FINCH II Installation and Operation Manual

TPM 010, Rev 7.1

PROPRIETARY INFORMATION

Contents

1 Introduction

1.1 About This Manual

This document will describe the recommended procedure for installing a FINCH II Display. A Titan Logix system must be installed and operated in accordance with the details described in the Titan Logix manuals, application notes and all other relevant publications.

- This Manual (TPM010) is specific to the FINCH II Installation and Operation.
- For complete information on the TD100, please refer the TD100 Product Manual, TPM 057.
- For complete information on the RCM, please refer to the RCM Product Manual, TPM 007.

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.

WARNING
Only qualified personnel familiar with the installation and operation of this equipment should install, adjust operate, or service this equipment. Failure to observe these instructions and applicable safety and electrical regulations could result in bodily injury or loss of life.
Only replace with sand filled fuses of same type and rating.
EXPLOSION HAZARD – Substitution of components may impair suitability for Class 1, Division 2.
EXPLOSION HAZARD – Do not connect or disconnect equipment or replace fuse unless power has been switched off and / or the area is known to be non-hazardous.
EXPLOSION HAZARD – Batteries must only be changed in an area known to be non-hazardous.
To maintain a Class 1, Division 2 rating, each relay must only be supplied with 8-30VDC / 3.3A max transient protected power.

1.3 FINCH II

The FINCH II Display is weather-proof device for internal or external use. It provides bright LED numeric display of volume information, alarms, and system error codes from the TD80 and the TD100 transmitter. Various alarm and error conditions are detected by the transmitter and display. These alarm states control four internal relays for alarming, high level shutdown and low-level prevention.
The FINCH II contains high power relays to directly control a bottom loading solenoid valve or control of an onboard loading pump.

- FINCH II-W provides Rack control (RCM)support for 1 or 2 compartments.
- FINCH II-6W provides Rack control (RCM) support for up to 5 compartments.

2 Installation

2.1 Pre-Installation Requirements

1. When choosing a location to install the Titan Logix system, the following guidelines must be followed:
   - Appropriate industry, national, provincial/state, and local codes.
   - Fuses and components are 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.
4. This manual will provide information about:

- Probe and Transmitter location
- Probes (Dual Rod & Coaxial)
- FINCH II Display location.
- Optional Alarm Device location.
- Electrical requirements

2.2 Titan System Installation Workflow

Installation Workflow	
1	Program the TD100 Transmitter and FINCH II Display
2	Install the TD100
3	Mount the FINCH II Display
4	Mount the Alarm Accessories (optional), including the RCM
5	Inspect the Mechanical Installation
6	Install the Electrical Wiring
7	Set and Verify the Correct Switch Settings
8	Confirm Fuses Installed with Correct Type and Rating
9	Perform the Basic Operation Test
10	Verify TD100 Transmitter Programming Information
11	Set the FILL or FALL Alarm Level Volume
12	Perform the TD100 System Test and Verification
13	Perform Offset Measurement

Table 2-2 Installation Workflow

2.3 Titan System Installation Steps

1. Program the TD100 and FINCH II Display

   The TD100 must be programmed before use. Programming may be done at the factory when purchased, programmed by the customer prior to installation or after installation on the vehicle when necessary.

   The FINCH II display may need to be programmed. Alarms are assigned to internal relay actions for flexible alarm annunciation and high-level shutdown. The factory settings are appropriate for most applications. Programming may be done by prior to installation or after installation on the vehicle when necessary.

2. Install the TD100 as indicated in the TD100 Installation and Operation manual. (TPM 057)
3. Mount the FINCH II display in a suitable location (preferably in a weatherproof enclosure)
4. Optional Alarm accessories mounting

   (Lights, Horns, Alarm Acknowledge push button)
5. Inspect the Mechanical Installation
6. Electrical Installation

   - The TD100 transmitter is provided with a 50'/ 75' cable kit. It is recommended to use the kit with included sealing fitting for connection to the FINCH II display.

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

   - Wire splices should be made inside a weatherproof enclosure to prevent premature failure due to corrosion.

- Secure all wires and cabling with clips or cable ties.
- Tighten all compression fittings.
- Refer to Figure 2-4 through Figure 2-11 within this document, for installation wiring diagrams and instructions.
- Tighten all terminal screws; both wired and unused. The screws may loosen and fall out due to vibration if not secured. Loose metal hardware inside the enclosure may cause permanent equipment damage.

7. FINCH display switch setting and verification.
Place the following switches in the positions required for the installation. The factory settings are listed below.

***The Rotary Switches in the FINCH II have been disabled. ***
As of FINCH II firmware v2.8.5, decimal point and volume units will be received from the TD100. User will see units and decimal point placement of the associated strapping table.

A-DIP, ON = up, OFF= down
1 Enable Offset Calibration (Factory set to ON)
2 Enable Low Level Reading (Factory set to OFF)
3 Dual Compartment Failsafe (Factory set to OFF)
4 Reserved

B-DIP, ON = up, OFF = down.
1 Reserved
2 Set Remote Acknowledge to be an Alarm Input (Factory set to OFF)
3 Global Acknowledge Enable (Factory set to OFF)
4 Hardware Settings Lock (Factory set to OFF)

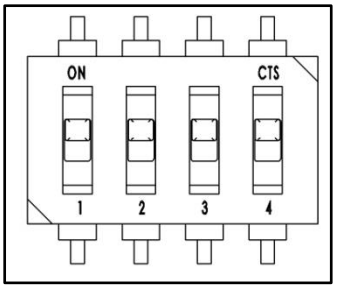

Figure 2-3, Dip Switch

8. Confirm FINCH Fuses are installed with correct Type (Ceramic, Sand Filled) and Rating.
- HORN, LIGHT, PUMP/AUX = 5A
- RELAY MAIN = 10A (*See section 11 for details on Relay Ratings)*.

