RACK CONTROL MODULE™
INTERFACE DEVICE FOR CONNECTING
TD80™ GAUGING SYSTEMS TO THERMISTOR
AND OPTIC STYLE LOADING RACKS
*Also available in an optic-only model

PRODUCT MANUAL

Rack Control Module

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TPM 007 Revision 1.2
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This warranty only covers manufacturing defects and does not cover those damages incurred during installation. Nor does it include damage to any peripheral devices or modifications made to TLC’s devices after sale. Nor does it include those damages which are incurred as a result of improper installation, misuse, maladjustment, abnormal operating conditions, or lack of routine maintenance. Nor does it include the furnishing of service for maintenance or problems arising from the foregoing causes. No claims for labour, installation, removal, transportation, or other expenses will be recognized. In the event of an accepted warranty claim, TLC shall assume financial responsibility only to the extent of TLC’s invoiced price of the particular product. Warranty does not cover the removal, reinstallation or modification of equipment. All repairs are FOB Edmonton, Alberta and/or Lampman, Saskatchewan and/or Overland Park, Kansas. Should repair be required, freight will only be covered by Titan Logix Corp. for the cost of the return of the repaired product to the customer. All other freight charges will be incurred by the customer.

This warranty does not cover those damages incurred due to corrosion of the wetted parts. Probe failure from corrosion is not covered by this warranty. The TD80™FINCH 5332 Display and all electronics supplied by Titan Logix Corp. are only warranted if protected from road hazards. The warranty is valid only if the TD80™ is installed in accordance with the instruction manual provided.

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Rev. 1.2, May 9, 2014
1 Introduction

1.1 About This Manual

This instruction manual provides information specific to the Titan Logix Corp. Rack Control Module™ (hereafter referred to as the RCM). Other peripheral equipment should be supplied with its own instruction manual and that manual should be referred to for proper operation of the peripheral equipment.

It is essential that this manual be read and understood for proper installation and operation of your new Rack Control Module™.

This manual describes Rack Control Module operation, installation and troubleshooting. Refer to the TD80 Installation and Operation Manual, TPM 001 for full TD80 Level Gauging and Overfill Prevention System details.

**THIS MANUAL INCLUDES:**

- **Introduction**: Description of the key features and components of the Rack Control Module.
- **Operation**: Description of Operation and Alarms.
- **Installation**: Description of mounting and wiring of equipment.
- **Troubleshooting**: Description of possible problems, their probable causes, and solutions.

1.2 Disclaimer

The information in this document is subject to change without notice. Titan Logix Corp. makes no representations or warranties with respect to the contents hereof.

> Only qualified personnel should install this product. Please read this manual before installing this product and follow all applicable safety and electrical regulations as required.

> **WARNING:** The TD80 and RCM are a secondary overfill prevention system only and does not replace operator attention and diligent monitoring of the loading process.
1.3 Introduction and Description

1.3.1 System Description

The RCM is part of a secondary overfill prevention system. It is an optional accessory that receives alarm information from the TD80 level transmitter, providing overfill information to industry standard 5-wire optic and 2-wire thermistor terminal rack controllers. The RCM may be used on single or two compartment tankers equipped with a TD80 level gauging system.

The RCM continuously checks one or two TD80 transmitters for overfill or any unsafe condition to halt the loading process. All conditions must be safe for the RCM to permit loading. Communication from the TD80 transmitters, vehicle battery voltage, loaded volume and alarm states are automatically and continuously tested to ensure a safe and reliable system prior to and during the loading process.

The RCM is compatible with all existing TD80 installation configurations, including onboard loading pump or bottom loading valve control. It will work with both Dual Rod and Coaxial Probe TD80 transmitters, multiple Finch displays, MIC 10 interface device and an external Relay Module for onboard loading control.

The RCM is an upgrade to systems using the P2000 5-wire optic terminal rack interface. It provides the benefit of both optic and thermistor terminal rack controller interfaces along with enhanced features to provide maximum safety while loading hazardous products.

1.3.2 About the TD80 System

The TD80 Level Transmitter is the heart of the TD80 level measurement system. The TD80 transmitter uses Guided Wave RADAR (GWR) to measure liquid level in a tank. It does not use any moving parts for level measurement.

Guided Wave RADAR is a contacting level measurement method that uses a probe as a wave guide to channel the radio frequency energy to the liquid being measured. The probe provides an efficient path for the transmitted energy and pulse reflections from the surface of the liquid.

The TD80 transmitter measures the time delay between transmitted and reflected pulses to calculate distance to the material's surface. This distance is then used to determine level of the liquid in the tank.

The calculated level is converted into common volume units and is sent to a Display such as the Finch 5332 Display. The display is also part of an optional secondary overfill prevention system. TD80 generated alarms provide the approaching overfill information to halt loading at industry standard optic and thermistor controlled loading racks, on-board loading pumps or valves.

The TD80 system consists of a TD80 transmitter, dual rod or coaxial probe and a Finch Display. Optional components such as the Finch Relay Module, horns and lights are installed as required.
1.3.3 TD80 System Components

**TD80 Transmitter**

The TD80 transmitter generates and processes the GWR signals to determine liquid level in a tank. The TD80 is mounted on the tank top and connected to the probe, is weatherproof and rated for use in hazardous locations where explosive fumes may be present. TD80s are available in two versions, dual rod or coaxial probe for compatibility with a wide range of liquids.

**Probe**

The probe guides the transmitted pulse and reflection from the surface of the liquid. Probes are available in dual rod or coaxial versions and require a matching transmitter type. The probe is mounted on the tank top and is connected to the bottom of the transmitter. Dual rod probes are designed for viscous liquids. Coaxial probes are used mostly for tanks containing products like aviation fuel.

**Finch 5332 Display**

Finch Displays are available in weather-proof external versions, the Finch 5332E and a smaller internal version, the Finch 5332. Both provide bright LED numeric display of volume information, alarms and system error codes from the TD80 transmitter. Various alarm and error conditions are detected by the transmitter and display. These alarm states control three internal relays for alarm annunciation, overfill and low level prevention.

1.3.4 Optional Components

**Rack Control Module**

The RCM is an accessory that enables secondary overfill prevention when used with industry standard optic and thermistor terminal rack controllers. The TD80 transmitter sends loaded volume, alarm states and detected errors by the SV Bus to the RCM, Finch display and optional MIC 10. The RCM continuously tests the validity of this information; monitors overfill alarms and send a permissive signal to the terminal rack controller only when all conditions are safe for loading a hazardous product. Any overfill alarm or invalid information is intelligently used to determine the correct response. The RCM continues to monitor the condition for a reasonable and safe time to allow correct information to be restored. Beyond this time, the RCM signals a non-permissive to deny loading until correct system operation is re-established.

False non-permissive conditions caused by product splashing or sloshing are minimized by the intelligent response of an Information Integrity Check. Marginal TD80 operation due to probe pitting, fouling or minor damage may cause a premature halt to loading. These conditions are also considered by the RCM as part of the intelligent response to maintaining a safe loading environment. Temporary loss of valid volume information due to sloshing or minor damage is tolerated in a way that ensures maximum safety near the overfill level of the tank.

