SM-TEMP Temperature Concentrator
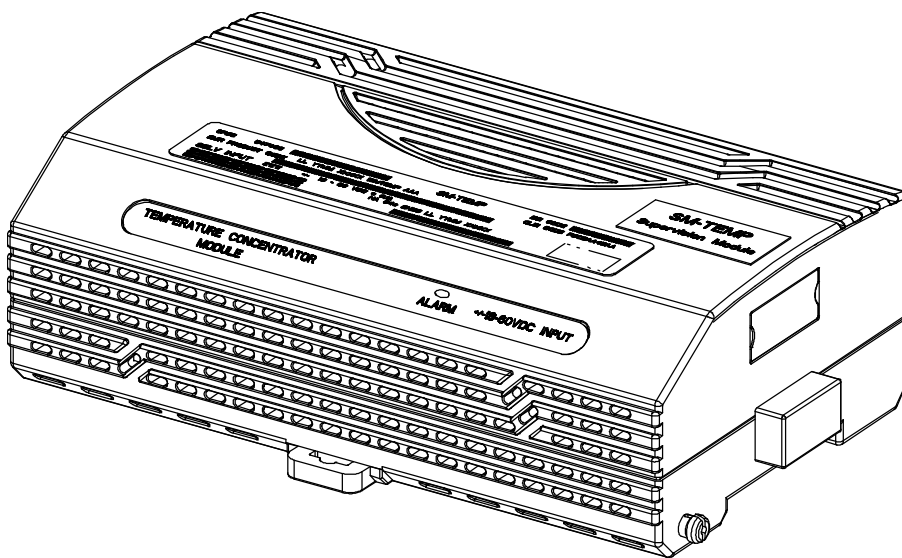
Installation and User Manual, UM547490 (Issue AG, September 24, 2013)

Specification Number: 547490

EMERSON
Network Power

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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

General Safety

⚠️ **Danger**

DANGER!
YOU MUST FOLLOW APPROVED SAFETY PROCEDURES.

Performing the following procedures may expose you to hazards. These procedures should be performed by qualified technicians familiar with the hazards associated with this type of equipment. These hazards may include shock, energy, and/or burns. To avoid these hazards:

a. The tasks should be performed in the order indicated.

b. Remove watches, rings, and other metal objects.

c. Prior to contacting any uninsulated surface or termination, use a voltmeter to verify that no voltage or the expected voltage is present.

d. Wear eye protection.

e. Use double insulated tools appropriately rated for the work to be performed.

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Description

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

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, and ACU+ 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 µA/K. The output is compatible with the temperature port input of the SCU, SCU+, ACU, and ACU+ 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), in lieu of connecting the analog output of the SM TEMP module to an ACU+ temperature port input, the SM TEMP module can simply be connected at the end of the ACU+ CAN bus. Via the CAN bus, the ACU+ reads each temperature probe from each SM TEMP module.

Specifications

Electrical

- Input Voltage: ±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.

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.