9. Perform the TD100 Basic Operation Test

10. Verify TD100 programming information for the following:
a) Correct depth chart and units
b) Fill or Fall alarm levels.
c) HH level
d) Spill Level

11. Set the Fill and/ or Fall alarm for the required level
12. Perform TD100 System Test and Verification
13. Perform the Offset Measurement

2.4 FINCH II Electrical Wiring Instructions

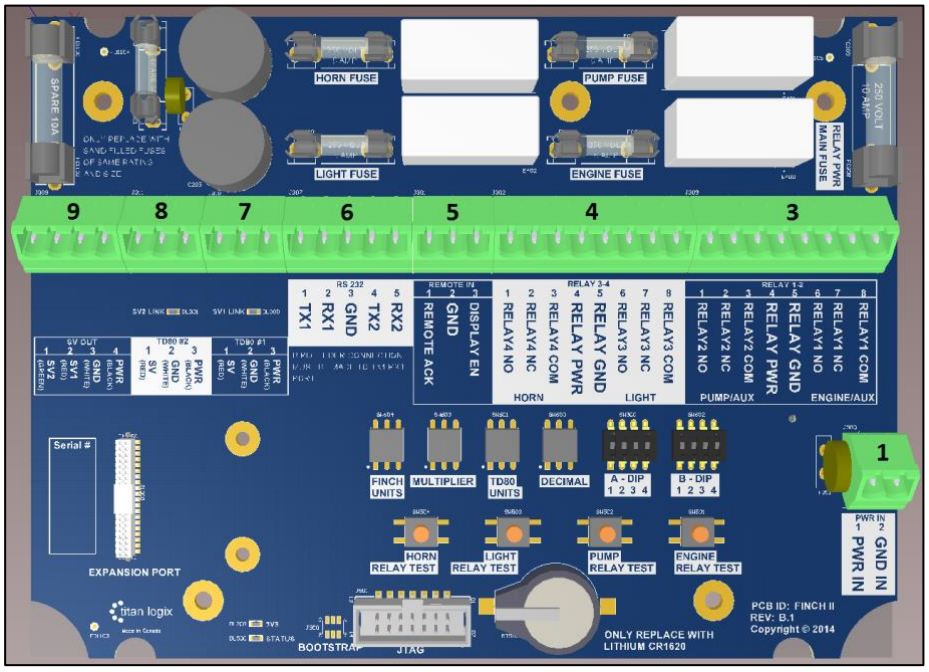

Figure 2-3B, FINCH II Terminal Board, Revision B

Figure 2-3C, FINCH II Terminal Board 3V3 LED

Note 2-1: Electrical Installation

1. Vehicle manufacturers usually have specific locations for electrical power access. These locations are fuse protected to limit short-circuit current. Refer to the vehicle documentation or contact the manufacturer for the recommended locations prior to the electrical installation.
2. For trailers, connect the TD100 system power and ground to the nose box electrical connector. This will be a fused electrical power source from the truck. For trucks, connect TD100 system power to a switched and fused accessory power connection from the battery. A switched electrical power source is required to reduce battery drain while not in operation.
3. When making connections to the vehicle electrical ground, ensure that the wiring is terminated at a battery ground terminal. Some metal components are electrically insulated from the battery ground or bolted with painted surfaces causing a poor connection.
4. Wire splices should be made inside a weatherproof enclosure to prevent premature failure due to corrosion.
5. Secure all wires and cabling with clips or cable ties.
6. Tighten all compression fittings.
7. To maintain safety integrity of the Titan Logix system, It is recommended that armoured cable be used for all wiring between devices. Alternatively, approved conduit can be used to protect the cables.
8. Follow all safety standards and requirements as per the Authorities Holding Jurisdiction (AHJ). Additionally, all industry recommended practices for the vehicle must be followed.

2.5 Basic Single or Dual Compartment Installation (FINCH II-W)

Wiring steps for a basic single or dual TD100 transmitter and FINCH II-W installation.
Refer to Figure 2-4 through Figure 2-7 for the wiring diagrams and schematics. Observe the recommended cable routing in Figure 2-5 and Figure 2-7 to minimize external wiring connections. All wiring interconnections should be made inside a weatherproof enclosure.

Note 2-2: Electrical Installation

1. Terminals on the FINCH are identified by the name of the connector group: terminal name (terminal number), for example PWR IN: GND IN (1) describes the power ground terminal at the far-right hand side of the FINCH terminals.
2. The Power Switch, Remote Alarm Acknowledge push button and Horn are optional accessories.

