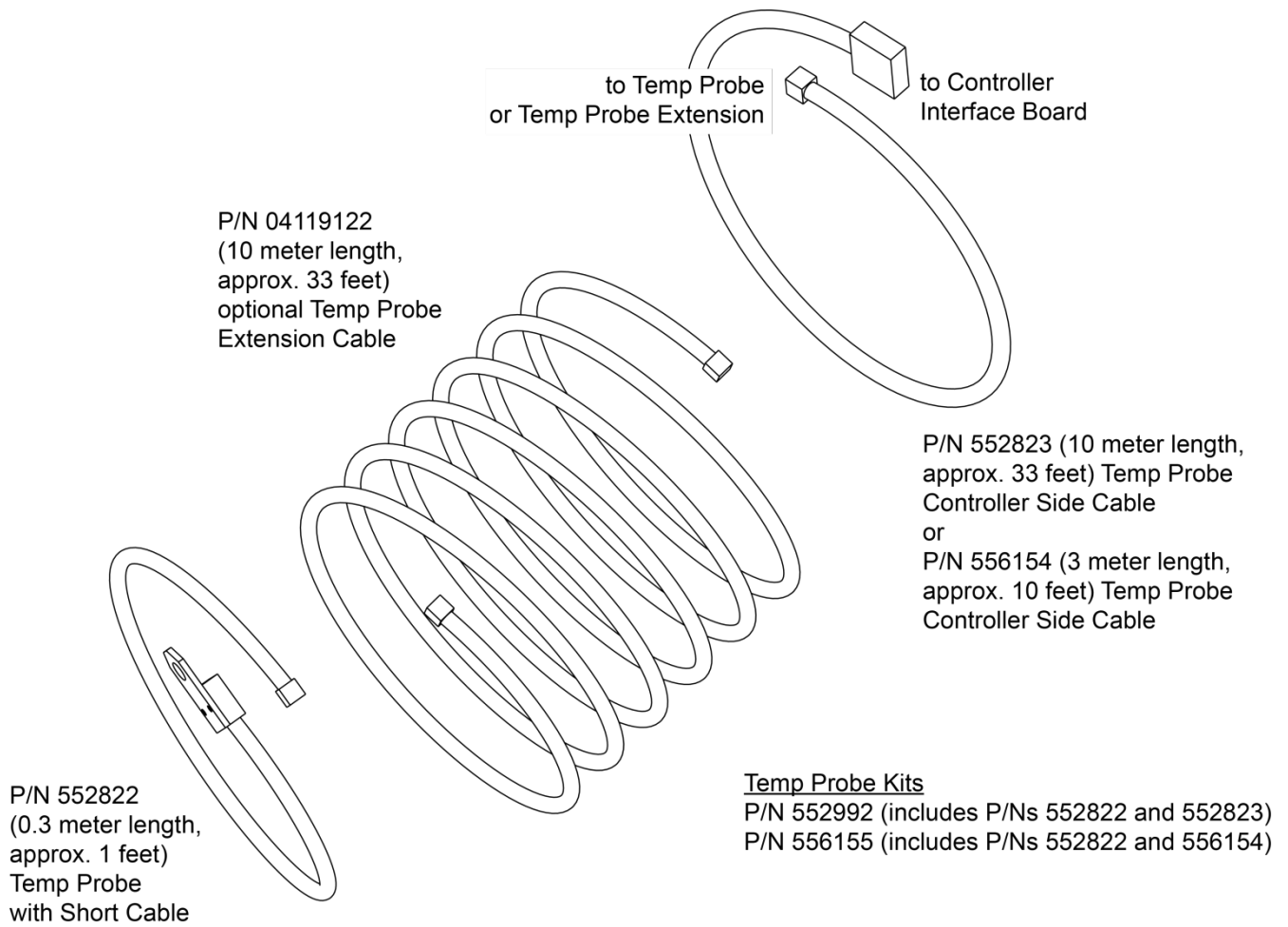
A temperature probe programmed to monitor battery temperature should be mounted on the negative post of a battery cell to sense battery temperature.

#### **Ordering Notes**

1. Order temperature probes as required. Note that each temperature probe consists of two pieces which plug together to make a complete probe (see the following illustration). For a complete temperature probe, order one (1) P/N 552992 (10.3 meters) or one (1) P/N 556155 (3.3 meters). If additional length is required, order temperature probe extension cable P/N 04119122 (10 meters).
2. If more probes are desired, order one or more SM-Temp Temperature Concentrator, P/N 547490.