**MIC 10**

The MIC 10 is an interface device for connecting multiple TD80s to a third party modem.
Finch Relay Module

The Finch Relay Module is an accessory that enables overfill prevention by control of an onboard pump or loading valve.

Horns and Lights

Alarm reporting is through optional vehicle mounted horns and lights.

1.3.5 The TD80 Alarm System

This description refers to TD80 transmitters and the RCM only. Refer to the TD80 Installation and Operation Manual, TPM 001 for a full description of the alarm system.

The TD80 alarms are listed below.

High-High (HH) Alarm

The High-High alarm is set during transmitter programming and is normally the maximum safe volume of the tank. Dual Rod TD80 transmitters and probes are settable to a volume from 8" below the tank top and lower while the Coaxial TD80 transmitters and probes are able to be set from 3" and lower.

The TD80 transmitter is the source of this alarm. The HH alarm is activated by a measured volume equal to or exceeding the alarm level set during programming.

Spill Alarm

Spill is an approaching overfill condition. Dual Rod TD80 transmitters and probes are factory set at 7.5" below the tank top while Coaxial TD80 transmitters and probes are selectable in the range of 2.5" down to 15.5" from the top.

The TD80 transmitter is the source of this alarm. The Spill alarm is activated by a measured level equal to or exceeding the alarm level set during programming.

Fail Alarm

TD80 system failures such as internal transmitter errors and probe faults are reported to the RCM. This is the same error information shown on the Finch display as an error code, Exx where xx is the code for a specific TD80 failure. RCM indicator lights are unable to report the specific cause of the halted loading process. Refer to the TD80 Installation and Operation Manual, TPM 001 for the error codes and failure description.
1.4 Graphical Glossary of Terms

Dual Rod Probe Truck and Trailer Installation

Figure 1-1: Dual Rod Probe Truck & Trailer Installation
Coaxial Probe Truck and Trailer Installation

Figure 1-2: Coaxial Probe Truck & Trailer Installation
2 Operation

The RCM does not have any operator controls. It receives all information and control from the TD80 transmitter. Loading permit status and diagnostic information is provided by four indicator lights, as shown below.

![Figure 2-1: Rack Control Module](image)

2.1 Indicators

<table>
<thead>
<tr>
<th>LED</th>
<th>Purpose</th>
<th>Status</th>
<th>Indication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permit</td>
<td>Indicates loading permissive.</td>
<td>OFF</td>
<td>The RCM is unpowered. Loading is denied.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Solid Red</td>
<td>The RCM is receiving a level or error alarm from one of the compartments or an unsafe condition was detected by internal tests. Loading is denied.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Solid Green</td>
<td>The RCM is providing a signal to the terminal rack controller to permit loading.</td>
</tr>
<tr>
<td>Sensor 1</td>
<td>Indicates alarm state of the TD80 transmitter monitoring compartment #1</td>
<td>Solid Red</td>
<td>Active overfill, spill or system error alarm from compartment #1. Loading is denied until the indicator is OFF</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OFF</td>
<td>No alarms are detected for compartment #1.</td>
</tr>
<tr>
<td>Sensor 2</td>
<td>Indicates alarm state of the TD80 transmitter monitoring compartment #2</td>
<td>Solid Red</td>
<td>Active overfill, spill or system error alarm from compartment #2. Loading is denied until the indicator is OFF</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OFF</td>
<td>No alarms are detected for compartment #2.</td>
</tr>
<tr>
<td>Power</td>
<td>Indicates condition of the vehicle battery power.</td>
<td>OFF</td>
<td>No power is applied to the RCM.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Blinking Yellow</td>
<td>The vehicle battery voltage is below the minimum 8VDC required for reliable operation.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Solid Yellow</td>
<td>The vehicle battery voltage is 8VDC or greater.</td>
</tr>
</tbody>
</table>

Table 2-1: LED Indicators
The following table describes a normal sequence of events for loading and unloading the tanker. Included is the RCM response to system failures. The principal concept of RCM operation is to deny loading until all conditions are safe. Then the terminal rack controller receives a signal to permit loading. High level alarms are cleared to permit loading once the product level is unloaded below the alarm settings and the power has been turned off, then on. Loading is also automatically permitted when the tank has been near empty for at least 1 minute. Approximately 1/4 or less of the total volume is considered near empty to permit loading. System failures halt loading and remain in that state until the condition clears and the system has power removed, and then reapplied. This allows the operator to resolve the problem before loading continues.

### 2.2 Sequence of Events

<table>
<thead>
<tr>
<th>Event Sequence - Inputs are Battery Power and TD80 Data</th>
<th>Permissive Signal to the Terminal Rack Controller OFF is Loading Denied, ON is Permitted</th>
<th>Power Indicator</th>
<th>Sensor 1 Indicator</th>
<th>Sensor 2 Indicator</th>
<th>Permit Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal Operating Conditions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Power off</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>2. Power on and less than 8VDC</td>
<td>OFF</td>
<td>Blinking Yellow</td>
<td>OFF</td>
<td>OFF</td>
<td>Solid Red</td>
</tr>
<tr>
<td>3. Power on and greater than 8VDC during transmitter warm up</td>
<td>OFF</td>
<td>Solid Yellow</td>
<td>OFF</td>
<td>OFF</td>
<td>Solid Red</td>
</tr>
<tr>
<td>4. Power on, tank empty, Finch display shows &quot;2 LO&quot;</td>
<td>ON</td>
<td>Solid Yellow</td>
<td>OFF</td>
<td>OFF</td>
<td>Solid Green</td>
</tr>
<tr>
<td>5. Power on, tank loading and below HH alarm volume</td>
<td>ON</td>
<td>Solid Yellow</td>
<td>OFF</td>
<td>OFF</td>
<td>Solid Green</td>
</tr>
<tr>
<td>6. Power on, tank loading and at HH alarm volume</td>
<td>OFF</td>
<td>Solid Yellow</td>
<td>Solid Red</td>
<td>Solid Red</td>
<td>Solid Red</td>
</tr>
<tr>
<td>7. Power on, tank at Spill alarm level</td>
<td>OFF</td>
<td>Solid Yellow</td>
<td>Solid Red</td>
<td>Solid Red</td>
<td>Solid Red</td>
</tr>
<tr>
<td>8. Power off</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
</tr>
</tbody>
</table>
### Event Sequence - Inputs are Battery Power and TD80 Data

<table>
<thead>
<tr>
<th>Event Sequence</th>
<th>Power Indicator</th>
<th>Sensor 1 Indicator</th>
<th>Sensor 2 Indicator</th>
<th>Permit Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>10. Power on, tank unloading below Spill alarm level and above HH alarm volume</strong></td>
<td>OFF</td>
<td>Solid Yellow</td>
<td>Solid Red</td>
<td>Solid Red</td>
</tr>
<tr>
<td><strong>11. Power on, unload below HH alarm volume</strong></td>
<td>OFF (NOTE: a power cycle at this point results in a PERMISSIVE=ON, as in event 5, OR continue to Step 12, below)</td>
<td>Solid Yellow</td>
<td>Solid Red</td>
<td>Solid Red</td>
</tr>
<tr>
<td><strong>12. Power on, unload to “2 LO”, empty tank for more than 1 minute</strong></td>
<td>ON</td>
<td>Solid Yellow</td>
<td>OFF</td>
<td>OFF</td>
</tr>
</tbody>
</table>