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2.5.1 FINCH II-W Installation Overview

	FINCH II-W Installation Overview
1	Locate a switched and fuse protected source of electrical power. Wire from nose box socket or junction box to FINCH PWR IN: PWR IN (1). *See Note 2-1.*
2	Ground wire from nose box socket to FINCH PWR IN: GND IN (2)
3	First TD100 Power (black wire) to FINCH TD100 #1: PWR (BLACK) (3)
4	First TD100 Ground (white wire) to FINCH TD100 #1: GND (WHITE) (2)
5	First TD100 SV Bus (red wire) to FINCH TD100 #1: SV (RED) (1)
6	Complete these Steps for the optional second TD100 transmitter. I. Second TD100 Power (black wire) to FINCH TD100 #2: PWR (BLACK) (3) II. Second TD100 Ground (white wire) to FINCH TD100 #2: GND (WHITE) (2) III. Second TD100 SV Bus (red wire) to FINCH TD100 #2: SV (RED) (1)
7	Wire from FINCH REMOTE IN: DISPLAY EN (3) to REMOTE IN: GND (2).
8	**Optional** Remote Alarm Acknowledge push button. Follow the instructions below for the push button installation or skip to next step if the push button is not installed. Wire REMOTE IN: REMOTE ACK (1) to one terminal of the Normally Open push button switch. Wire REMOTE IN: GND (2) to the other terminal of the push button switch.
9	Optional Horn. Follow the instructions below for horn installation or skip to next step if the horn is not installed. I. Wire from RELAY 3-4: RELAY PWR (4) to RELAY 3-4: RELAY4 COM (3). II. RELAY 3-4: RELAY4 NO (1) to HORN (+) III. RELAY 3-4: RELAY GND (5) to HORN (–)
10	Tighten all terminal screws; both wired and unused. The screws may loosen and fall out due to vibration if not secured. Loose metal hardware inside the enclosure may cause permanent equipment damage.

2.5.2 Mount the FINCH II-W Display

a) Attach the mounting tabs to the back of the FINCH II-W display.

b) Mount the display, ensuring that the unit is:
- Installed in a location that does not exceed Class 1, Div. 2 hazardous area classification.
- Mounted in a protected area, shielded from wheel spray and stones.
- Not operated in temperatures less than -40C and greater than +65.

2.5.3 Enable Remote Display

a) To enable the display to stay ON while in use, access the FINCH II-W circuit board and connect DISPLAY EN and GND using a jumper wire as shown.

Figure 2-5-3, Connect the Jumper wire

2.5.4 Connect TD 100 to FINCH II-W

a) Use the Titan-supplied explosion-proof harness (wire kit) to connect the TD100 cable to the FINCH II-W.
b) Insert wires from the explosion-proof elbow into the 1/2" thread for the connector and tighten the union nut on the TD100.
c) Make the following connections:
   i) TD100 Power (PWR) to FINCH II-W Power (PWR) - Black Wire
   ii) TD100 Ground (GND) to FINCH II-W Ground (GND) - White Wire
   iii) TD100 SV (SV Bus) to FINCH II-W SV (SV) - Red or Green Wire

Figure 2-5-4A, Explosion Proof Elbow

Figure 2-5-4B, Connection Power, Ground, SV

Figure 2-5-4C, Connections

2.5.5 Connect to Vehicle Power

a) TRAILERS - connect the FINCH II power and ground to the nose box or junction box electrical connector.
   TANK TRUCKS - connect FINCH II system power to a switched accessory power connection from the battery.
b) Pass the power cable from a vehicle through a strain relief (gland) and connect it to power and ground as shown in the image.
c) Tighten the strain relief until the cable cannot be pulled, leaving enough cable inside to open the door.

Figure 2-5-5,
Connect to Vehicle Power

2.5.6 Connect to Compartments 1 & 2

a) Install wire harness from TD100 on Compartment 1 through a gland to COMP #1 following the color sequence as shown in the picture.

b) Install wire harness from TD100 on Compartment 2 through a gland to COMP #2 following the color sequence as shown in the picture.

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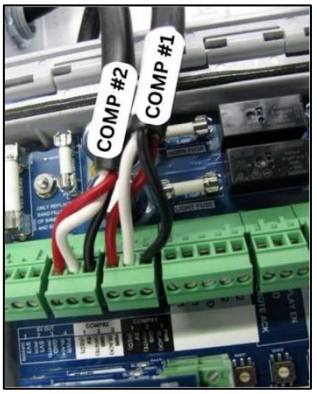

Figure 2-5-6, Compartments 1 & 2

Figure 2.5.6B, Connections on the TD100

2.5.7 Connect the RCM (Optional)

Make the following connections from the 4 wires on the RCM wiring harness to SV out terminal strip on the FINCH II-W.

BLACK ⟶ #4 PWR
WHITE ⟶ #3 GND
RED ⟶ #2 SV1
GREEN ⟶ #1 SV2

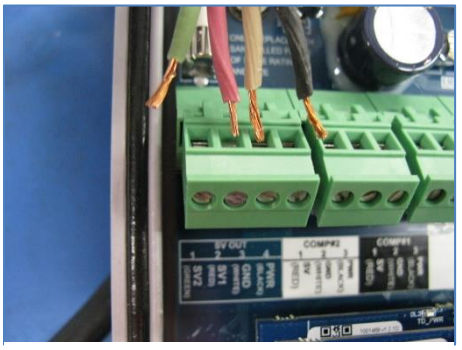

Figure 2-5-7, Connect the RCM

2.5.8 Complete the Installation

a) Close and tighten the screws of the FINCH II-W enclosure, ensuring all connections are secure before applying power to the TD100 system.
b) Complete the programming of FINCH II-W following the steps described in FINCH II Programming and Configuration Guide.
c) Visually confirm if the number of compartments displayed in the Finch II-W matches the number of compartments in the truck.
d) In the event error messages are observed when applying power to the system, refer to the Troubleshooting section of this manual.