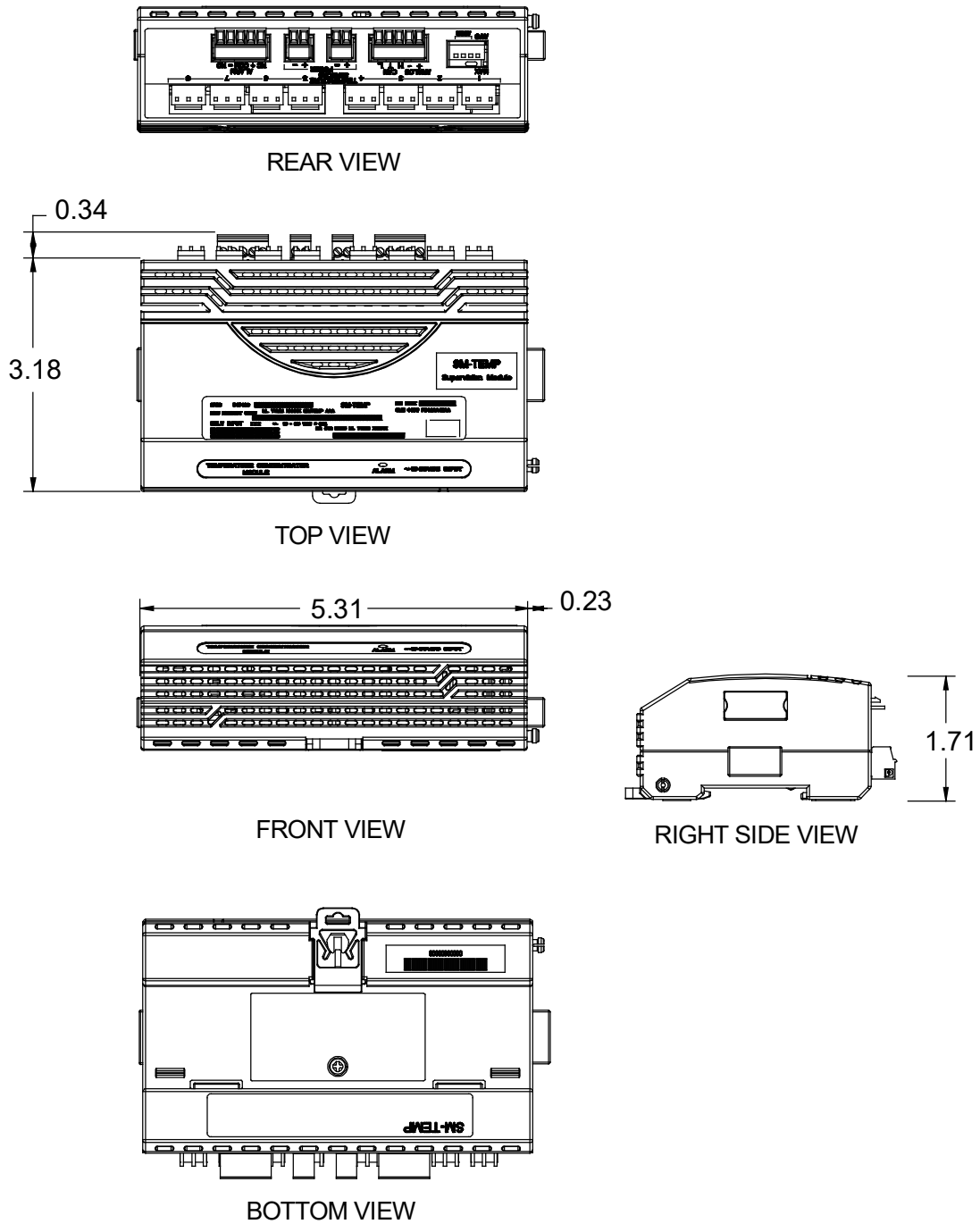


Figure 2.1 Temperature Probe Kit



## 2.4 Dimensions

Figure 2.2 Dimensions (in inches)



## 3 Installation

### 3.1 Important Safety Instructions



**DANGER!** Batteries can produce large amounts of electrical current. Read and follow the “Important Safety Instructions” at the beginning of this document before proceeding.

### 3.2 User Selections (Switch S1)

See Figure 3.1 for location of switch S1.