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 (ACU+ Interface Board). Up to two (2) additional temperature probes can be connected to the optional EIB (ACU+ 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+ 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 t he 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.
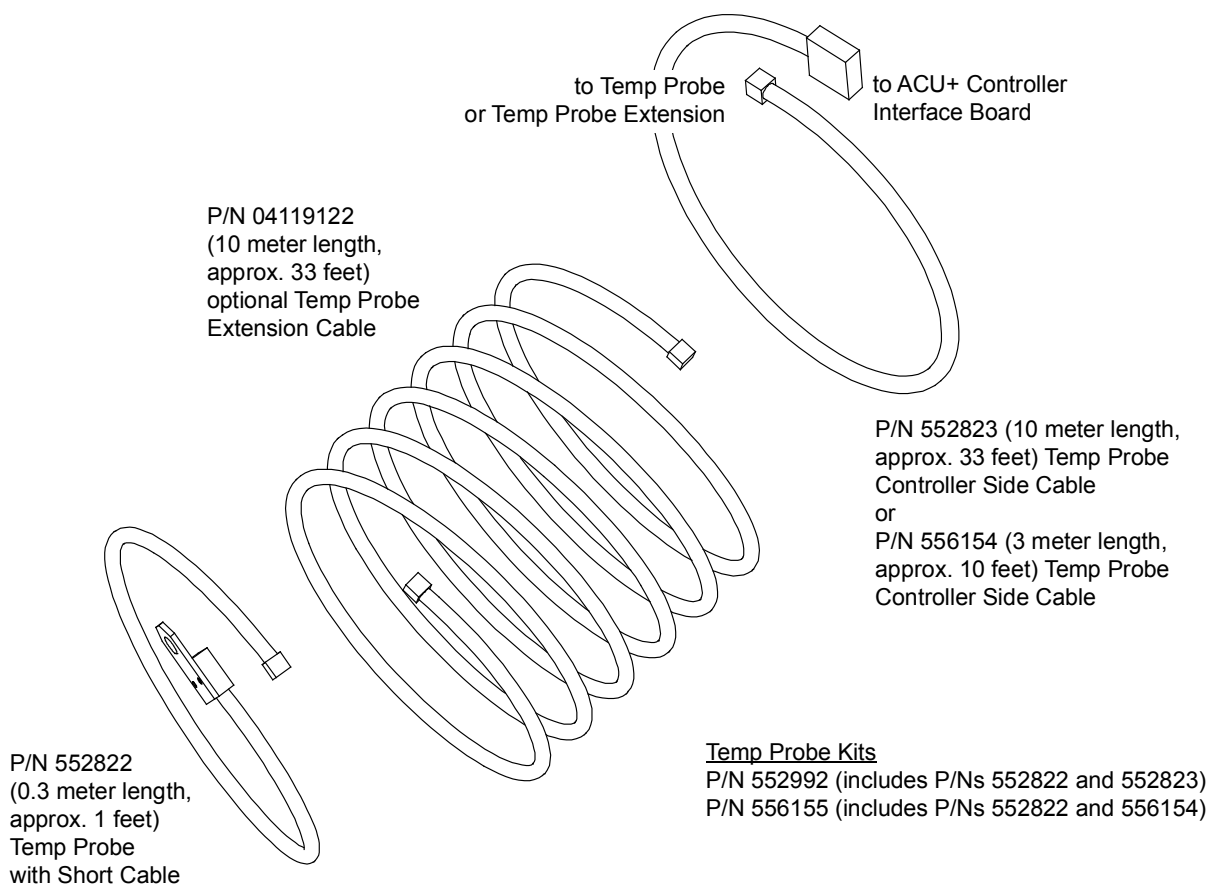
Restrictions

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 1. Temperature Probe Kit

to Temp Probe
or Temp Probe Extension

to ACU+ Controller
Interface Board

P/N 04119122
(10 meter length,
approx. 33 feet)
optional Temp Probe
Extension Cable

P/N 552823 (10 meter length,
approx. 33 feet) Temp Probe
Controller Side Cable
or
P/N 556154 (3 meter length,
approx. 10 feet) Temp Probe
Controller Side Cable

P/N 552822
(0.3 meter length,
approx. 1 feet)
Temp Probe
with Short Cable

Temp Probe Kits
P/N 552992 (includes P/Ns 552822 and 552823)
P/N 556155 (includes P/Ns 552822 and 556154)

Dimensions

Figure 2. Dimensions (in inches)