### Normal Operating Conditions

<table>
<thead>
<tr>
<th>Normal System Configuration Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>13. TD80 Offset Calibration</strong></td>
</tr>
<tr>
<td><strong>14. TD80 transmitter programming using Birdfeeder</strong></td>
</tr>
</tbody>
</table>

### Error and Failure Conditions

<table>
<thead>
<tr>
<th>Error and Failure Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>15. TD80 to RCM Communication failure</strong></td>
</tr>
<tr>
<td><strong>16. TD80 reported error, Finch display shows Exx, xx is an error code</strong></td>
</tr>
<tr>
<td><strong>17. Volume trend and alarm state integrity check failure</strong></td>
</tr>
</tbody>
</table>

*Table 2-2: Sequence of Events*
3 Installation

3.1 TD80 Installation Steps Overview

The following installation instructions are specific to the RCM only. Refer to the TD80 Installation and Operation Manual, TPM 001 for full TD80 Level Gauging and Overfill Prevention System details. The RCM may be installed in any currently recommended level gauging system including one that performs onboard loading control. These details are beyond the scope of RCM installation and testing.

3.2 Pre-Installation Requirements

1. When choosing a location to install the TD80 components, including the RCM, the following guidelines must be followed:
   a. Appropriate industry, national, provincial/state and local codes
   b. Fuses and components appropriate for the area classification

2. The tank is completely drained of liquid and vapour free.

3. No drilling or welding to the tank and frame without first consulting with the tank manufacturer.

3.3 Installation Steps

<table>
<thead>
<tr>
<th>Checked</th>
<th>Step</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1. Program the TD80</td>
</tr>
<tr>
<td></td>
<td>2. Install the 1&quot; NPT Top Fitting</td>
</tr>
<tr>
<td></td>
<td>3. Install the Anchor Cone</td>
</tr>
<tr>
<td></td>
<td>4. Install the Probe</td>
</tr>
<tr>
<td></td>
<td>5. Mount the Transmitter</td>
</tr>
<tr>
<td></td>
<td>6. Mount the Finch Display</td>
</tr>
<tr>
<td></td>
<td>7. Mount the Relay Module (optional)</td>
</tr>
<tr>
<td></td>
<td><strong>8. Mount the Alarm Accessories (optional), including the RCM</strong></td>
</tr>
<tr>
<td></td>
<td>9. Inspect the Mechanical Installation</td>
</tr>
<tr>
<td></td>
<td><strong>10. Install the Electrical Wiring</strong></td>
</tr>
<tr>
<td></td>
<td>11. Set and Verify the Finch Display Jumpers</td>
</tr>
<tr>
<td></td>
<td>12. Confirm Fuses Installed with Correct Type and Rating</td>
</tr>
<tr>
<td></td>
<td>13. Perform the TD80 Basic Operation Test</td>
</tr>
<tr>
<td></td>
<td>14. Verify TD80 Transmitter Programming</td>
</tr>
<tr>
<td></td>
<td>15. Set the Fill or Fall Alarm Level</td>
</tr>
<tr>
<td></td>
<td><strong>16. Perform the TD80 System Test and Verification</strong></td>
</tr>
<tr>
<td></td>
<td><strong>17. Perform the Offset Calibration</strong></td>
</tr>
</tbody>
</table>

*Table 3-1: Installation Steps*
*The following installation instructions provide detail for steps 8, 10, 16 and 17 in the table above. Refer to the TD80 Installation and Operation Manual, TPM 001 for full TD80 Level Gauging and Overfill Prevention System installation steps 1 through 17.*

**Step 8: Mount the Alarm Accessories, Including the RCM**

1. Position the RCM where indicated by the manufacturing or installation drawings. Typical locations are near the Finch display for viewing both the loaded volume or alarm information and RCM indicators.

2. Bolt the RCM to the panel, bracket or protective box. Ensure that the bolts are not torqued to the extent that the plastic mounting tabs are crushed.

3. Position and bolt all remaining alarm accessories.

**Step 10: Install the Electrical wiring**

1. The TD80 transmitter is provided with a 50’ or 75’ cable kit. It is recommended to use the kit with included sealing fitting for connection to the Finch Display.

2. All electrical grounding is to the vehicle or trailer electrical ground connection and not to the chassis.

3. For trailers, connect the TD80 system power and ground to the nose box electrical connector. For trucks, connect TD80 system power to a switched accessory power connection from the battery.

4. Wire splices should be made inside a weather proof enclosure or junction box to prevent premature failure due to corrosion.

5. Secure all wires and cabling with clips or cable ties

6. Tighten all compression fittings

7. Refer to the specific installation wiring diagrams and instructions for details. See the figures below for sample electrical wiring installation. Single compartment installations have both Sensor 1 and 2 RCM wiring connected to the single SV Bus wire from the TD80 transmitter. The RCM Black/White cable pairs are to be wired to the dummy and booster of each socket. It does not matter which Black/White pair goes to which.

**Warning:** It is not code compliant to mix Intrinsically Safe (IS) wiring with Non-Intrinsically Safe wiring. IS wiring needs to be kept separated from Non-IS wiring by a physical barrier (conduit or other). Do not use Sockets that contain IS circuits as junction boxes, as doing so may compromise the safety of the entire system.

**NOTE:** For more complex installations where several options are also installed (lights, horns, pump shutdown, external ACK switch), the number of wires/cables being terminated inside the Finch might be a problem. It may be advantageous to use a junction box to simplify the wiring; this option is also shown below.

**NOTE:** Ensure all retrofit installations meet current Titan Logix recommended installation practices and current safety regulations regarding components appropriate for the area classification, use of ABS power and compliance to all industry, national, state/provincial and local codes. See TPM 001; TD80 Product Manual, for details.
Figure 3-1: Wiring For Standard API Optic and Thermistor Sockets
Figure 3-2: Wiring For Standalone J560 7-Pin Optic Socket

NOTE:

SUITABILITY OF THE FINAL INSTALLATION IS TO BE DETERMINED BY THE INSPECTION AUTHORITY HAVING JURISDICTION.

TO MAINTAIN THE INTRINSIC SAFETY (IS) OF RACK SIGNAL ENSURE THE ENTITY PARAMETERS OF CONNECTED DEVICES HAVE BEEN CONSIDERED.

ENSURE ONLY APPROVED (IS) DEVICES ARE CONNECTED TO (IS) RACK CIRCUIT.

DO NOT MIX (IS) AND NON (IS) WIRING.
Figure 3-3: Wiring For Optic API Socket and RCM-J560 Optic Socket

NOTE:
Suitability of the final installation is to be determined by the inspection authority having jurisdiction.

To maintain the intrinsic safety (IS) of rack signal, ensure the entity parameters of connected devices have been considered.