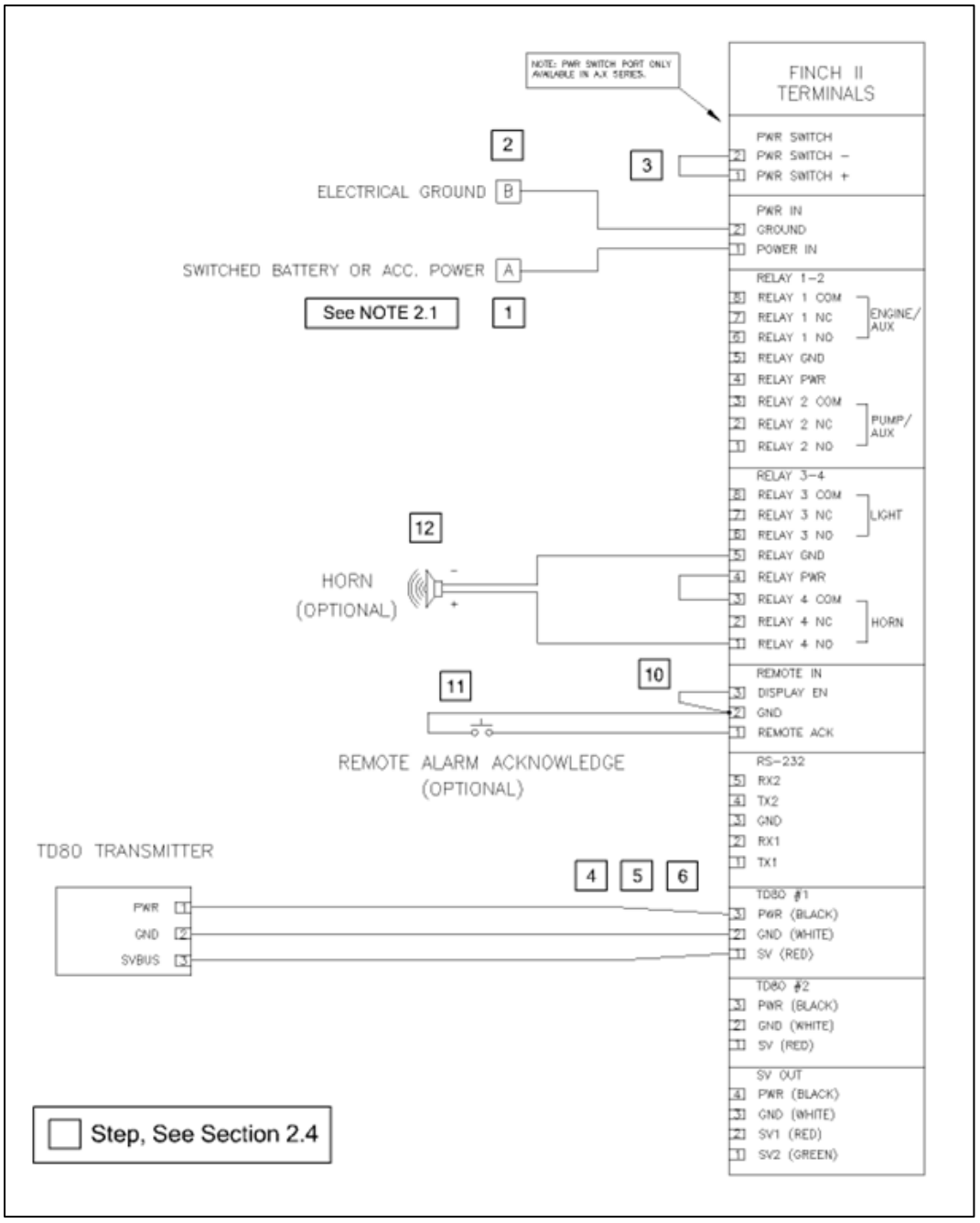

Figure 2-4 Single TD100 Wiring Schematic for FINCH II External Display

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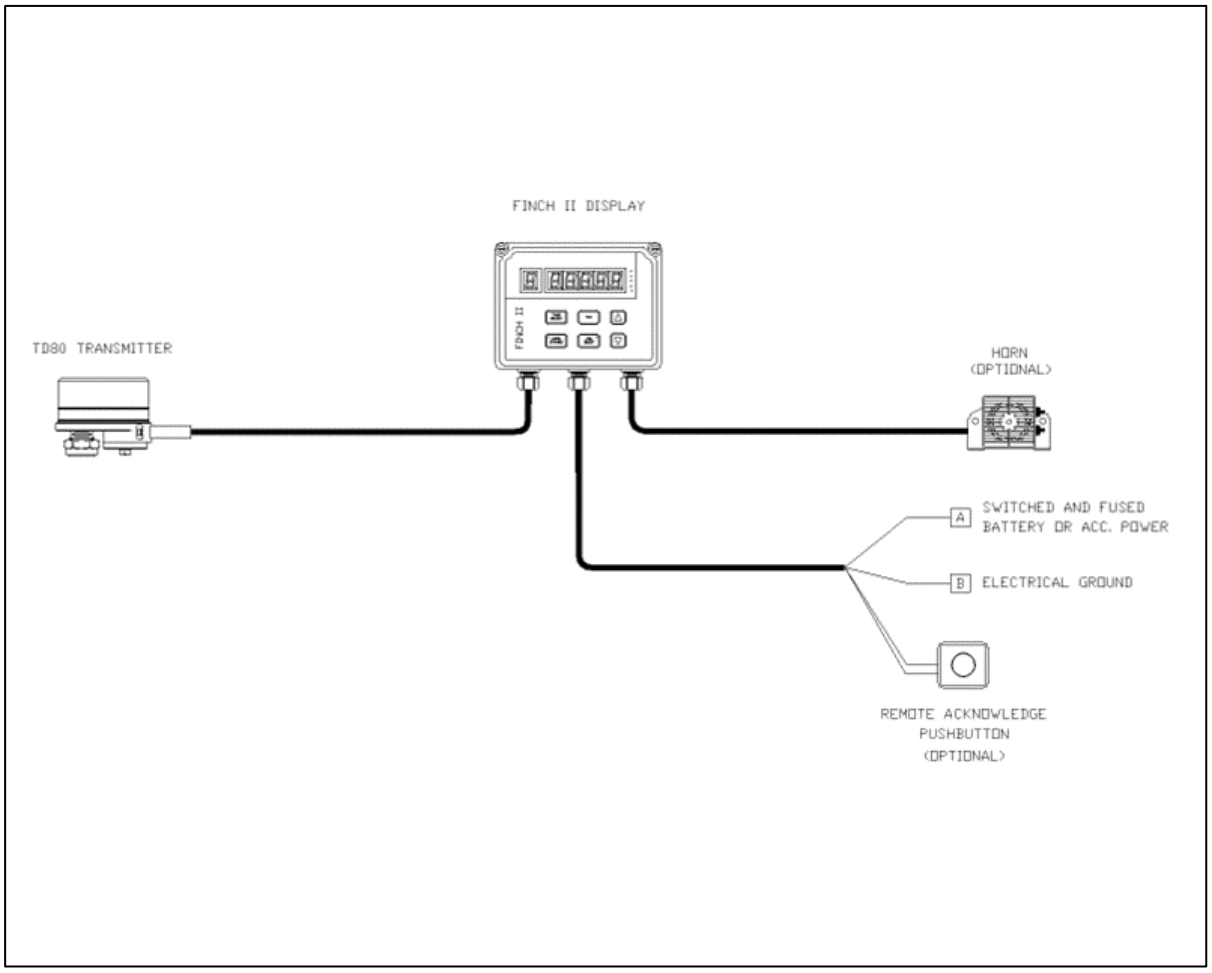