REAR VIEW

TOP VIEW

0.34

3.18

FRONT VIEW

5.31

0.23

RIGHT SIDE VIEW

1.71

BOTTOM VIEW
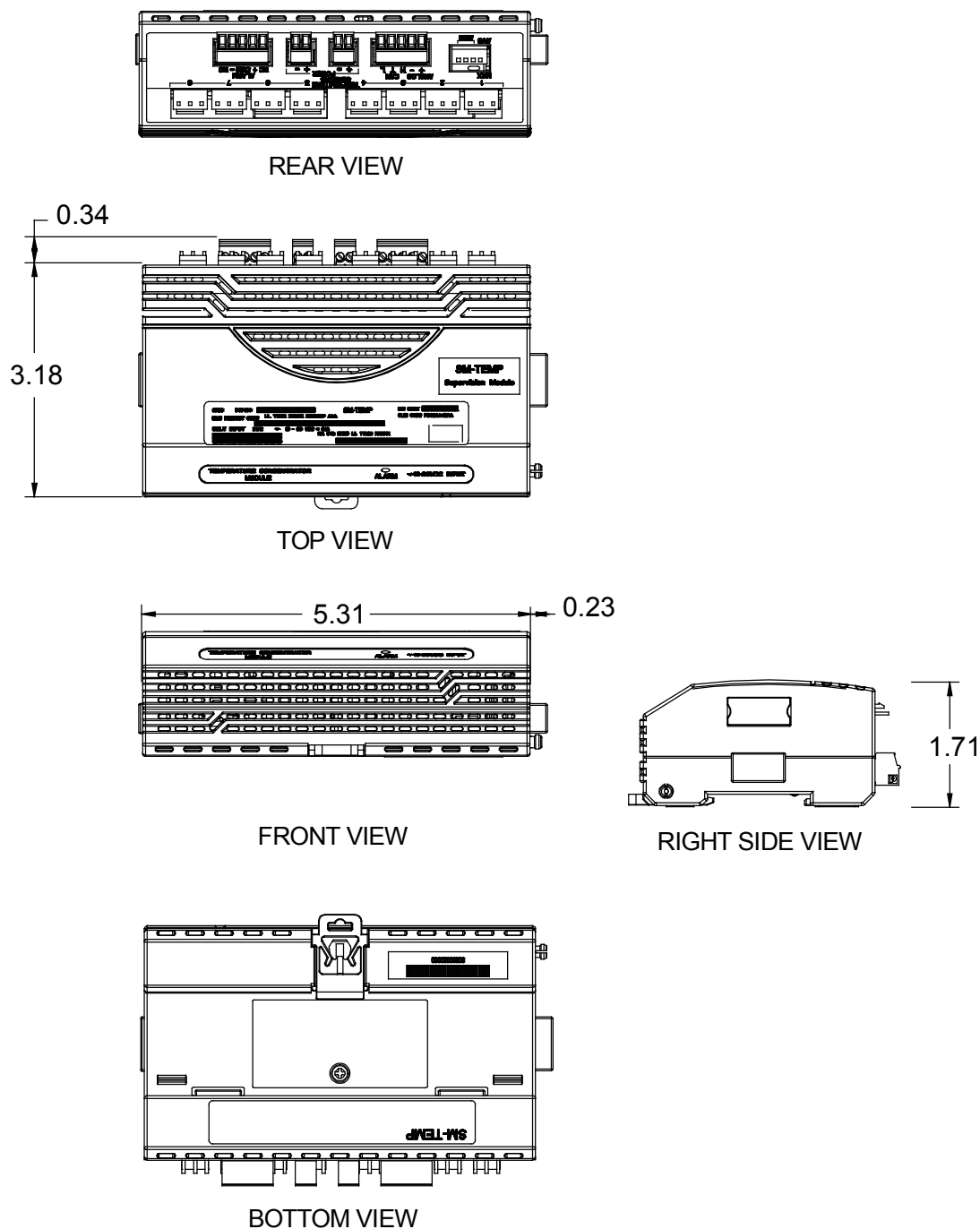
Installation

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.

User Selections (Switch S1)