Ensure only approved (IS) devices are connected to (IS) rack circuit.

Do not mix (IS) and non-(IS) wiring.
Figure 3-4: Wiring For Standard API Optic and Thermistor Sockets and RCM-J560 Optic Socket
Figure 3-5: TD80 and RCM Interconnection (no Junction Box), Single Installations, Wiring Schematic
Figure 3-6: TD80 and RCM Interconnection (no Junction Box), Single Installations, Wiring Diagram
Figure 3-7: TD80 and RCM Interconnection, Single Installation, Wiring Schematic
Figure 3-8: TD80 and RCM Interconnection, Single Installation, Wiring Diagram
Figure 3-9: TD80 and RCM Interconnection, Dual Installation (2x Single Displays), Wiring Schematic
Figure 3-10: TD80 and RCM Interconnection, Dual Installation (2x Single Displays), Wiring Diagram
Step 16: Perform the TD80 Overfill Prevention System Test and Verification

Each TD80 system installed on the tanker is to be tested by the following procedure. For two compartment tankers, steps 1 through 7 must be repeated for each TD80 and Finch. The RCM combines information from both TD80s, so each RCM compartment channel needs to be tested. Step 8, testing the permissive at the API sockets only requires one of the channels to confirm correct operation.

These steps describe tests to be completed after mechanical and electrical installation of the TD80 system. These tests may also be used to confirm correct system operation after repair. Normal responses are indicated for each test. Proceed to troubleshooting if the test results differ from the ones shown.

System Test and Verification Checklist:

<table>
<thead>
<tr>
<th>Checked</th>
<th>Step</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1. Power ON Check. Confirm Finch display and RCM startup.</td>
</tr>
<tr>
<td></td>
<td>2. Check Finch display for communication with the TD80.</td>
</tr>
<tr>
<td></td>
<td>3. Volume display</td>
</tr>
<tr>
<td></td>
<td>4. Set the Fill alarm</td>
</tr>
<tr>
<td></td>
<td>5. Clear all alarms</td>
</tr>
<tr>
<td></td>
<td>6. Simulated level and alarm response. Volume display, alarm response and RCM indicators are tested from 2LO to Spill and back to 2LO</td>
</tr>
<tr>
<td></td>
<td>7. Test the optional 4-20mA output.</td>
</tr>
<tr>
<td></td>
<td>8. Test the Optic and/or Thermistor sockets</td>
</tr>
</tbody>
</table>

Table 3-2: System Test and Verification Checklist

1. Turn power on to the TD80 system. The Display should turn on and go through its start-up sequence (approximately 10 seconds long).
   a. Finch Display is tested, showing numbers 0 thru 9 and then letters A thru F
   b. Finch Display Fill/Fall alarm is pulsed
      i. Installed light will blink
      ii. Installed horn will briefly sound
      iii. Installed underfill prevention system will activate then deactivate
   c. Finch Display Fail/Spill alarm is pulsed
      i. Installed light will blink
      ii. Installed horn will briefly sound
      iii. Installed Overfill prevention system will activate then deactivate
   d. RCM Indicators are as follows:
      i. Power Indicator is ON and solid YELLOW
      ii. Sensor #1 and #2 are OFF
      iii. Permit is ON and solid RED

2. Finch Display will show "---" for up to several seconds, then one of the following. Clear any active alarms before continuing to Step 3:
   a. "2 LO" if the tank is empty or contains liquid and the depth is less than 5.5"
   b. Level if the tank contains liquid and the depth is greater than 5.5"
   c. Error message "E xx", where xx is a number
   d. "SPill"
   e. Ensure RCM Indicators are as follows:
i. Power Indicator is ON and solid YELLOW
ii. Sensor #1 and #2 are OFF
iii. Permit is ON and solid GREEN
   1. If the Permit is SOLID RED, turn the power OFF and then back ON

3. Test the Finch volume display by doing the following:
   a. For dual rod probes, place your hand across the rods and slide it up and down the probe to check the volume display and alarm settings. If the probe is not within reach, use foil or a metal rod to short the two probe rods together.
      i. Volume displayed will increase as the hand or shorting rod moves toward the top of the compartment
      ii. Volume displayed will decrease as the hand or shorting rod moves toward the bottom of the compartment
   b. For coaxial probes, insert a small metal rod into the holes along the probe. Short the center rod to the outer tube to check the volume and alarm settings.
      i. Volume displayed will increase as the shorting rod moves toward the top of the compartment
      ii. Volume displayed will decrease as the shorting rod moves toward the bottom of the compartment

4. Set the Fill alarm according to the customer's requirements.

5. Clear all active alarms.
   a. Ensure RCM Indicators are as follows:
      i. Power Indicator is ON and solid YELLOW
      ii. Sensor #1 and #2 are OFF
      iii. Permit is ON and solid GREEN
         1. If the Permit is SOLID RED, turn the power OFF and then back ON

6. Confirm that the following occurs when the probe is shorted by a hand or metal tool to simulate liquid level at selected points:
   a. "2 LO" is displayed when the tank level is less than 5.5”. Volume is displayed when the level is above 5.5”.
   b. Installed Fall alarm activates when the tank level decreases to or is less than the Fall alarm setting.
      i. Display flashes the volume
      ii. Installed light and horn activate
      iii. Installed underfill prevention system activates
   c. Installed Fall alarm deactivates when either the Up or Down button is pressed.
      i. Display returns to normal, not flashing
      ii. Installed light and horn deactivate
      iii. Installed underfill prevention system deactivates
   d. Installed Fill alarm activates when the tank level increases to or exceeds the Fill alarm setting.
      i. Display flashes the volume
      ii. Installed light and horn activate
   e. Installed Fill alarm deactivates when either the Up or Down button is pressed.
      i. Display returns to normal, not flashing
      ii. Installed light and horn deactivate
   f. HH alarm activates when the tank level reaches the HH alarm setting.
      i. Display shows blinking “HH” and volume
      ii. Installed light and horn activate
iii. Installed onboard overfill prevention system activates
iv. RCM Indicators are as follows:
   1. Power Indicator is ON and solid YELLOW
   2. Sensor #1 or #2 is solid RED for the compartment being tested
   3. Permit is ON and solid RED

\textbf{g. HH alarm deactivates when Up-Up-Down-Up button combination is pressed.}
   i. Display returns to normal, not blinking
   ii. Installed light and horn deactivate
   iii. Installed onboard overfill prevention system deactivates
   iv. RCM Indicators are as follows:
       1. Power Indicator is ON and solid YELLOW
       2. Sensor #1 or #2 is solid RED for the compartment being tested
       3. Permit is ON and solid RED

\textbf{h. Spill alarm activates when the tank level reaches the Spill alarm setting.}
   i. Display shows flashing “SPIII”
   ii. Installed light and horn activate
   iii. Installed onboard overfill prevention system activates
   iv. RCM Indicators are as follows:
       1. Power Indicator is ON and solid YELLOW
       2. Comp #1 or #2 is solid RED for the compartment being tested
       3. Permit is ON and solid RED