Figure 2-5: Single TD100 Wiring Diagram for FINCH II External Display

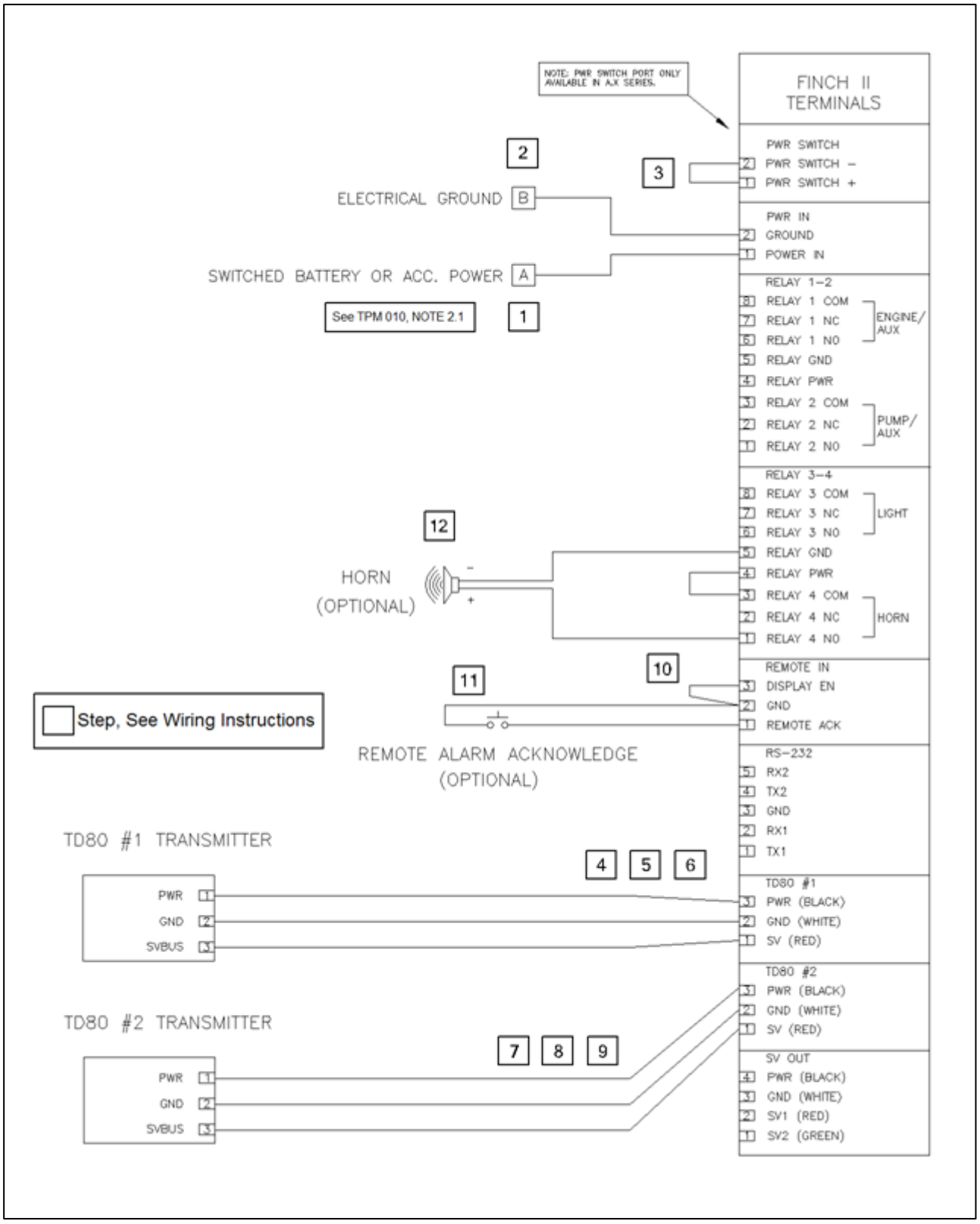

Figure 2-6: Dual TD100 Wiring Schematic for FINCH II External Display

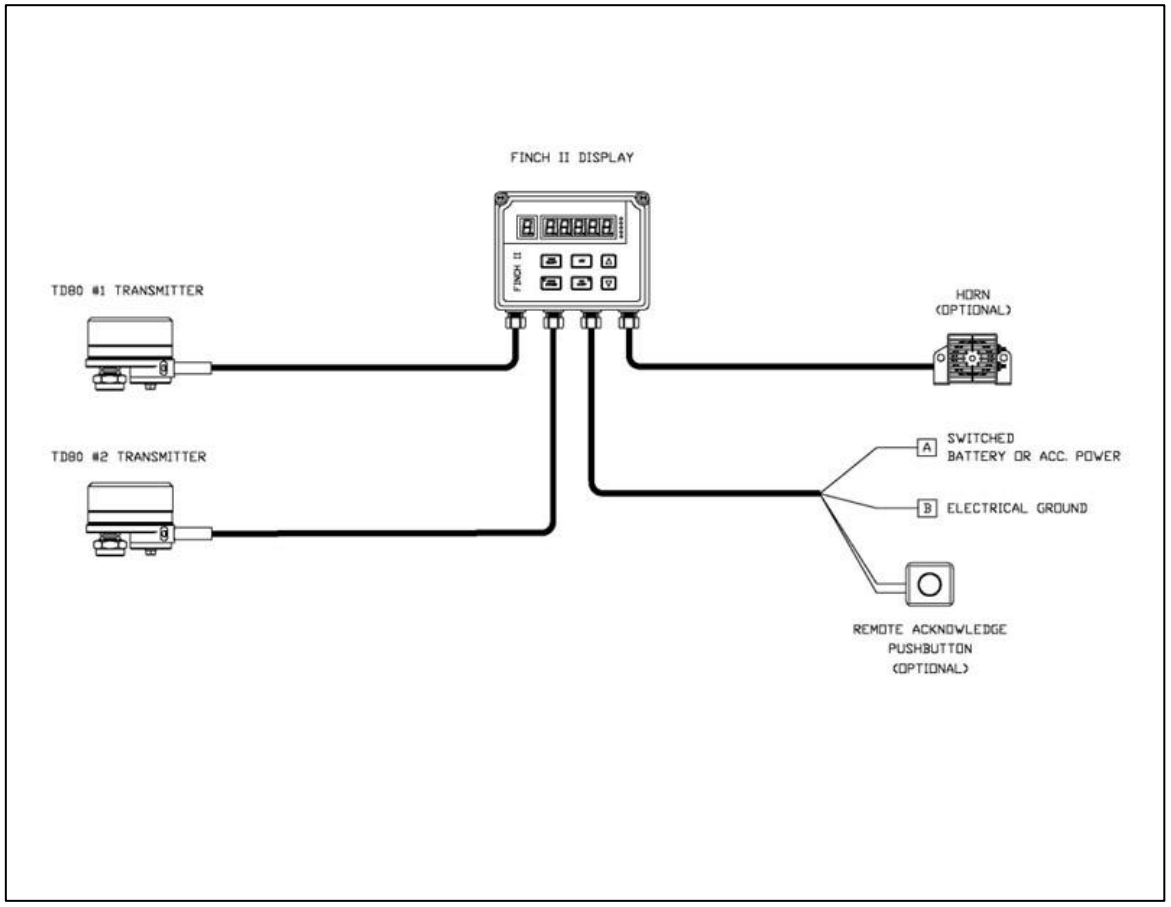

Figure 2-7: Dual TD100 Wiring Diagram for FINCH II External Display

2.6 Multi Compartment Installation (FINCH II-6W)

FINCH II-6W Installation Overview	
1	Mount the FINCH II-6W in a suitable location
2	Enable remote display
3	Connect TD100 to FINCH 6-W
4	Connect to vehicle power
5	Connect to compartments 1 & 2
6	Connect to compartments 3 & 4
7	Connect to compartments 5 & 6
8	Connect to RCM
9	Complete the installation

2.6.1 Mount the FINCH II-6W

i) Attach the mounting tabs to the back of the FINCH display.

ii) Mount the display, ensuring that the unit is:

- Installed in a location that does not exceed Class 1, Div. 2 hazardous area classification.
- Mounted in a protected area, shielded from wheel spray and stones.
- Not operated in temperatures less than -40°C or greater than +65°C.