See Figure 3 for location of switch S1.
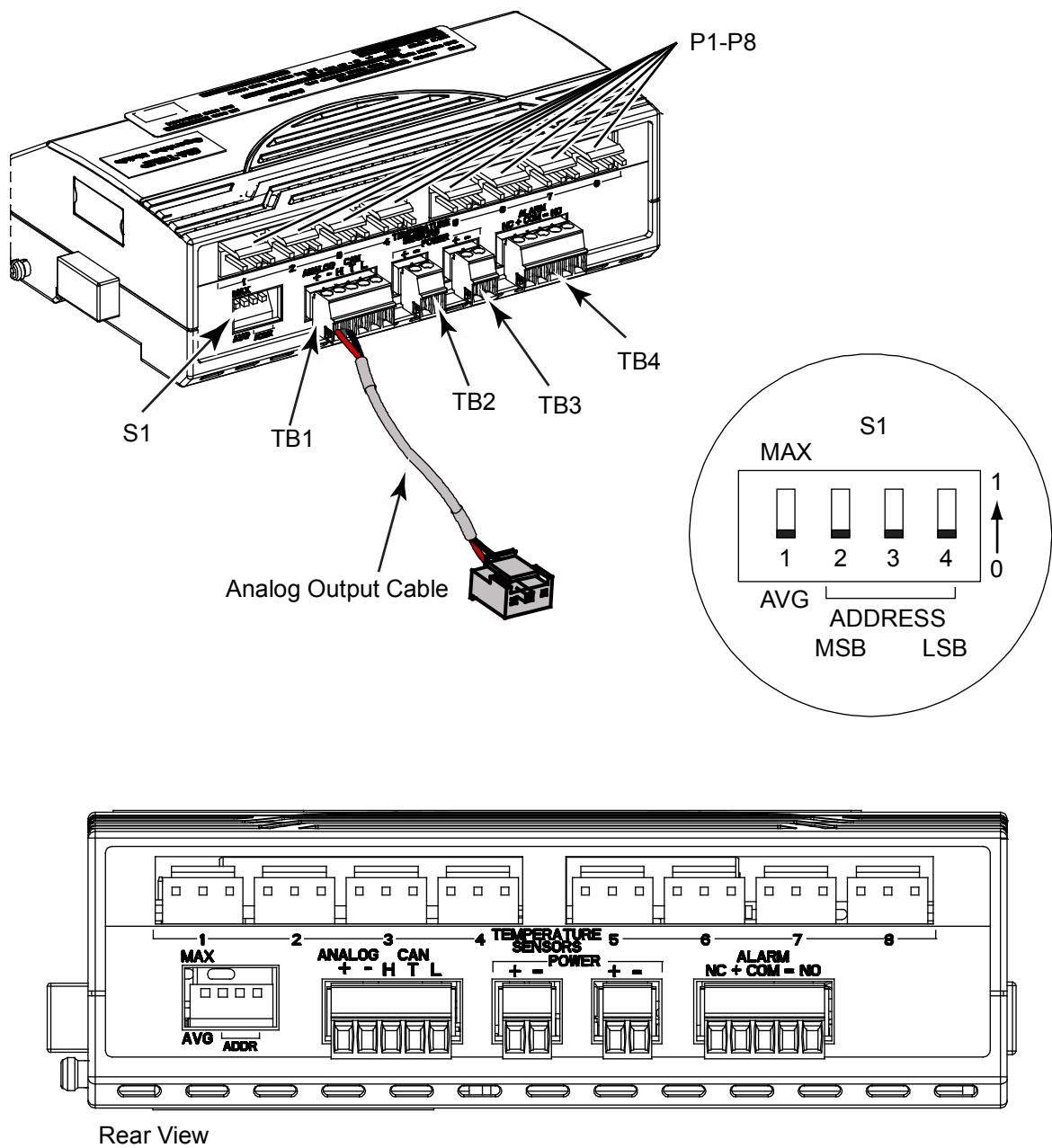
Table 1. S1 Output Mode Switch Settings

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	CAN Address (switch position #2 sets the most significant bit, switch position #4 sets the least significant bit)
4	CAN Address (switch position #2 sets the most significant bit, switch position #4 sets the least significant bit)

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 2.*

Table 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. Connector Locations

Analog Output Cable

S1 TB1 TB2 TB3 TB4

S1
MAX
1 2 3 4
1
0
AVG ADDRESS
MSB LSB

Rear View

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.

