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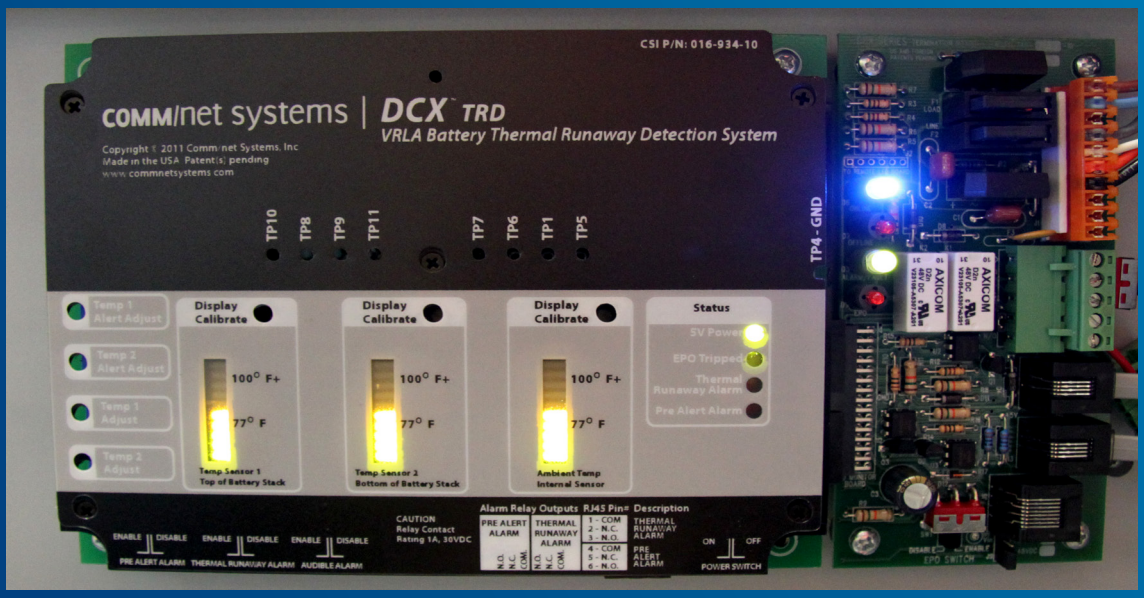
TRD

VRLA BATTERY THERMAL RUNAWAY DETECTION SYSTEM FOR DCX BATTERY DISCONNECTS

INSTALLATION AND OPERATION MANUAL



Comm/net Systems, Inc.
4237 – 24th Avenue West
Seattle, WA 98199

TEL: 206.282.8670
FAX: 206.282.8684
www.commnetsystems.com

24/7 Sales & Service
To purchase Comm/net Systems solutions, contact your Comm/net Systems representative at: (800) 274-0544 or e-mail: sales@commnetsystems.com

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Table of Contents

Section 1: Purpose and Applicability

The purpose of this document is to detail the installation and operation instructions for the TRD VRLA Battery Thermal Runaway Detection System.

1.1 Product Model

This document applies to the Comm/net Systems TRD Thermal Runaway Detector kit. The kit may have been supplied pre-installed on your DCX Battery Disconnect, or was sold separately.

- ☐ 016-934-10, TRD Thermal Runaway Detector Kit.

Section 2: Theory of Operation

The CSI DCX top terminal mount DC disconnect product family consists of an internal magnetic trip DC rated circuit breaker and control circuit to provide remote status monitoring, remote trip and provides an interface expansion connector to allow optional circuit modules to plug into the DCX system. DCX units are available in 400,600, 800, 1,000 and 1,200 ampere rated versions with a multitude of adapter termination copper bus and mounting kits to support many battery types.

The standard DCX disconnect comes with circuit breaker status monitoring via both LED indicators as well as form-c alarm contacts for remote breaker status detection. In addition, a remote EPO *(emergency power off)* input circuit is provided to allow for use of EPO wall mounted switches, remote trip supervisory controllers or other options to comply with applicable fire or building codes for remote trip function.