2.6.2 Enable Display

To enable the display to stay ON while in use, access the FINCH II-6W circuit board and connect DISPLAY EN and GND using a jumper wire.

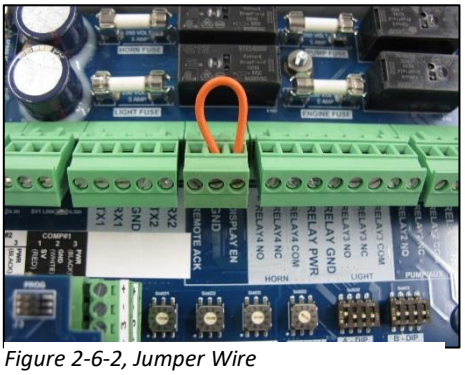

Figure 2-6-2, Jumper Wire

2.6.3 Connect TD100 to FINCH II-6W

i) Use the Titan-supplied explosion-proof harness (wire kit) to connect the TD100 cable to the FINCH II-6W.

ii) Insert wires from the explosion-proof elbow into the 1/2" thread for the connector and tighten the union nut on the TD100.

iii) Make the following connections:

- TD100 Power (PWR) to FINCH II-6W Power (PWR) - Black Wire
- TD100 Ground (GND) to FINCH II-6W Ground (GND) - White Wire
- TD100 SV (SV Bus) to FINCH II-6W SV (SV) - Red or Green Wire

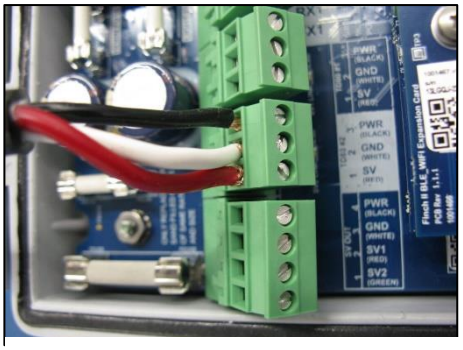

Figure 2-6-3, Connect TD100 to FINCH II-6W

2.6.4 Connect to Vehicle Power

i) TRAILERS - connect the FINCH II power and ground to the nose box or junction box electrical connector.
TANK TRUCKS - connect FINCH II system power to a switched accessory power connection from the battery.

ii) Pass the power cable from a vehicle through a strain relief (gland) and connect it to power and ground as shown in the image.

iii) Tighten the strain relief until the cable cannot be pulled, leaving enough cable inside so the door can be opened.

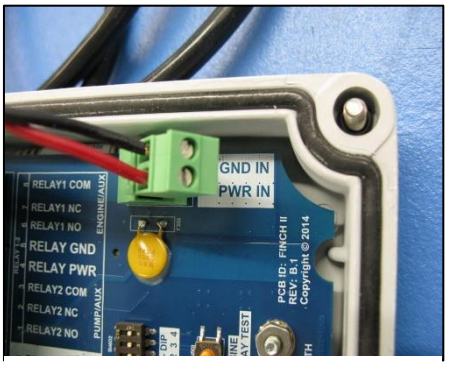

Figure 2-6-4, Connect to Vehicle Power

2.6.5 Connect to Compartments 1& 2

i) Install wire harness from TD100 on Compartment # 1 through a cable gland to COMP #1 following the colour sequence as shown in the picture.

ii) Install wire harness from TD100 on Compartment # 2 through a cable gland to COMP #2 following the colour sequence as shown in the picture

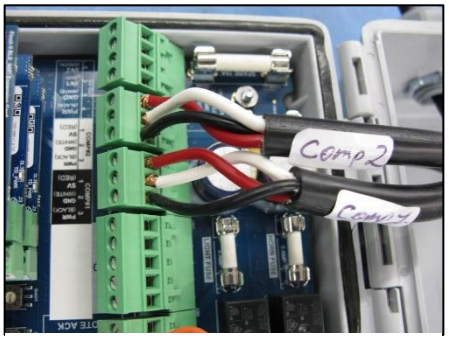

Figure 2-6-5A, Connect compartment 1 & 2

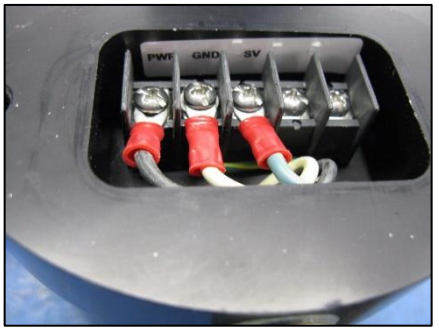

Figure 2-6-5B, Connect to TD100

NOTE:
Some wire harnesses have GREEN colored wired instead of RED. Ensure the color sequence matches what was connected to the TD100 terminal strip.