Electrical Connections

Refer to Figure 3 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 (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.
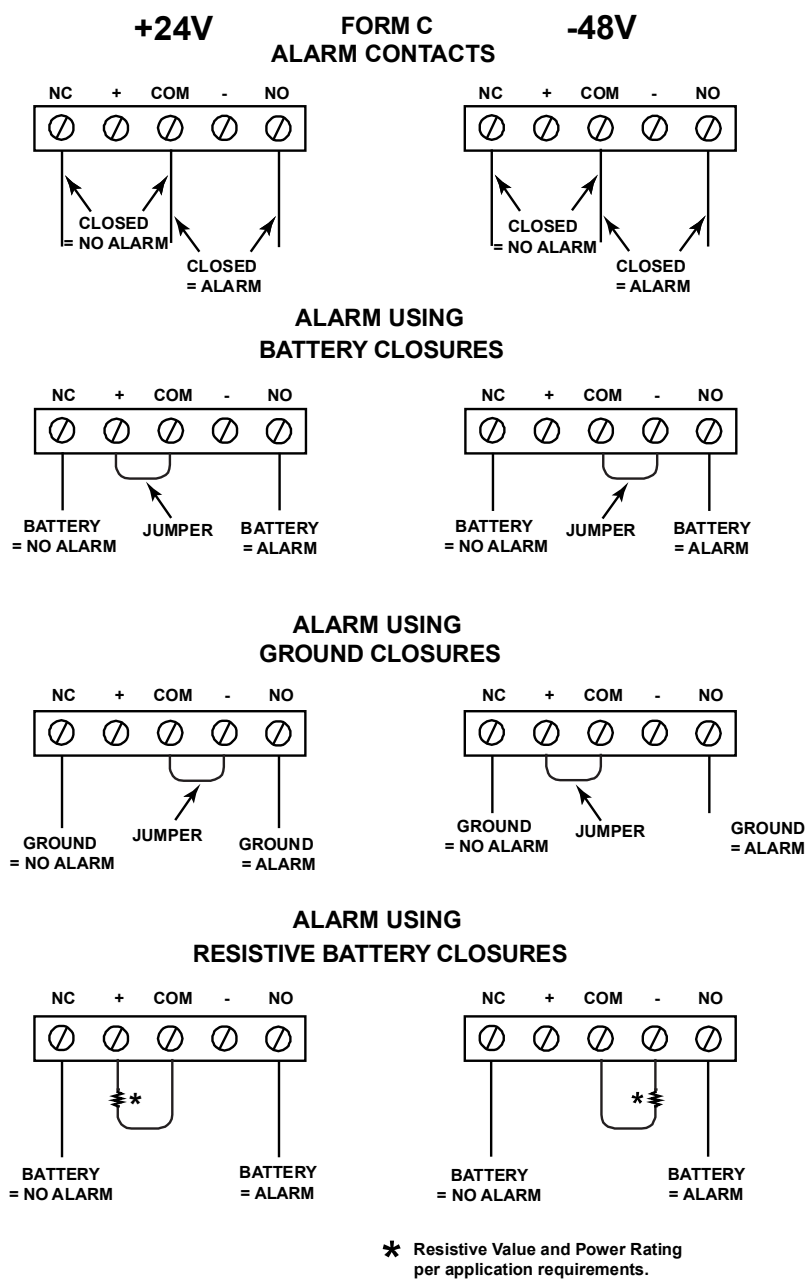
Note: *Do not apply voltages higher than 42.4 volts AC (peak) or 60 volts DC.*

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 4 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 4. Alarm Wiring (TB4)

+24V   **FORM C**   **-48V**
ALARM CONTACTS

NC   +   COM   -   NO

CLOSED = NO ALARM
CLOSED = ALARM

NC   +   COM   -   NO

CLOSED = NO ALARM
CLOSED = ALARM

ALARM USING BATTERY CLOSURES

NC   +   COM   -   NO

BATTERY = NO ALARM   JUMPER   BATTERY = ALARM

NC   +   COM   -   NO

BATTERY = NO ALARM   JUMPER   BATTERY = ALARM

ALARM USING GROUND CLOSURES

NC   +   COM   -   NO

GROUND = NO ALARM   JUMPER   GROUND = ALARM

NC   +   COM   -   NO

GROUND = NO ALARM   JUMPER   GROUND = ALARM

ALARM USING RESISTIVE BATTERY CLOSURES

NC   +   COM   -   NO

BATTERY = NO ALARM   *   BATTERY = ALARM

NC   +   COM   -   NO

BATTERY = NO ALARM   *   BATTERY = ALARM

* Resistive Value and Power Rating per application requirements.

