1.3.6 System Integrity Checking

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.

Not only loss of communication or alarms, but loss of data integrity due to TD80 transmitter failure, marginal operation or interference causes the loading operation to halt.

The TD80 and RCM must be powered and operating normally when unloading from a Spill alarm level. The RCM continues to send a shutdown or non-permissive signal until the tank is unloaded below ¼ of the HH alarm volume and remains there for at least 1 minute or the power is turned from off to on while the tank is below HH.

Loading from an empty (2LO) condition begins the integrity checking sequence. Any volume below ¼ of the HH volume does not trigger an alarm response for shutdown. Sporadic HH or 2LO near the bottom of the tank is not an immediate concern. The sensitivity to sporadic 2LO and HH alarm increases as the tank is loaded through several zones. Between 1/4HH and 3/4HH, the 2LO and HH alarm may be active for up to 30 seconds without danger of overfill. When one of these conditions exists over 30s, usually caused by a malfunction, loading is halted. The logic for 2LO and HH alarm becomes more sensitive between 3/4HH and 9/10HH volume. The threshold is now 10 seconds for shutdown. At 9/10HH to HH volume, the logic becomes much more sensitive with a 5s threshold for shutdown. Once the loaded volume is greater than the HH volume, shutdown is delayed by 2 seconds to allow the rack controller to halt loading normally without detecting an overfill with the resulting emergency shutdown. The Spill alarm is filtered for volumes below HH to prevent sporadic alarms with the resulting shutdown. Spill alarm causes immediate shutdown when loaded at or above the HH alarm volume.
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.

Wiring Instructions for RCM to Thermistor Dummy and Optic Booster Modules

The following installation instructions are for prewired socket and dummy module assemblies provided by Titan for use with the RCM.

Industry standard API 10-pin and J560 sockets, the thermistor dummy and optic booster are required for the RCM to operate with the terminal rack controller for overfill prevention.

These pre-assembled sockets and modules are shipped ready for connection to the RCM wiring. A crimp style parallel splice is attached to the orange wire of the thermistor dummy and optic booster modules. This is normally connected to one of the black RCM wires. It doesn’t matter which black wire in the cable. A ring terminal is ready on each of the sockets for connection to a white wire. Each black and white wire pair controls a separate socket and module.

Installation Notes

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

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

3. Ensure only approved IS devices are connected to the IS rack circuit.

4. Do not mix IS and non-IS wiring.
Wiring Instructions

Refer to the instructions below and the wiring diagrams appropriate for the socket type being installed.

1. Locate the red parallel splice on the orange wire of the thermistor dummy or optic booster module.
2. Separate the RCM cable wire pairs. There are two sets of black and white wires. One black and white pair is for each socket in dual socket assemblies. Ensure that the foil shield and bare grounding wires are cut back to the cable sheath. This prevents shorting to the socket pins with the resulting non-permissive at the rack.
3. Strip and crimp a black RCM wire onto the parallel splice at step 1.
4. Remove the red ring terminal from the appropriate socket:
   a. 10-pin thermistor socket pin-3
   b. 10-pin optic socket pin-6
5. Strip and crimp the matching white RCM wire onto the ring terminal and reconnect to the appropriate socket pin.
6. Repeat steps 1 through 5 for the remaining black and white wires to the second socket. For single sockets, cut off the remaining pair of wires at the cable jacket.

**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.
Updated Section 3.3, Step 16

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.

Keep the integrity checking in mind when testing the RCM. Lifting your hand or metal tool away from the probe may result in a non-permissive. This is reset by cycling power or allowing an empty tank (2LO) indication for over 1 minute.

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>
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<tr>
<td></td>
<td>3. Volume display</td>
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<td></td>
<td>4. Set the Fill alarm</td>
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<tr>
<td></td>
<td>5. Clear all alarms</td>
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<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 3-1: 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 (Finch 5332 only)
      i. Optional light will blink
      ii. Optional horn will briefly sound
      iii. Optional low level prevention system will activate then deactivate
   c. Finch Display Fail/Spill alarm is pulsed (Finch 5332 only)
      i. Optional light will blink
      ii. Optional horn will briefly sound
      iii. Optional 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 or allow the 2LO indication for over 1 minute.

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 and Fall alarms 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 ON or allow the 2LO indication for over 1 minute.

6. Confirm that the following occurs when the probe is shorted by a hand or metal tool to simulate liquid level at selected points:

   **Warning: Removing the hand or metal tool from the probe during test may cause the RCM to non-permit.**

   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. Optional Fall alarm activates when the tank level decreases to or is less than the Fall alarm setting.
      i. Display flashes the volume
      ii. Optional light and horn activate
      iii. Optional low level prevention system activates
   c. Optional Fall alarm deactivates when the ACK button for the Finch II or either the Up or Down button for the Finch 5332 is pressed.
      i. Display returns to normal, not flashing
      ii. Optional light and horn deactivate
      iii. Optional low level prevention system deactivates
d. Optional Fill alarm activates when the tank level increases to or exceeds the Fill alarm setting.
   i. Display flashes the volume
   ii. Optional light and horn activate

e. Optional Fill alarm deactivates when the ACK button for the Finch II or either the Up or Down button for the Finch 5332 is pressed.
   i. Display returns to normal, not flashing
   ii. Optional 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. Optional light and horn activate
   iii. Optional 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

g. HH alarm deactivates when the ACK button for Finch II or Up-Up-Down-Up button combination for Finch 5332 is pressed.
   i. Display returns to normal, not blinking
   ii. Optional light and horn deactivate
   iii. Optional 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

h. Spill alarm activates when the tank level reaches the Spill alarm setting.
   i. Display shows flashing “SPill”
   ii. Optional light and horn activate
   iii. Optional 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

i. Spill alarm deactivates when the tank level decreases more than 2" below the HH alarm setting.
   i. Display returns to normal, not flashing “SPill”
   ii. Optional light and horn deactivate
   iii. Optional 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

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, near the bottom at the shorting block 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, then remove the hand or tool 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, near the bottom at the shorting block 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, then remove the hand or tool and confirm that the UTT indicates Good solid after 1 minute or cycling the power.
Figure 3-1: Wiring for Standard API Optic and Thermistor Sockets

**NOTE:**
SUITABILITY OF THE FINAL INSTALLATION IS TO BE DETERMINED BY THE INSPECTION AUTHORITY HAVING JURISDICTION TO MAINTAIN THE INTEGRITY SAFE SYSTEMS OF THE EQUIPMENT. ONLY APPROVED DEVICES ARE CONNECTED TO THE INSTRUMENT CIRCUITRY.

DO NOT MIX IEC (15) AND NBN (16) WIRING.
Figure 3-2: Wiring For Standalone J560 7-pin Optic Socket
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 SIGNALS 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 Standalone API Optic and Thermistor Sockets 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 3-12: TD80 and RCM Interconnection, Dual Installation (1x Finch II),
Wiring Schematic
Figure 3-13: TD80 and RCM Interconnection, Dual Installation (1x Finch II), Wiring Schematic