\textbf{i. Spill and HH alarms deactivate when the tank level decreases more than 2” below the HH alarm setting.}
   i. Display returns to normal, not flashing “SPIII”
   ii. Installed light and horn deactivate
   iii. Installed onboard overfill prevention system deactivates
   iv. RCM Indicators are as follows:
       1. Power Indicator is ON and solid YELLOW
       2. Sensor #1 or #2 is solid RED for the compartment being tested
       3. Permit is ON and solid RED

\textbf{j. Tank level is decreased to empty and loading is permitted after 1 minute.}
   i. Display shows “2 LO”
   ii. RCM Indicators are as follows:
       1. Power Indicator is solid YELLOW
       2. Sensor 1 and 2 are OFF
       3. Permit is ON and solid GREEN
          a. If the Permit is SOLID RED, turn the power OFF and then back ON

7. Test the 4-20mA output (if installed) by doing the following:
   a. Monitor the 4-20mA signal with a Digital Multimeter (DMM).
   b. Short the probe with a small metal rod at several points along the length of the probe.
   c. No short across the probe produces a signal of 4mA or slightly greater. Increasing height of the short produces an increasing current toward 20mA.
NOTE: The TD80 system has now been thoroughly tested. The next step is to confirm correct operation of the RCM and sockets. A Universal Truck Tester (UTT) is required to test correct operation of the installed 5-wire Optic and/or 2-wire Thermistor socket(s).

8. Test the RCM signals to the Sockets. A Universal Truck Tester (UTT) with suitable cables for optic and thermistor sockets is required to complete the remaining tests.
   a. Ensure that the TD80 system and RCM are operating normally and all alarms are cleared before continuing.
   b. Configure the UTT for 5-wire optic probe testing. Refer to the UTT Operating Manual for details.
   c. Confirm that the UTT indicates Optic controlled loading permitted and denied by the following:
      i. Plug the UTT cable into the vehicle mounted 10-pin API Optic Socket.
      ii. Confirm that the Good Indicator is ON solid.
      iii. Place a hand or metal tool across the probe and slide up the probe to the HH alarm level.
      iv. Confirm that the Finch display indicates a HH alarm and the UTT indicates Fail ON solid.
      v. Slide the hand or metal tool down to the bottom of the probe and confirm that the UTT indicates Good solid after 1 minute or cycling the power.
   d. Configure the UTT for 2-wire thermistor probe testing. Refer to the UTT Operating Manual for details.
   e. Confirm that the UTT indicates Thermistor controlled loading permitted and denied by the following:
      i. Plug the UTT cable into the vehicle mounted 10-pin API Thermistor Socket.
      ii. Confirm that all the Good Indicators are ON solid.
      iii. Place a hand or metal tool across the probe and slide up the probe to the HH alarm level.
      iv. Confirm that the Finch display indicates a HH alarm and the UTT shows all Fail Indicators ON solid.
      v. Slide the hand or metal tool down to the bottom of the probe and confirm that the UTT indicates Good solid after 1 minute or cycling the power.
### Step 17: Offset Calibration Description

Offset calibration of the TD80 transmitter is required after installation, programming or replacement of the TD80 transmitter. The calibration compensates for variations from the calibration chart provided by the tank manufacturer and probe mounting height above the tank top. It is recommended to recalibrate seasonally to maintain the rated accuracy.

Small differences in tank height, probe position on the tank and variation from the calibration chart are compensated by adjusting the displayed volume to a known amount. Large changes to the offset calibration indicate an error in programming. Review the calibration chart and mounting details, confirm that the TD80 transmitter is programmed for the compartment it is installed on and reprogram if necessary.

Offset calibration will halt if the adjusted level causes the High-High alarm setting to exceed the Spill alarm level. The High-High alarm is programmed to be no closer than ½” below the Spill alarm. This is also an indication of incorrect programming to be resolved. The adjusted level may only be lowered by the distance between the High-High and Spill alarm levels.

### Methods

Methods 1 and 2 are preferred, while method 3 is acceptable as better than no calibration. The first two methods calibrate to a metered load under normal conditions. This is the most accurate compensation for mounting location and calibration chart differences. The third method compensates for mounting height only and does not have any effect on variations from the calibration chart supplied by the tank manufacturer.

1. **Offset Calibration Using a Loaded and Metered Volume**

   a. Ensure the tank is level in all directions.
   b. Fill the tank approximately 3/4 full. Determine the volume with a flow meter.
   c. Turn the gauge power off.
   d. Press and hold either the Up or Down button while turning on gauge power.
   e. Continue to hold the button down until “CAL” is displayed and then release it.
   f. After the normal display start-up sequence, “CAL” will be displayed flashing for several seconds and

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<table>
<thead>
<tr>
<th>in</th>
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<tbody>
<tr>
<td>1</td>
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<td>203.45 Spill alarm level</td>
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<td>74</td>
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<tr>
<td>75</td>
<td>205.2</td>
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<td>76</td>
<td>205.7</td>
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<tr>
<td>80</td>
<td>206.5</td>
</tr>
<tr>
<td>81</td>
<td>206.7</td>
</tr>
</tbody>
</table>

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*Figure 3-11: Sample Depth Chart*
then the current volume measured by the TD80. This should be close to the actual volume.

g. Use the Up and/or Down buttons to adjust the displayed volume to the actual amount. Then release the buttons.
h. Turn the gauge power off.
i. Turn the gauge power on, without holding any buttons.
j. Verify that the display matches the actual volume.
k. Offset calibration is now complete. This procedure should be done seasonally to maintain the TD80 rated accuracy.

2. Offset Calibration Using an Unloaded and Metered Volume

See Figure 3-11 sample depth chart for the following calibration step examples.

a. Ensure the tank is level in all directions at the unloading site.
b. Note the TD80 reported volume. This must be less than the Spill alarm level.
   i. For example, the TD80 reported volume is 198.9 bbl
c. Unload at a metered site. Note the metered volume when the tank is completely empty.
   i. For example, the site metered volume is 195.4 bbl
d. Refer to the manufacturer’s depth chart for the following step.
   i. Determine the distance between the TD80 reported volume and the metered amount. For example:
      1. The TD80 volume is 198.9 bbl at a depth of 70.75"
      2. The site metered unloaded volume is 195.4 bbl
      3. The depth chart shows 195.4 bbl at a depth of 69.00"
      4. 70.75“ - 69.00” = 1.75"
      5. The difference is 1.75” down in depth
   ii. Note this difference as an increasing or decreasing number of inches and fractional part of an inch to adjust the TD80 reported volume.
e. At the next site, load the tank to approximately 3/4 full. Note the TD80 reported volume.
   i. For example, 168.1 bbl is loaded for the calibration as shown on the Finch Display.
f. Refer to the manufacturer’s depth chart. Determine the depth at the currently loaded volume reported by the TD80.
   i. According to the sample depth chart, 168.1 bbl is at a depth of 59”
g. Add or subtract the distance calculated at step 4 to increase or decrease to the actual volume. Note the actual volume from the depth chart.
   i. For example, 59” – 1.75” = 57.25”
   ii. Actual volume is 162.5 bbl at a depth of 57.25”
   iii. 162.5 bbl will be the newly calibrated volume
h. The TD80 can now be calibrated to a metered volume.
   i. Turn the gauge power off.
   j. Press and hold either the Up or Down button while turning on gauge power.
k. Continue to hold the button down until “CAL” is displayed and then release it.
l. After the normal display start-up sequence, “CAL” will be displayed flashing for several seconds and then the current volume measured by the TD80.
   i. The TD80 reports the loaded volume as 168.1 bbl
m. Use the Up and/or Down buttons to adjust the displayed volume to the actual amount determined in step 7. Then release the buttons.
   i. In this example, press the down button until 162.5 bbl is displayed.
n. Turn the gauge power off.
o. Turn the gauge power on, without holding any buttons.
p. Verify that the display matches the actual volume.
q. Offset calibration is now complete. This procedure should be done seasonally to maintain the TD80 rated accuracy.
r. Continue to complete loading.
3. Offset Calibration Using a Measured Level