**Table 3.1 S1 Output Mode Switch Settings**

POSITION	FUNCTION
1	Compensation Mode (for SM-TEMP Analog Output) (Maximum / Average Temperature)
2	CAN Address (switch position #2 sets the most significant bit, switch position #4 sets the least significant bit)
3	
4	

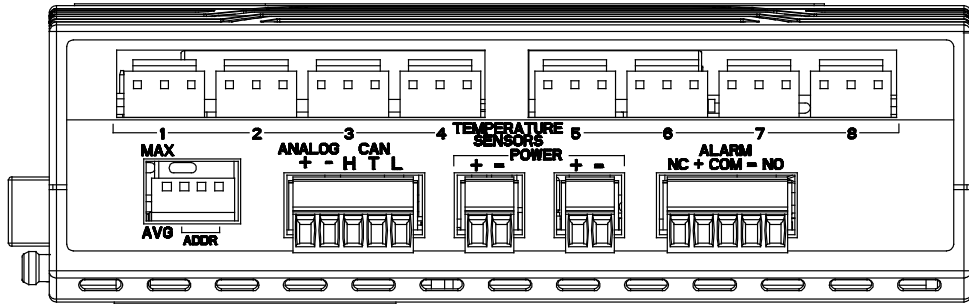
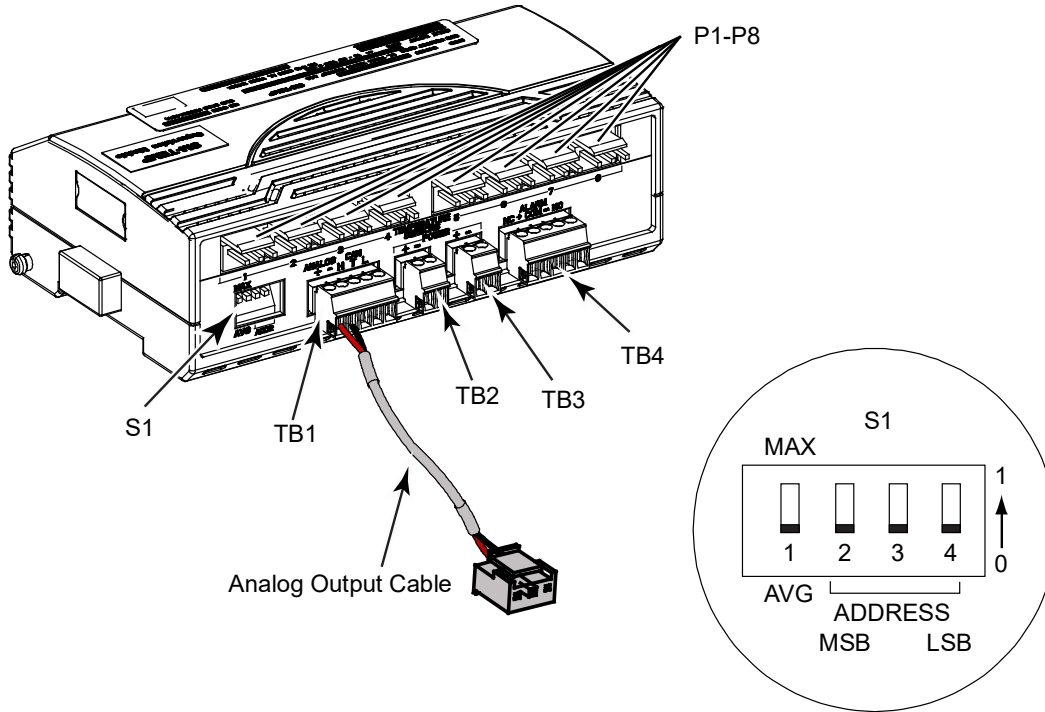


**NOTE!** Up to eight (8) SM-TEMP modules may be connected together via a CAN bus. Use switch positions 2 – 4 to give each module a unique address. See Table 3.2.

**Table 3.2 SM-Temp CAN Bus Addressing**

SM-TEMP MODULE #	SWITCH POSITIONS		
	2	3	4
1	0	0	0
2	0	0	1
3	0	1	0
4	0	1	1
5	1	0	0
6	1	0	1
7	1	1	0
8	1	1	1

Figure 3.1 Connector Locations



Rear View

## 3.3 Mounting

### Mounting the SM-TEMP

A 6" DIN rail, P/N 116765, is included with each module.

### Mounting the Battery Temperature Probes



**DANGER!** Batteries can produce large amounts of electrical current. Read and follow the “Important Safety Instructions” at the beginning of this document before proceeding.