## 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: 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 and Figure 5. 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 5 for correct CAN bus wiring.

Figure 5.   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)
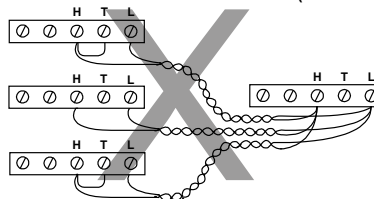

ANALOG OUTPUT CONNECTION
(when connecting the SM-TEMP analog output
to the Controller's temperature sensor port
and not connecting into the Controller's CAN bus)
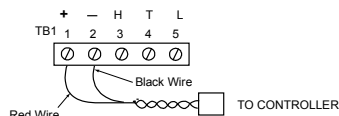
CAN BUS INTERCONNECTIONS
(when connecting the SM-TEMP analog output
to the Controller's temperature sensor port
and not connecting into the Controller's CAN bus)
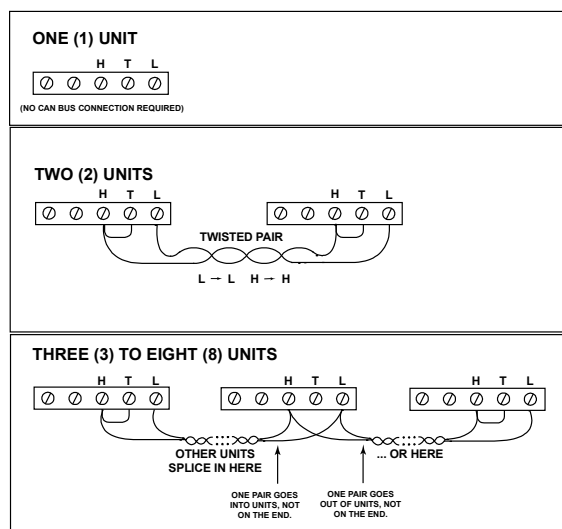
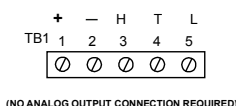DO NOT WIRE THE TEMP CONCENTRATOR THIS WAY (STAR TOPOLOGY)

When connected into the ACU+ CAN Bus

When used with an ACU+ (version 3.02 or later), in lieu of connecting the analog output of the SM TEMP module to an ACU+ temperature port input, the SM TEMP module can simply be connected at the end of the ACU+ CAN bus.
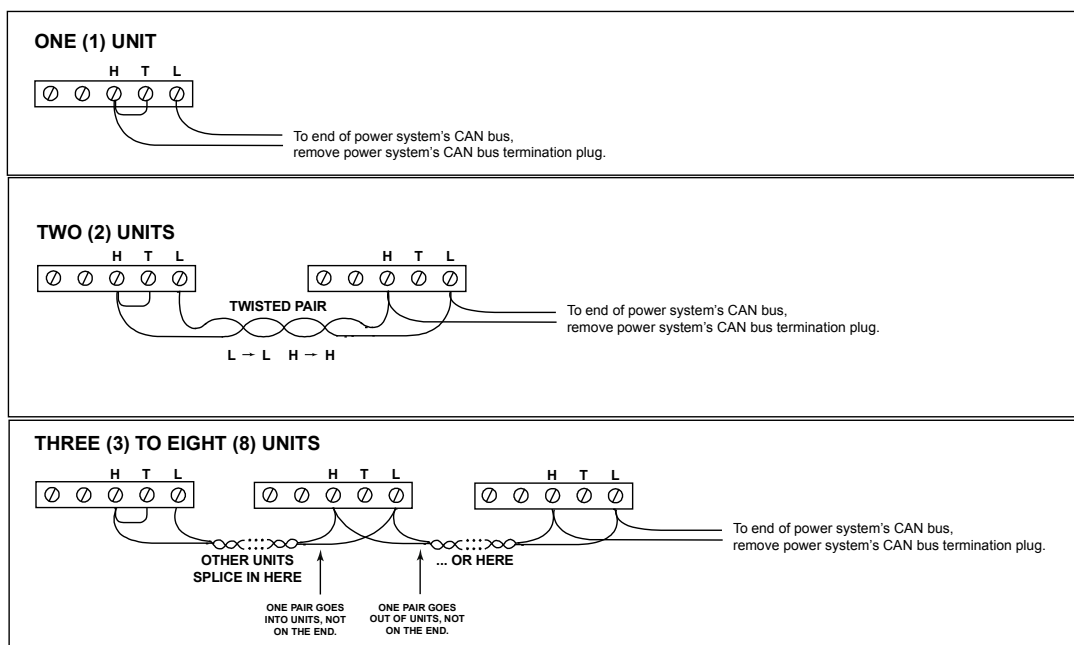
- The analog output connections ARE NOT REQUIRED.