See Figure 3-11 sample depth chart for the following calibration step examples.

a. Fill the tank approximately 3/4 full. Determine the volume by dipping and referring to a depth chart. An alternative is to place a wire short at a level 1/2 to 2/3 of the probe depth in an empty tank.
   i.  For example
      1. Flat bottom tank or center of sloped bottom, 55” from the bottom
      2. Sloped bottom tank, 26” from the top (81” - 26” = 55”)
      3. Volume is 155.00 bbl
b. Turn the gauge power off.
c. Press and hold either the Up or Down button while turning on gauge power.
d. Continue to hold the button down until “CAL” is displayed and then release it.
e. After the normal display start-up sequence, “CAL” will be displayed flashing for several seconds and then the current volume measured by the TD80. This should be close to the actual volume.
f. Use the Up and/or Down buttons to adjust the displayed volume to the actual amount. Then release the buttons.
   i.  For this example, the display shows 155.0 when offset calibrated
g. Turn the gauge power off.
h. Turn the gauge power on, without holding any buttons.
i. Verify that the display matches the actual volume.
j. Offset calibration is now complete. This procedure should be done seasonally to maintain the TD80 rated accuracy.
4 Troubleshooting

The following troubleshooting instructions are specific to the RCM only. Refer to the TD80 Installation and Operation Manual, TPM 001 for full TD80 Level Gauging and Overfill Prevention System details. The RCM may be installed in any currently recommended TD80 system including one that performs onboard loading control. These details are beyond the scope of RCM installation and testing.

It is strongly recommended to complete the installation tests at step 16 once any failed component(s) have been repaired or replaced. A UTT is required to thoroughly test the entire system and provides the confidence in having a correctly and safely operating level gauging and overfill prevention system.

Equipment Required: The following items are the minimum equipment required depending on the nature of the failure.
1. Automotive Test light, 6VDC to 24VDC
2. Short length of wire bare at both ends or with alligator clips.

Optional Equipment: May be required depending on the nature of the failure.
1. Digital Multimeter (DMM)
2. Universal Truck Tester (UTT) for 5-wire optic and 2-wire thermistor installations.

4.1 Overview and General Techniques

The test light is a multi-purpose tool for checking the presence of power or ground in an automotive electrical circuit. The tip is usually pointed and sharp enough to pierce the insulation of a wire for circuit testing. Most test lights have a low resistance path due to the cold resistance of the light bulb. This makes it useful to apply either power or ground to a part of the circuit. Short circuit current is limited by the light bulb to several hundred milliamps in a typical automotive circuit. Care must be taken because even this low current may damage some low power electronic devices. The value of a test light is its inexpensiveness, ruggedness, ease of use and indications are readily apparent at a glance.

1. Check presence of battery power
   1. Test light clip is connected to power common or ground/return to battery power. This is usually the chassis of the vehicle.
   2. Probe with test light tip in all circuit points that are energized by battery power.
      a. Dim or dark light indicates low or no voltage due to a high resistance connection or open circuit.

2. Check presence of circuit ground or power return
   1. Test light clip is connected to battery power.
   2. Probe with test light tip in all circuit points that are connected to circuit ground.
      a. Dim or dark light indicates a high resistance connection or open circuit.

Varying brightness of the light bulb indicates an intermittent connection. This could be from any combination of faults listed below:

1. Corroded connector pin/socket, terminal or crimp
2. Loose screw on terminal
3. Corroded wire or splice
4. Pinched wire shorting to power, ground or another signal
5. Poor solder joint
6. Defective electrical component such as connector, switch, plug, socket, terminal strip or junction box

3. Confirm presence of an open circuit in wiring

An open circuit in wiring may be confirmed after testing by temporarily bridging the break with a short length of wire bared at both ends or a jumper with alligator clips. Care must be taken to ensure that only the open circuit is bridged and not any other part of the circuit. Confirm normal circuit operation with the wire in place. Repair the wiring as necessary.

The test light may also be used to bridge a wire break. It is current limited and will indicate current flow in the circuit. The internal resistance of the light bulb will allow some circuit components to operate such as horns, relays and lights. It will not provide operating power for a full system and indicates low current with a dim light.

4. Short circuit isolation

This can be done by disconnecting the devices from the affected wire or signal, then testing at each circuit point until the short circuit or defective component is isolated.

1. Short circuit to ground isolation.
   a. Disconnect the shorted wire at each component to isolate the short circuit.
   b. Clip on battery power; probe each component at the shorted terminal and disconnected wire. A short circuit to ground is indicated by the light partially or fully illuminating.

2. Short circuit to power isolation.
   a. Disconnect the shorted wire at each component to isolate the short circuit.
   b. Clip on ground; probe each component at the shorted terminal and disconnected wire. A short circuit to power is indicated by the light partially or fully illuminating.

4.2 TD80 System Specific Troubleshooting

Verify correct TD80 level gauging system operation before continuing with the RCM. Resolve all problems at this point before continuing.

Specific parts of the TD80 and RCM overfill prevention system are tested using a combination of voltage checking with the test light and DMM. The test light does not precisely measure the circuit voltage and must be kept in mind during the troubleshooting process.

Finding the defective component is troubleshooting or sometimes described as fault isolation. Once the defective component is determined, it is replaced or repaired and the system is fully tested to confirm correct operation. It is common for more than one defective component to cause a system failure.

The RCM front panel has four indicators to view the permit status, alarm states and vehicle battery voltage. These indicators will guide you through a logical troubleshooting process to the component requiring repair or replacement.
Provide power from a well charged battery or DC power source, 8VDC to 28VDC, steady output. Confirm this voltage using a Digital Multimeter. Do not use a battery charger for testing.

The following troubleshooting steps are organized by system or circuit function and symptoms. These are some of the most common system wiring and component failures along with suggested troubleshooting and repair steps.

As an alternative, please also refer to the pictorial Rack Control Module Operator Guide for loading, unloading, alarm and error conditions.
Symptom 1: Terminal rack controller does not permit loading. A NON-PERMISSIVE signal is always sent to the terminal rack controller. Confirm with a UTT.