Refer to power system documentation for mounting guidelines.

## 3.4 Electrical Connections

Refer to Figure 3.1 for connector locations.

### General

- CAN bus and analog output connections are made to TB1. TB1 provides screw compression type terminals, which accept a wire size of 28-16 AWG. Strip 1/4" of insulation from each lead; insert the lead in the wire cavity and tighten the screw. Recommended torque is 2 in-lbs.
- Power connections are made to terminal blocks TB2 or TB3 (the other terminal block is available to feed this power to other SM-TEMP units or other SM modules). TB2 and TB3 provide screw compression type terminals, which accept a wire size of 28-16 AWG. Strip 1/4" of insulation from each lead; insert the lead in the wire cavity and tighten the screw. Recommended torque is 2 in lbs.
- Alarm connections are made to terminal block TB4. TB4 provides screw compression type terminals, which accept a wire size of 28-16 AWG. Strip 1/4" of insulation from each lead; insert the lead in the wire cavity and tighten the screw. Recommended torque is 2 in-lbs.
- The SM-TEMP receives temperature information from temperature probes. These are the same types used with the power system controllers (NCU, ACU, ACU+, SCU, or SCU+) when the SM-TEMP is not present. The temperature probes plug into the eight connectors on the top row on the back of the SM-TEMP (P1 – P8). Temperature probe connections are made by means of locking-plug type connectors.

### Input Power



**NOTE!** Observe correct polarity. The + side of the power input (ground in a -48V system, battery in a +24V system) goes to the + terminal, while the – side of the power input goes to the – terminal. Provide an external 1-1/3A fuse in the ungrounded input lead.

Connect power from a distribution fuse to either one of the two terminal blocks (TB2 or TB3).

1. Connect positive (+) battery to terminal 1 of TB2 or TB3.
2. Connect negative (–) battery to terminal 2 of TB2 or TB3.

### External Fail Alarm

Alarm contacts are rated for 0.5A at 125VAC, 1A at 30VDC, and 0.3A at 110VDC.

When used with a controller on the CAN bus, the controller will issue alarms for bad or disconnected probes or SM-TEMP units. Refer to the controller manual for more information.



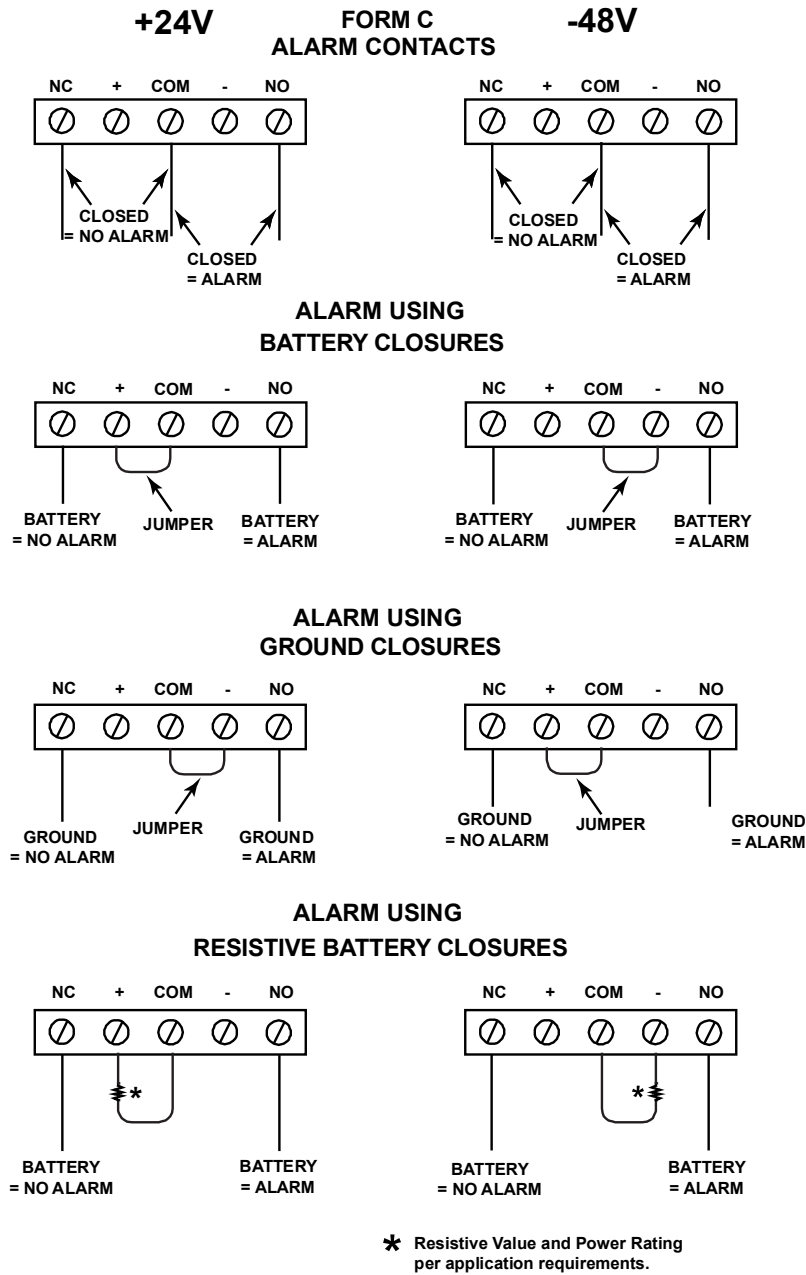
**NOTE!** Do not apply voltages higher than 42.4 volts AC (peak) or 60 volts DC.