A terminal block is provided for remote switch contact or relay contact closure to EPO trip the DC circuit breaker and disconnect the battery string from the load and rectifier system. Manual disconnect is always available via simply turning off the circuit breaker handle.

The CSI TRD option *(Thermal Runaway Detector)* is a kit that consists of a plug-in circuit card and control panel assembly, two remote temperature sensors, and cable. The TRD can be installed in any CSI DCX disconnect unit.

The TRD control board assembly simply plugs into the DCX circuit board expansion connector and is secured with mounting screws to hold it in position.

The TRD controller circuit monitors temperature in three locations to analyze and determine if the VRLA battery system is approaching or is in thermal runaway condition. Two remote battery terminal sensors are compared against an internal reference temperature sensor and differential is analyzed and if a thermal fault is detected, the system alerts this status.

New NFPA and local state fire codes now specify use of a thermal runaway detection system for VRLA batteries to provide the ability to detect and alert if the battery system has a thermal fault developing or in process. In addition, many local municipalities have added the requirement that if thermal runaway is detected, the battery system must automatically be disconnected from the charging and load circuit without requiring manual intervention.

The CSI DCX and TRD system is the only self-contained Telecom grade thermal runaway detection AND auto-disconnect system that complies with both NFPA and State/Local fire codes for VRLA battery installations.

2.1 Features

- ☐ Modular, hot-swap circuit card assembly
- ☐ Two remote temperature sensor probes
- ☐ Pre-alert and Thermal Runaway alarm relay contacts
- ☐ Temperature display
- ☐ Optional self disconnect feature
- ☐ Kit retrofits in any existing CSI DCX Disconnect System

Section 3: Unpacking and Inspection

3.1 Package Contents

Included with your product are the following items:

- ☐ TRD Control Board 1 See"Figure 1. TRD Board" on page 2
- ☐ Two remote temperature sensors with LED status See "Figure 2. Battery Temperature Sensor for TRD" on page 2
- ☐ Mounting Screws Kit
- ☐ Temperature sensor cables

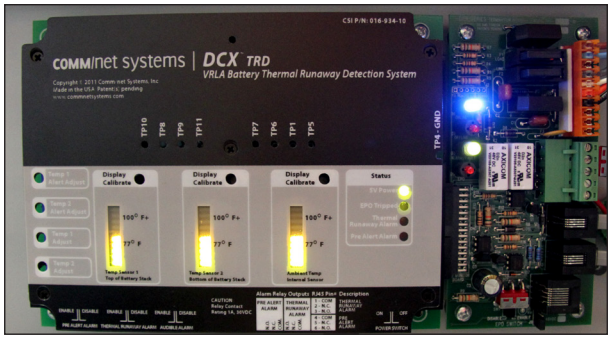


Figure 1. TRD Board

Section 4: Installation

Installation of the TRD kit is typically performed as a retrofit for existing DCX battery disconnect systems in communications battery rooms or similar -48VDC powerplants. Orders direct to the factory for new systems where the TRD option is specified on the order are factory installed prior to shipment.

This procedure defines the retrofit process to install the TRD kit in an existing DCX disconnect system.

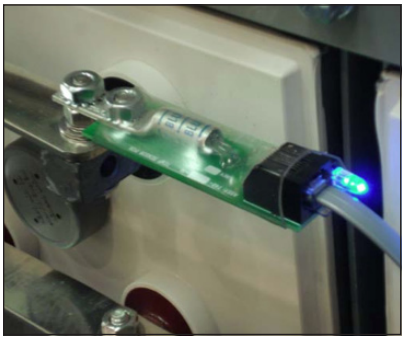


Figure 2. Battery Temperature Sensor for TRD

4.1 Installation Procedure

Step 1. Unpack and inspect contents of TRD kit. See "3.1 Package Contents" on page 2 for more information. Confirm all parts are present and no shipping damage has occurred.