### For Single or Dual TD80 Systems:

<table>
<thead>
<tr>
<th>Permit: OFF</th>
<th>Sensor 1: OFF</th>
<th>Sensor 2: OFF</th>
<th>Power: OFF</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>WHAT TO DO:</th>
<th>DETAILS:</th>
<th>WHAT TO CHECK:</th>
<th>REMEDY:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check for power and ground inside the RCM Junction Box</td>
<td>Clip the test light to the ground terminal and probe the power terminal</td>
<td>i. If the test light illuminates, check wiring between the junction box and the RCM</td>
<td>Repair the wiring or replace the RCM</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ii. If the test light does not illuminate, check for a loose or disconnected wiring inside the junction box</td>
<td>Repair or replace the wiring</td>
</tr>
</tbody>
</table>

### For Single or Dual TD80 Systems:

<table>
<thead>
<tr>
<th>Permit: RED</th>
<th>Sensor 1: OFF</th>
<th>Sensor 2: OFF</th>
<th>Power: BLINKING YELLOW</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>WHAT TO DO:</th>
<th>DETAILS:</th>
<th>WHAT TO CHECK:</th>
<th>REMEDY:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measure the battery voltage inside the RCM junction box</td>
<td>Place the DMM probes on the power and ground terminals</td>
<td>i. Voltage measures greater than 8VDC. Typical vehicle battery voltage is 13VDC.</td>
<td>Check wiring between the junction box and RCM. Repair the wiring or replace the RCM</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ii. Voltage measures less than 8VDC</td>
<td>1. Check for loose or corroded wiring inside the junction box. Repair or replace the wiring. 2. Ensure that the vehicle power is from a well charged battery or DC power source, 8VDC to 28VDC. 3. Check for loose or corroded wiring providing power to the Finch display and RCM junction box. Repair or replace the wiring.</td>
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</tbody>
</table>
### For Single or Dual TD80 Systems:

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<th>Sensor 2: BLINKING ORANGE</th>
<th>Power: BLINKING ORANGE</th>
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<td><strong>WHAT TO DO:</strong></td>
<td><strong>DETAILS:</strong></td>
<td><strong>WHAT TO CHECK:</strong></td>
<td><strong>REMEDY:</strong></td>
</tr>
<tr>
<td>Check ground connection</td>
<td>Poor or no ground connection</td>
<td>Check for continuity of ground connection from RCM to truck ground</td>
<td>1. Inspect RCM wiring connections and repair as necessary</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2. Test RCM wiring for continuity and repair as necessary</td>
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<tr>
<td></td>
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<td></td>
<td>3. Possible defective RCM, replace the RCM</td>
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</table>

### For Single or Dual TD80 Systems:

<table>
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<td><strong>DETAILS:</strong></td>
<td><strong>WHAT TO CHECK:</strong></td>
<td><strong>REMEDY:</strong></td>
</tr>
<tr>
<td>Use the UTT to test the permissive signal at the API socket(s)</td>
<td>a. If the UTT indicates GOOD</td>
<td>i. Check for worn or corroded pins on the API socket(s)</td>
<td>Repair or replace the socket</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ii. Problem with the terminal rack controller cable</td>
<td>Inform terminal rack operator of problem</td>
</tr>
<tr>
<td></td>
<td>b. If the UTT indicates FAIL</td>
<td>i. Check for worn or corroded pins on the API socket(s)</td>
<td>Repair or replace the socket(s)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ii. Check for loose, broken or corroded wiring inside the API socket(s)</td>
<td>Repair or replace the wiring or terminator module</td>
</tr>
<tr>
<td></td>
<td></td>
<td>iii. Check the wiring between the RCM and socket(s)</td>
<td>Repair the wiring, replace the RCM or affected terminator module</td>
</tr>
</tbody>
</table>
### For Single or Dual TD80 Systems:

<table>
<thead>
<tr>
<th>Permit: RED</th>
<th>Sensor 1: RED</th>
<th>Sensor 2: OFF</th>
<th>Power: SOLID YELLOW</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>WHAT TO DO:</th>
<th>DETAILS:</th>
<th>WHAT TO CHECK:</th>
<th>REMEDY:</th>
</tr>
</thead>
</table>
| Check the Finch display for an active alarm, system error code or loss of communication | Clear the alarm or resolve the TD80 system malfunction | If the alarm clears, no system errors or loss of communication and Sensor 1 remains RED | 1. Check for loose or broken wiring at the RCM junction box. Repair or replace the wiring.
2. Check the wiring between the junction box and RCM. Repair the wiring or replace the RCM |

### For Single or Dual TD80 Systems:

<table>
<thead>
<tr>
<th>Permit: DIM RED, BLINKING</th>
<th>Sensor 1: DIM RED, BLINKING</th>
<th>Sensor 2: DIM RED, BLINKING</th>
<th>Power: DIM RED, BLINKING</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>WHAT TO DO:</th>
<th>DETAILS:</th>
<th>WHAT TO CHECK:</th>
<th>REMEDY:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check for incorrect wiring of SV input and power input</td>
<td>One or Two SV channels are switched with RCM Power Input</td>
<td>If test light on SV input does not blink after first 10 second of power up, this is likely power connected to the wrong input.</td>
<td>Correct wiring to ensure SV from TD80 goes to RCM SV Input, and power goes to RCM Power Input</td>
</tr>
</tbody>
</table>
For Single or Dual TD80 Systems:

**Permit:** RED  
**Sensor 1:** OFF  
**Sensor 2:** RED  
**Power:** SOLID YELLOW

<table>
<thead>
<tr>
<th>WHAT TO DO:</th>
<th>DETAILS:</th>
<th>WHAT TO CHECK:</th>
<th>REMEDY:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check the Finch display for an active alarm, system error code or loss of communication</td>
<td>Clear the alarm or resolve the TD80 system malfunction</td>
<td>If the alarm clears, no system errors or loss of communication and Sensor 2 remains RED</td>
<td>1. Check for loose or broken wiring at the RCM junction box. Repair or replace the wiring.</td>
</tr>
</tbody>
</table>

2. Check the wiring between the junction box and RCM. Repair the wiring or replace the RCM.

---

For Single or Dual TD80 Systems:

**Permit:** RED  
**Sensor 1:** RED  
**Sensor 2:** RED  
**Power:** SOLID YELLOW

<table>
<thead>
<tr>
<th>WHAT TO DO:</th>
<th>DETAILS:</th>
<th>WHAT TO CHECK:</th>
<th>REMEDY:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check the Finch display for an active alarm, system error code or loss of communication</td>
<td>Clear the alarm or resolve the TD80 system malfunction</td>
<td>If the alarm clears, no system errors or loss of communication and Sensor 1 and 2 remains RED</td>
<td>1. Check for loose or broken wiring at the RCM junction box. Repair or replace the wiring.</td>
</tr>
</tbody>
</table>

2. Check the wiring between the junction box and RCM. Repair the wiring or replace the RCM.
Symptom 2: Terminal rack controller does not deny loading. A PERMISSIVE signal is always sent to the terminal rack controller. Confirm with the UTT.