In the event of an alarm condition, a closed loop circuit will be provided between terminals 3 and 5 of terminal block TB4, and an open loop circuit will be provided between terminals 1 and 3 of TB4. Refer to Figure 3.2 for alarm configurations.

**Probes**

Plug the Battery Temperature Probe(s) into connectors P1-P8 on the SM-TEMP. Probe locations can be recorded on the label provided on the SM-TEMP.

**Figure 3.2 Alarm Wiring (TB4)**



## Interface Connection to the Power System

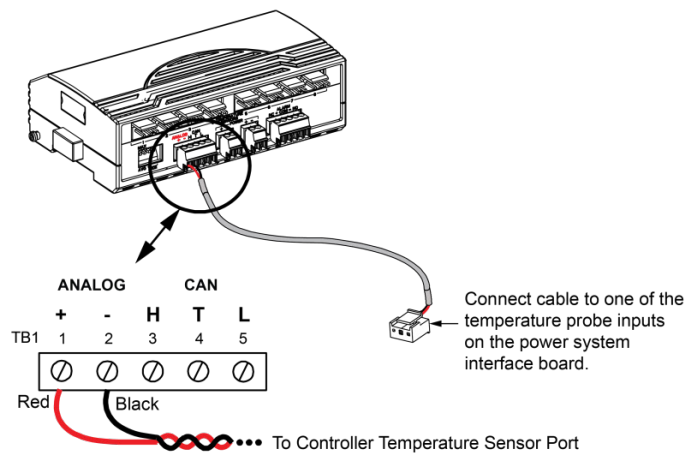
### When Connected to a Controller's Temperature Port Input

The SM-TEMP module is designed to interface with the following Controllers: NCU, ACU, ACU+, SCU, and SCU+. Use cable P/N 547565 (shipped loose with each unit) when using the analog output of the SM-TEMP.

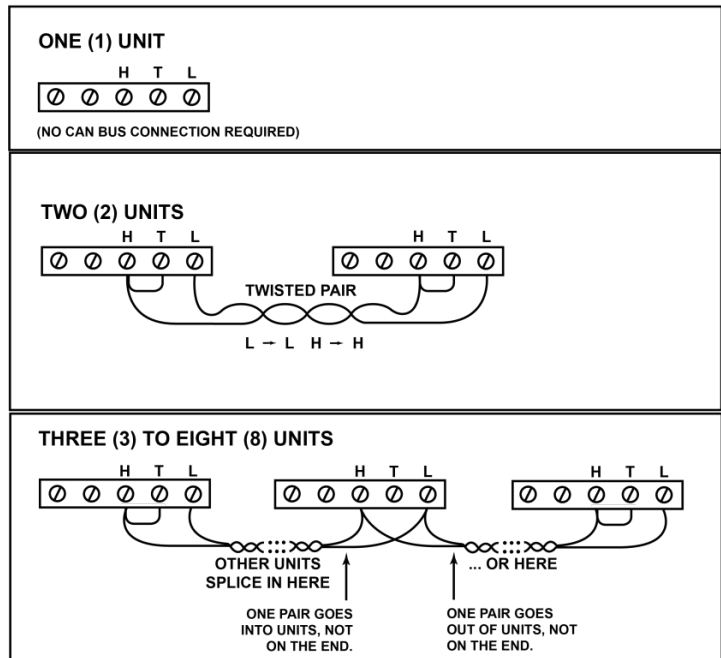
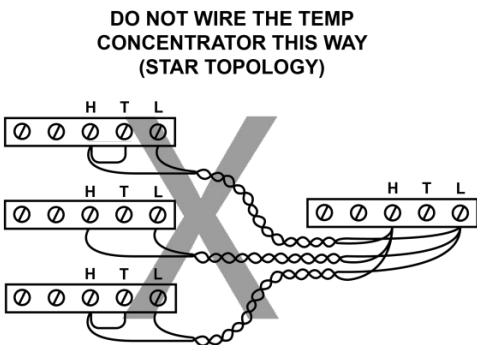
- The analog output connections are made to TB1 pins 1-2. Refer to Figure 3.1 and Figure 3.3. When multiple SM-TEMP modules are used, the analog output of only one of the SM-TEMP modules is connected to the controller's temperature port input.
- CAN bus connections are made to TB1 pins 3-5. See Figure 3.3 for correct CAN bus wiring.