Step 2. Installation into the DCX disconnect technically can be performed with the battery disconnect circuit breaker on and connected to the rectifier and load system in extreme cases but is not recommended for safety reasons and due to the fact that battery bus bar connections must be loosened as part of the temperature sensor installation process. It is recommended that the battery disconnect circuit breaker be turned off for the installation process.

Step 3. Safety warnings: The large telecom VRLA battery stacks can provide thousands of amperes of discharge current into a short circuit, in addition, paralleled battery stacks and large rectifier systems can also discharge extremely high currents into a short circuit fault. There is an extreme safety hazard when working on large systems with this discharge ampacity potential.

CAUTION:

ONLY AUTHORIZED AND TRAINED PERSONNEL ARE RECOMMENDED TO WORK ON THESE SYSTEMS AND MUST USE SAFEY EQUIPMENT, USE INSULATED TOOLS, FOLLOW SAFETY PROCEDURES AND ENSURE THAT SUFFICIENT PLANNING, SAFETY PROCEDURE REVIEW AND PROPER INSTALLATION TECHNIQUES ARE FOLLOWED. EYE PROTECTION, SAFETY GLOVES AND PROTECTIVE SHIELDS ARE REQUIRED ENTIRELY DURING THE TRD INSTALLATION PROCESS.

Step 4. Locate the DCX disconnect to be retrofitted with the TRD kit. Turn off the DCX circuit breaker and tape in the off position as a reminder during the work process and as a notification to co-workers that may be present. Ensure that eye protection, safety gloves, long sleeve shirts are used as a precaution.

Step 5. Open the flip-up DCX lid/door and confirm that it latches in the secure upright position.

Step 6. Install the TRD circuit board and control assembly from the left of the DCX and move toward the right to plug into the expansion connector on the existing DCX circuit board assembly. Confirm a secure connection with full alignment and seating of the connectors. Observe the mounting screw holes in the TRD board assembly that match the existing DCX threaded metal stand-offs. Install the screws provided in the kit to secure the TRD board module assembly to the DCX metal housing.

Step 7. Locate the temperature sensor kit which consists of two remote terminal temperature sensors and cable assemblies. Note that one cable may be shorter than the other. One temperature sensor and cable is intended to mount on a battery terminal near the top of the battery stack which requires a shorter cable, one sensor is required to install on the lower section of the battery stack which requires a longer cable to rout to this location.

Step 8. Installation of the temperature sensor modules requires that the bolt connecting the copper bus strap that will be used to mount the sensor be removed and replaced with a longer bolt to mount the TRD sensor module. This requires access to the battery terminals and is a safety hazard area ***AND REQUIRES USE OF INSULATED TOOLS AND EYE PROTECTION AND SAFETY GLOVES.***

Step 9. To install the temperature sensor modules, two mounting locations must be confirmed, one at the top of the battery stack to monitor the upper section of the stack and one near the lower third of the stack to monitor lower stack temperature. These two temperature sensing points are compared to an ambient temperature sensor in the TRD unit to determine the temperature rise of the battery sensors compared to ambient and compared to each other. The temperature sensor module has a copper lug with a clearance hole for a 1/4-20 bolt which is the typical size bolt used in the strapping kit from the battery manufacturer. Confirm that the DCX circuit breaker is off, remove the appropriate clear cover from the battery stack that is covering the bolt location desired for installation and ensure that insulated tools are used along with eye protection and safety gloves. Carefully loosen and remove the bolt while being extremely careful to not contact adjacent battery terminal posts or strap locations. Remove this bolt and washers and nut and set aside.