- CAN bus connections are made to TB1 pins 3-5. See Figure 6 for correct CAN bus wiring.

Figure 6.   SM-TEMP Connections (when connecting the SM-TEMP to the ACU+ CAN bus and not connecting the SM-TEMP analog output to the ACU+ 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)

```
        +   —   H   T   L
TB1  1   2   3   4   5
    ⊘   ⊘   ⊘   ⊘   ⊘
```

(NO ANALOG OUTPUT CONNECTION REQUIRED)

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)

ONE (1) UNIT

To end of power system's CAN bus, remove power system's CAN bus termination plug.

TWO (2) UNITS

TWISTED PAIR

L → L   H → H

To end of power system's CAN bus, remove power system's CAN bus termination plug.

THREE (3) TO EIGHT (8) UNITS

OTHER UNITS SPLICE IN HERE

... OR HERE

ONE PAIR GOES INTO UNITS, NOT ON THE END.

ONE PAIR GOES OUT OF UNITS, NOT ON THE END.

To end of power system's CAN bus, remove power system's CAN bus termination plug.

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.

2. 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).

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 3.   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.

Operating Procedures

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

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.

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 Emerson Network Power.

Note: *See Table 3 for Status Information.*

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Customer Service (Pre-Shipment)

Email	CustomerService.ESNA@Emerson.com	Pricing and availability [1,2], purchase orders, expediting requests and order tracking. Ask for your company's dedicated Customer Service Associate.
Phone	1.800.800.1280 option 2	

Customer Support Center (Post-Shipment)

Email	ESNACustomerSupportCenter@Emerson.com	After an order has shipped, contact our Customer Support Center with related questions, concerns or claims.
Phone	1.956.661.6867	

Account Management

Email	AccountManagement.ESNA@Emerson.com	Provides quotes and bid responses for custom configured [2] DC power systems and outside plant enclosures for customers and channel partners (Reps, VARs & Distributors).
Phone	1.800.800.1280 option 3	

Spare Parts

Email	DCpower.Spares@Emerson.com OSP.Spares@Emerson.com	Pricing and purchase orders for spare parts, including but not limited to breakers, cables, fuses, rectifier fans, misc. breaker and fuse panels, enclosure fans, doors and switches, etc.
Phone	1.800.800.1280 option 5	

DC Power Depot Repair

Email	DCpower.Repair@Emerson.com	Creates and processes RMAs for depot repair and refurbishment. Determines repair and refurbishment lead times and pricing based on warranties/contractual agreements. Provides repair shipping information and status.
Phone	1.800.800.1280 option 6	

Technical Support

Email	DCpower.TAC@Emerson.com OSP.TAC@Emerson.com	Answers technical product and system questions; determines status of warranties and contractual agreements for repair.
Phone	1.800.800.5260	

[1] Contact Account Management for custom-configurations.
[2] Contact DC Power Spare Parts for parts and accessories.

For More Information

To learn more about service offerings from Emerson Network Power, please contact your sales representative, call 1-800-800-1280 option 7, email ES.Services@Emerson.com or visit EmersonNetworkPower.com/EnergySystems.

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