**Figure 3.3 SM-TEMP Connections (when connecting the SM-TEMP analog output to the Controller's temperature sensor port and not connecting into the Controller's CAN bus)**

**ANALOG OUTPUT CONNECTION**  
(when connecting the SM-TEMP analog output to the Controller's temperature sensor port and not connecting into the Controller's CAN bus)



**CAN BUS INTERCONNECTIONS**  
(when connecting the SM-TEMP analog output to the Controller's temperature sensor port and not connecting into the Controller's CAN bus)



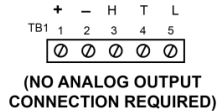
**When Connected into the ACU+ or NCU CAN Bus**

When used with an ACU+ (version 3.02 or later) or NCU, in lieu of connecting the analog output of the SM-TEMP module to an ACU+ or NCU temperature port input, the SM-TEMP module can simply be connected at the end of the ACU+ or NCU CAN bus.

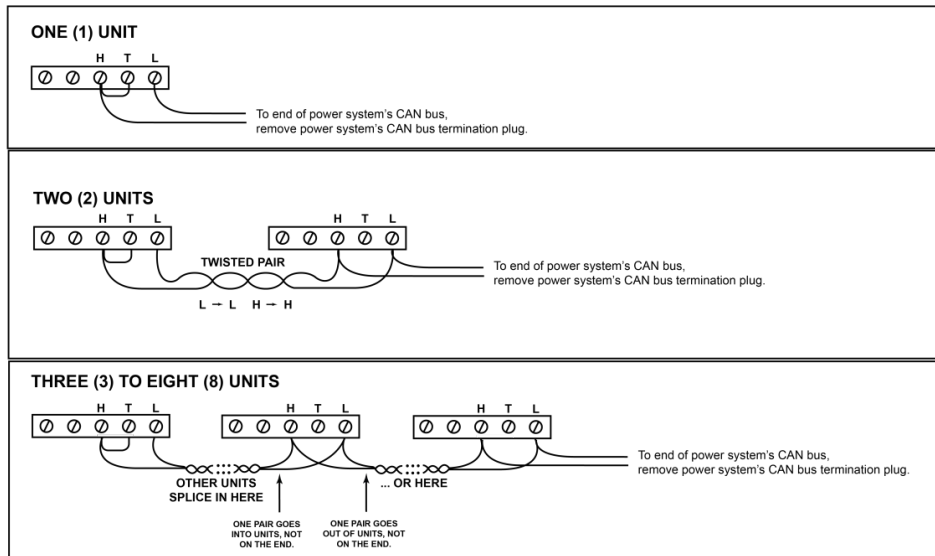
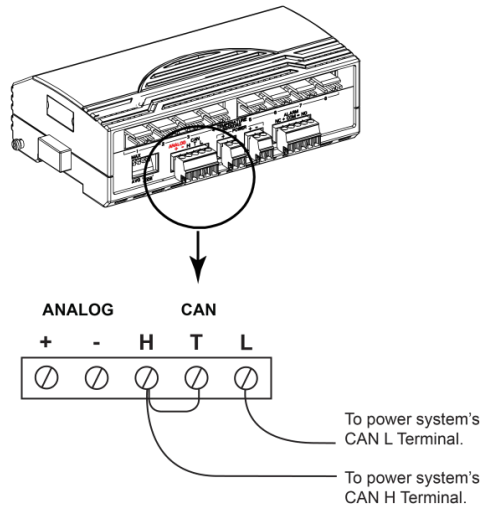
- The analog output connections ARE NOT REQUIRED.
- CAN bus connections are made to TB1 pins 3-5. See Figure 3.4 for correct CAN bus wiring.