Step 10. Top sensor. Select a bolt location in the top battery string shelf or second shelf from the top. Locate the temperature sensor module and longer bolt kit. Locate the sensor module lug clearance hole on the battery terminal post and slide the new bolt in from the bottom up through the battery post and strap assembly and new nut. The hardware order from bottom up should be bolt, flat washer, battery terminal post and strap then flat washer, split lock washer, second nut, temperature sensor lug and final nut. Finger tighten this assembly and check to ensure that the sensor lug and PCB assembly are not pinched or pressed against adjacent terminals, bus bars etc. The sensor module is designed to

sit above the first nut so that the sensor lug is not in compression with the bolt assembly required for correct tight torque for current carrying capacity of the battery strap system. Tighten the hardware on the battery post and strap to the battery manufacturers correct torque setting. Typically this is about 100 inch pounds. Use a torque wrench with insulated feature to avoid potential for short circuit. Locate the temperature sensor lug and tighten top nut carefully on top of lug to hold the sensor to the bolt. This connection does not need to be over tightened and be careful to not rotate or stress the sensor circuit board while tightening. This is intended as a temperature measurement connection not a high current connection requiring extreme tightness to hold the sensor module in place.

Step 11. Bottom sensor. Select a bolt location in the second or third battery shelf from the bottom of the stack and repeat the installation procedure for this sensor.

Step 12. Confirm connections are tight.

Step 13. Locate temperature sensor cables and confirm if they are different lengths, the shorter cable is for the top sensor, longer cable for the bottom sensor. Plug in the sensor cable into the jack of the sensor module securely and ensure that it latches. Route the sensor cable up the face of the battery stack carefully around the battery posts and straps. It is not recommended that this cable be allowed to chafe on these bus bars or be cable-tied to the bus bars. Use double sided tape cable tie anchors or route cable directly up to the top of the stack in such a manner that it is not contacting battery straps or terminal posts to avoid a potential short circuit. Plug in both cables at the sensor ends, confirm correct routing of the cables safely up the stack to the DCX unit mounted on the top of the battery stack.

Step 14. Replace all of the battery terminal plastic cover shields removed for access for the sensor installation. Confirm all are mounted correctly.

Step 15. Route the two sensor cables up to the bottom of the DCX housing can through the black plastic grommet hole and into the control panel assembly and plug in the cables into the jacks provided on the DCX control circuit board. ***THE SENSOR ON THE TOP OF THE STACK IS TEMP 1, THE SENSOR ON THE BOTTOM OF THE STACK IS TEMP 2. CONFIRM THIS BY READING THE LABEL ON THE DCX PCB NEXT TO THE JACKS. THESE ARE CLEARLY MARKED, DOUBLE CHECK THAT THE CORRECT SENSOR CABLE IS PLUGGED INTO THE CORRECT JACK.*** Store any excess sensor cable by carefully coiling and secure with a cable tie.

This concludes the TRD control and temperature sensor installation procedure.

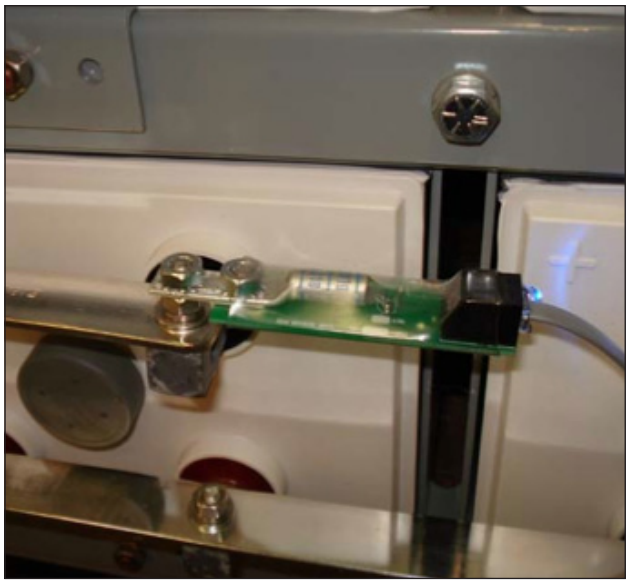


Figure 3. Temperature sensor cable connected to battery terminal.

Figure 4. Route temperature sensor cables up through DCX chassis, through grommet hole and up to DCX control PCB jack locations.