For Single or Dual TD80 Systems:

<table>
<thead>
<tr>
<th>WHAT TO DO:</th>
<th>DETAILS:</th>
<th>REMEDY:</th>
</tr>
</thead>
<tbody>
<tr>
<td>If both optic and thermistor sockets continue to permit</td>
<td>a. Check the sockets for shorted terminals and wires</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. Check the wiring between the RCM and the sockets</td>
<td>Repair or replace the wiring</td>
</tr>
<tr>
<td>If only one socket continues to permit</td>
<td>a. Check the socket(s) for loose or shorted wiring</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. Replace the affected optic or thermistor terminator module</td>
<td></td>
</tr>
<tr>
<td></td>
<td>c. Check the wiring between the RCM and affected socket</td>
<td>Repair the wiring or replace the RCM</td>
</tr>
</tbody>
</table>
Symptom 3: Terminal rack controller halts loading before expected. HH alarm shuts down loading prematurely. Finch display shows flashing “HH” and loaded volume for the affected compartment.

For Single or Dual TD80 Systems:

<table>
<thead>
<tr>
<th>Permit: RED</th>
<th>Sensor 1 or Sensor 2: RED</th>
<th>Power: SOLID YELLOW</th>
</tr>
</thead>
<tbody>
<tr>
<td>WHAT TO DO:</td>
<td>DETAILS:</td>
<td>WHAT TO CHECK:</td>
</tr>
<tr>
<td>Check the following for the affected Sensor</td>
<td>Check the volume of product loaded at the terminal rack</td>
<td>i. If the volume loaded is less than the expected HH alarm level</td>
</tr>
<tr>
<td>ii. If the volume loaded is the same as the HH alarm volume, then a normal rack shutdown occurred.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
4.3 TD80 and RCM Intermittent Circuit Troubleshooting

Diagnosing and repairing a problem that comes and goes is one of the most challenging situations to troubleshoot. Sometimes the problem only affects one part of a system or seeming random things happen everywhere.

Where do you start?

Start by knowing your system; how it operates, what features and options are installed and know that most problems are caused by wires. Broken wires, corroded wires, short circuited wires and ones that sometimes make and then break a circuit can cause a confusing collection of symptoms.

General guidelines for intermittent faults are listed below.

1. Visually inspect all wiring and interconnections for:
   a. Broken, stretched or chaffed insulation.
   b. Areas at terminal strips for loose connections and corrosion.
   c. Places where wires have been joined by a crimp or solder connection.
   d. Any place that is covered with electrical tape that appears to be a splice or repair.
   e. Water, frost, ice, heavy dust, metal particles or loose hardware inside enclosures and junction boxes.

2. Observe all trouble indications
   a. Does the problem always appear in the same way or does it change from time-to-time?

3. Consider the history.
   a. Was the system recently installed, repaired or modified?
   b. Does this problem have a history of reappearing after repair?

4. Try to reproduce the problem.
   a. Does the problem appear when the system is first turned on or after some period of time?
   b. Does the problem seem to be vibration related?

A useful technique is to inspect the system while it is operating and carefully wiggle, slightly tug or bend wires where intermittent connections are most likely to occur. These are at terminal strips, crimped or soldered connections, plug and sockets. Observe if the problem repeatedly appears when one area of the wiring is moved.

Keep in mind that there may be more than one wiring problem if the situation is after an installation or extensive repair.

Some common TD80, Finch and RCM indications are listed with suggested troubleshooting and repair steps.

1. Finch display repeatedly cycles the display (0 thru 9, A thru F) and alarm tests.
   a. Power is being interrupted:
      i. Check all battery power and electrical ground connections to the Finch display.

2. Finch display repeatedly shows “----”, indicating loss of communication with the TD80 transmitter.
   a. Power, electrical ground or the SV Bus data between the Finch display and TD80 transmitter is being interrupted:
i. Check all electrical wiring and connections between the affected transmitter and display.

ii. If this happens while a two-way radio is keyed, find and physically separate all TD80/Finch and radio wiring.

3. Intermittent RCM Permissive. Permit light changes from green to red and back to green intermittently.
   a. All lights go out:
      i. Check power and electrical ground between the RCM and Finch or junction box terminated wiring.
   b. Power light blinks, and then turns solid yellow:
      i. Check power and electrical ground between the RCM and Finch or junction box terminated wiring.
      ii. Measure the battery voltage at the Finch with a Digital Multimeter (DMM).
         1. The voltage must be at least 8VDC and stable for correct RCM operation. Provide power from a well charged battery. Do not use a battery charger.
   c. One or both Sensor lights blink red and off while the Power light remains solid yellow:
      i. Finch display shows “----” and then volume:
         1. Power, electrical ground or the SV Bus data between the Finch display and TD80 transmitter is being interrupted.
            a. Check all electrical wiring and connections between the affected transmitter and display.
      ii. Finch is operating normally, showing volume:
         1. Check the SV Bus data wiring of the affected Sensor channel between the RCM and the Finch or junction box terminated wiring.
   d. Permit light goes from green to red and then back to green after about 10 seconds. Sensor 1 and/or Sensor 2 lights go red:
      i. Power to the TD80 and Finch is being interrupted.
         1. Check all battery power and electrical ground connections to the Finch display.
   e. Permit light goes from green to red and then back to green after about 5 seconds. Sensor 1 and/or Sensor 2 lights go red:
      i. SV Bus data is between the Finch and the RCM is being interrupted.
         1. Check the SV Bus data wiring of the affected Sensor 1 and/or Sensor 2 channel between the RCM and Finch or junction box terminated wiring.
   f. Permit light remains red until the next time power is cycled and then returns to green:
      i. Check the Finch display for error codes indicating a TD80 transmitter or probe malfunction. Resolve the TD80 and/or probe problem.
      ii. Observe the Finch display for erratic and incorrect volume changes or alarms. This indicates a TD80 or probe malfunction. Resolve the TD80 and/or probe problem.
5 Technical Reference

5.1 Rack Control Module Kit Components:

- Rack Control Module
- Dual sockets with built-in ground bolt
- Thermistor 6-Way Dummy and Optical Booster (Optic-only model does not include thermistor socket with dummy)
- Installation Manual
- Quick Reference Operator Guide

5.2 Specifications:

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power</td>
<td>8-30 VDC</td>
</tr>
<tr>
<td>Current Consumption</td>
<td>40mA at 12V</td>
</tr>
<tr>
<td>Ambient Temperature Range</td>
<td>-40°C to +40°C</td>
</tr>
<tr>
<td>Communications</td>
<td>TD80 SVBus</td>
</tr>
<tr>
<td>Environment</td>
<td>Hazardous area approvals</td>
</tr>
<tr>
<td></td>
<td>Class I, Div. 2, Groups C &amp; D, T3</td>
</tr>
<tr>
<td></td>
<td>Intrinsically safe associative</td>
</tr>
<tr>
<td></td>
<td>Weatherproof- NEMA 4 or Type 4</td>
</tr>
</tbody>
</table>

Dimensions:

![Figure 5-1: RCM Dimensions](image-url)