**Figure 3.4 SM-TEMP Connections (when connecting the SM-TEMP to the ACU+ or NCU CAN bus and not connecting the SM-TEMP analog output to the ACU+ or NCU temperature sensor port)**

ANALOG OUTPUT CONNECTION NOT REQUIRED  
(when connecting the SM-TEMP to the Controller's CAN bus and not connecting the SM-TEMP analog output to the Controller's temperature sensor port)



CAN BUS INTERCONNECTIONS  
(when connecting the SM-TEMP to the Controller's CAN bus and not connecting the SM-TEMP analog output to the Controller's temperature sensor port)

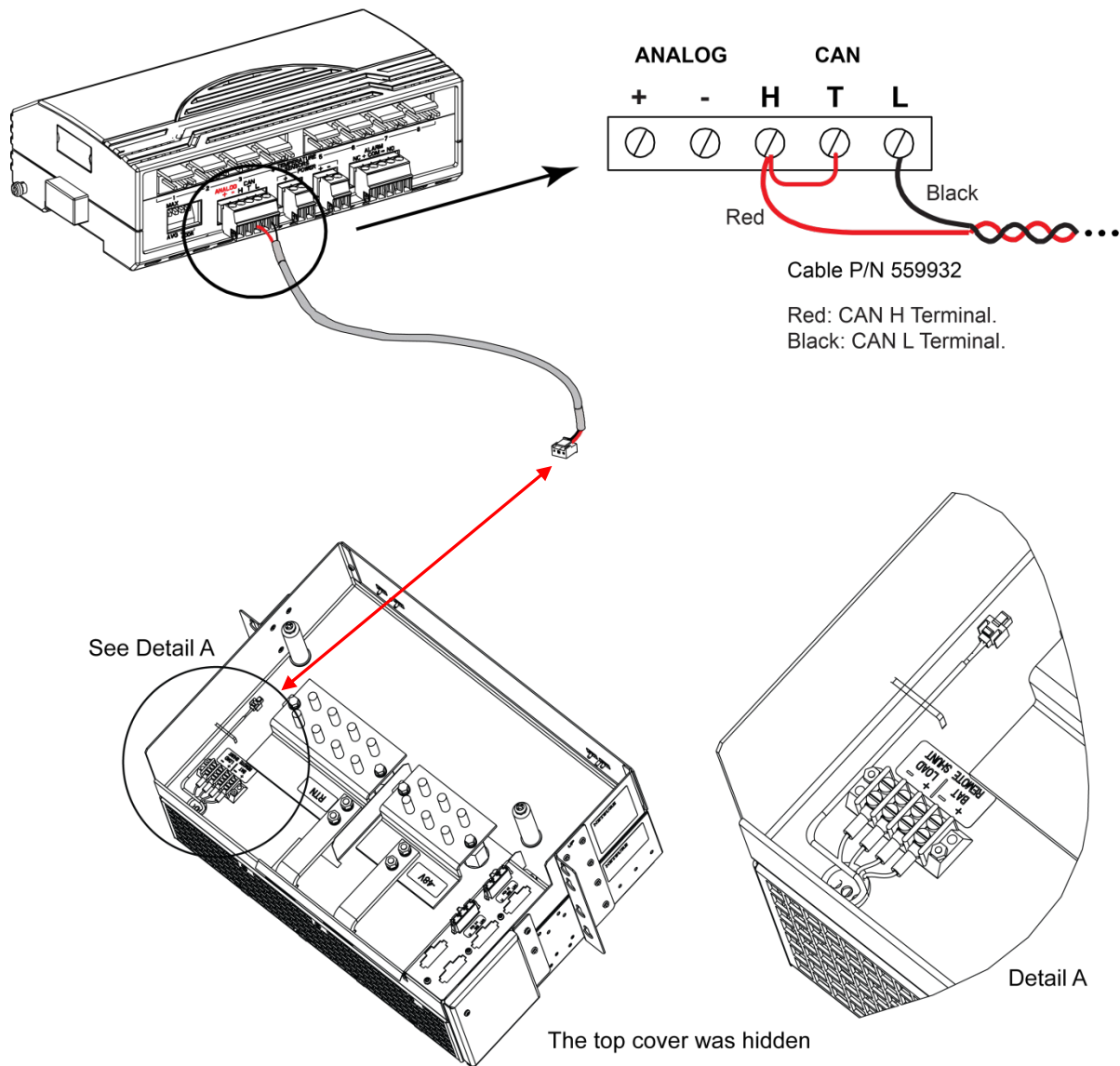




**Connecting the SM-TEMP Module's CAN Terminals to the NCU or ACU+ CAN Bus in a Spec. No. 582136800 Power System (List 5 – List8)**

Refer to Figure 3.5.