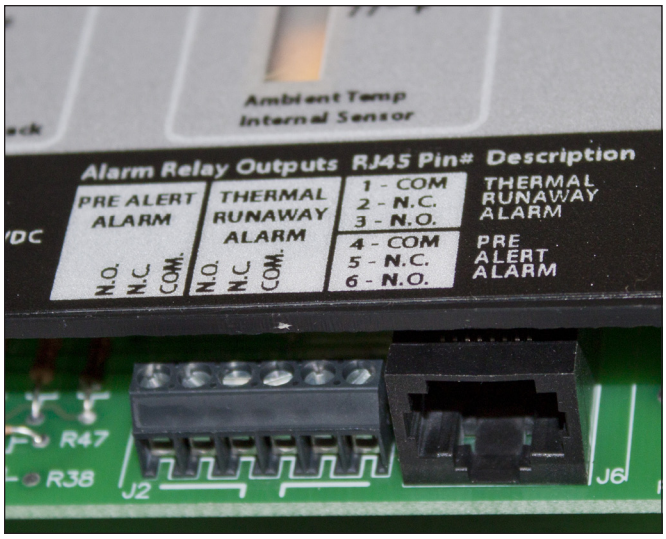


Figure 5. Alarm Connections

Section 5: Operation

Overview description of production operation and interface.

5.1 Configuration and Alarm Wiring

The DCX TRD system is configurable in several ways to provide remote alarm monitoring and either local or remote battery breaker trip disconnection if either terminal runaway is detected or a ventilation system fails etc.

The TRD PCB assembly includes the control circuit to monitor, analyze and detect thermal faults via three sensor systems. The alarm output of this circuit assembly includes LED indicators as well as two alarm contact relays that can provide remote alarm detection.

5.1.1 Alarm Connections

The alarm connections are provided on a 6-position terminal block and on an 8p8c *(RJ-45)* jack. (Refer to Figure 5)

Pre-alert

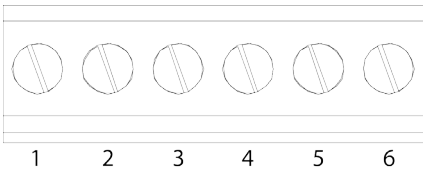
Form-C. NO *(normally open)*, NC (normally closed), C (common). Max 1 ampere, 30VDC.

Actuates first if a thermal fault is initially detected. Can be wired to a remote strobe, lamp, horn etc. to notify alert condition locally. Can be wired to remote monitoring or fire suppression control panel.

Thermal runaway detect

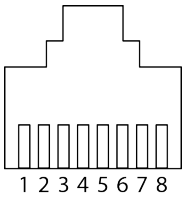
Form-C. NO *(normally open)*, NC (normally closed), C (common). Max 1 ampere, 30VDC.

Actuates second if a thermal runaway is detected. Can be wired to a remote strobe, lamp, horn etc. to notify alert condition locally. Can be wired to remote monitoring or fire suppression control panel. This signal is typically used for a remote monitoring and control system to detect thermal runaway and then to send a DCX battery breaker disconnect signal.



P-TERMINAL ALARM OUTPUTS

PIN #	DESCRIPTION	
1	N.O.	PRE-ALERT ALARM
2	N.C.	
3	COM	
4	N.O.	THERMAL RUNAWAY ALARM
5	N.C.	
6	COM	



RJ-45 ALARM OUTPUTS

PIN #	DESCRIPTION	
1	COM	THERMAL RUNAWAY ALARM
2	N.C	
3	N.O.	
4	COM	PRE-ALERT ALARM
5	N.C.	
6	N.O.	
7	RESERVED	
8	RESERVED	

5.1.2 Control options

Option A: Internal TRD detect and self-disconnect.

This option does not require an external monitoring or control system such as a fire suppression controller and simply uses the thermal runaway detect relay output of the TRD module to connect into the EPO switch input of the DCX control PCB. Essentially the TRD alarm relay closes and sends an EPO signal to the DCX which trips the battery circuit breaker and isolates the batteries from the charging system. This approach is viable for small systems with a single battery stack, remote sites such as cell sites, cabinets or equipment rooms where a fire suppression system may not be present or there may not be sufficient supervisory control functions in the fire suppression or monitoring controller.