**Figure 3.5 SM-TEMP Connections (when connecting the SM-TEMP to the NCU or ACU+ CAN Bus in a Spec. No. 582136800 Power System, List 5 – List8)**



## 3.5 Initially Starting and Checking Operation

After all electrical connections have been made and verified, perform the following procedures to start and verify SM-TEMP operation.

### **Initial Startup**

1. With the Power System operating, verify that the STATUS LED on the SM-TEMP is continuously illuminated GREEN.
  - a) If the STATUS LED does not illuminate, check for correct voltage and polarity at terminals 1 and 2 of TB2 and / or TB3 on the SM-TEMP.
  - b) If the STATUS LED illuminates continuously RED, the SM-TEMP has failed. Replace the SM-TEMP.
  - c) If the STATUS LED flashes red, update the temperature probe inventory by cycling output mode switch 1 (the left-most switch) three times in rapid succession. This should restore the STATUS LED to continuous green illumination. Note that any alarms for open temperature probes will be permanently lost.
  - d) If the STATUS LED flashes green, CAN address switches 2-4 on two SM-TEMP units connected by single CAN bus are set to the same address. Changing the switch settings on one of the affected SM-TEMP units should restore the STATUS LEDs on both units to continuous green illumination.
  - e) Verify Power System output voltage is as required by the temperature of the battery. Refer to the Power System documentation for details.

### **Checking the Fail Alarm**

1. Unplug any temperature probe from the SM-TEMP.
  - a) Requirement: The STATUS LED flashes RED.
  - b) Requirement: External fail alarms activate (if connected).
2. Unplug all temperature probes from all SM-TEMP units
  - a) Requirement: Power System output voltage switches to a default setting of approximately 54.48 volts DC.
3. Plug all temperature probes into the SM-TEMP.
  - a) Requirement: The STATUS LED illuminates GREEN.
  - b) Requirement: External fail alarms reset (if connected).
  - c) Requirement: Control of Power System output voltage is returned to temperature probe(s) (see Power System documentation).

## 4 Controls and Indicators

The STATUS LED on the SM-TEMP indicates possible trouble conditions in the SM-TEMP.

- STATUS LED Does Not Illuminate: A fault in the SM-TEMP is indicated. Check for proper input voltage (18-60 VDC) and polarity at terminals 1(+) and 2(-) of TB2 or TB3 on the SM-TEMP. Correct as required.
- STATUS LED flashes RED: Open or short condition in probe is indicated. Check to ensure that at least one temperature probe is connected to the SM-TEMP.
- STATUS LED illuminates GREEN: Normal operation is indicated.

**Table 4.1 Status Indicators**

TYPE	COLOR	DESCRIPTION
LED	Green	Module is powered and OK
	Flashing Green	Module is powered, operating correctly, and has all temperature sensors operating correctly, but two modules on the same CAN bus have the same address.
	Red	Module is powered but not operating correctly.
	Flashing Red	Module is powered and operating correctly, but one or more temperature sensors has failed or has been unplugged. To clear the alarm from failed or unplugged temperature sensors, toggle S1-1 three times in rapid succession.
	Off	Module is not powered.

## 5 Operating Procedures

Operation of the SM-TEMP is completely automatic, and User intervention should not be required.

## 6 Adjustments

Other than the initial setting of the maximum temperature / average temperature switch and the address switches, no adjustment of the SM-TEMP is required or provided. Refer to the Power System documentation for all Power System adjustment procedures.

## 7 Troubleshooting and Repair



**NOTE!** Refer to the Power System documentation for troubleshooting possible Power System or Battery Temperature Probe failures.

The SM-TEMP contains no user-replaceable parts. No attempt should be made to open or repair the SM-TEMP. If repair is required, contact Vertiv Co.



**NOTE!** See Table 4.1 for Status Information.

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