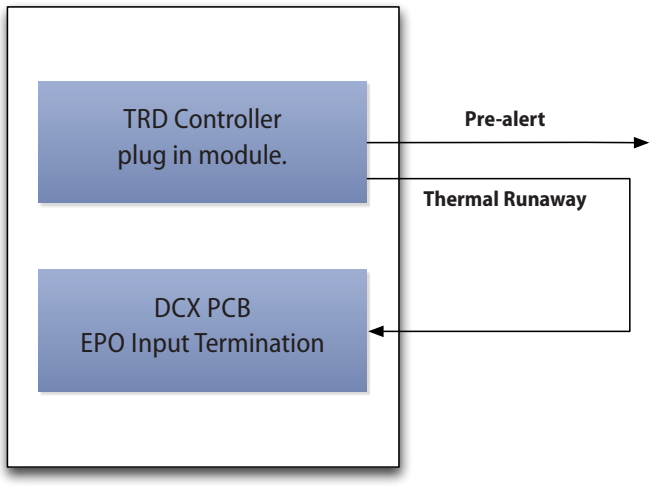


Figure 6. Internal TRD detect and remote disconnect control.

Option B: Internal TRD detect and remote disconnect control.

This option requires use of a remote controller device of some kind such as a fire control panel or supervisory controller or PLC etc. This device can monitor both the pre-alert and TRD relays of the TRD module and provide remote monitoring, send an alarm to a call center, send a fire department alarm and/or provide an EPO trip signal back to the DCX after a programmable time delay after waiting for manual intervention first etc.

The remote controller device provides the control monitoring and trip control. The advantage of this approach is that the controller device can also monitor other site conditions to determine if the DCX breaker should be EPO tripped off. Examples include EPO wall switches pushed, remote hydrogen sensors detecting out gassing, ventilation – cooling system failure etc. Any one of these conditions can be programmed to send an EPO trip signal to the DCX including the thermal runaway detection from the TRD module.

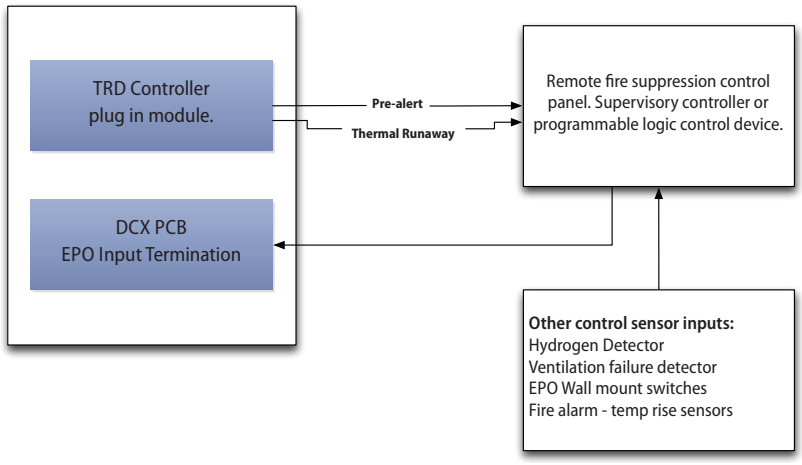


Figure 9. Internal TRD detect and remote disconnect control.

Section 6: Product Specifications

6.1 Electrical Specifications

The product has the following electrical specifications:

- Input Voltage: -48VDC *(Supplied by DCX term board)*

6.2 Physical Specifications

The product has the following physical specifications:

- **Dimensions**: 7.25" wide by 5.5" high

6.3 Environmental Specifications

- Operating Temperature: 0 to 50°C
- Humidity: 5 to 95% RH, Non-Condensing
- Elevation: -500m to 2800m *(-1640 to 9186ft)*

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