2.6.6 Connect to Compartments 3 & 4

i) Install wire harness from TD100 through a gland to the terminal block for COMP #3 on the SV3/4 daughter card following the colour sequence as shown in the picture.

ii) Install wire harness from TD100 through a gland to the terminal block for COMP #4 on the SV3/4 daughter card following the colour sequence as shown in the picture.

iii) It may be easier to remove the connector from the daughter board to install the wires as shown in the image.

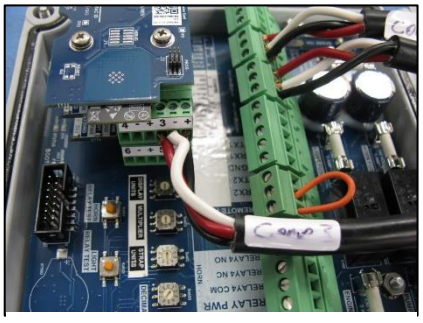

Figure 2-6-6A, Attach to terminal block on SV3/4 daughter card.

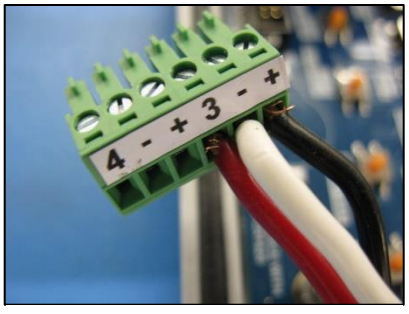

Figure 2-6-6B, Remove connector from daughter board

2.6.7 Connect to Compartments 5 & 6

i) Install wire harness from TD100 through a gland to the terminal block for COMP #5 on the SV5/6 daughter card following the colour sequence as shown in the picture.

ii) If your installation involves a Rack Control Module, then jump to next step. If you want to connect to the sixth compartment instead, please follow through with the next step.

iii) Install wire harness from TD100 through a gland to the terminal block for COMP #6 on the SV5/6 daughter card following the colour sequence as shown in the picture.

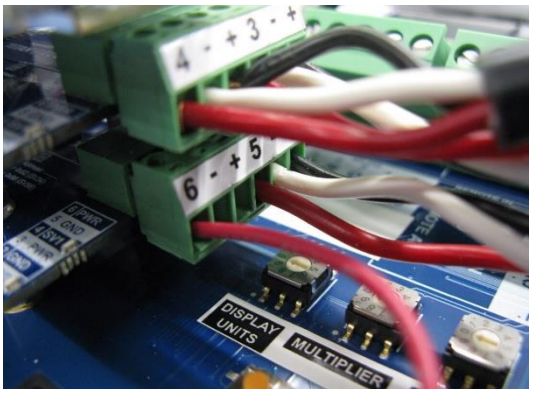

Figure 2-6-7, Connect compartments 5 & 6

2.6.8 Connect to Rack Control Module (Optional)

i) If using an RCM, Install wire harness from the RCM through a gland to the SV out connector of the FINCH II.

ii) Connect Power and Ground (Black & White Wires) to the SV out terminal strip and connect the Red & Green to a 3-way connector as shown in Figure 2-6-8B.

iii) Connect a 3rd wire (Yellow) to the 3-way connector and install it into SV 6 of the expansion board. (Figure 2-6-8C).

iv) Make sure to wrap the 3-way connector with electrical tape to insulate the metal part from the rest of the circuitry.

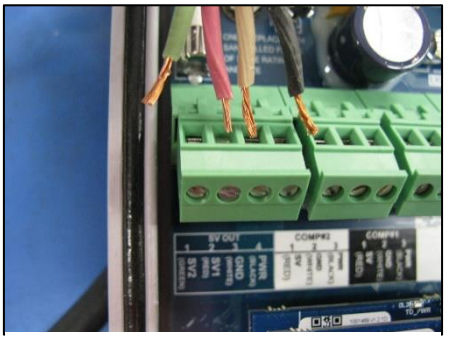

Figure 2-6-8A, Connect Power and Ground

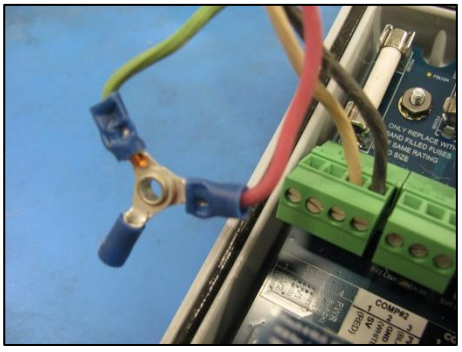

Figure 2-6-8B, Connect Red & Green to 3 way connector

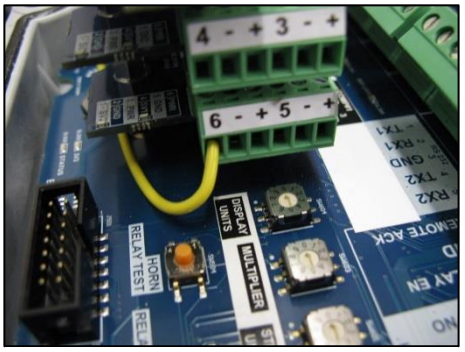

Figure 2-6-8C, Connect yellow wire to SV6

2.6.9 Complete the Installtion

i) Replace the FINCH II circuit board cover and any other system cover/ enclosure, ensuring all connections are secure before applying power to the TD100 system.

ii) Complete the programming of FINCH II following the steps described in FINCH II Programming and Configuration Guide.

iii) Visually confirm if the number of compartments displayed in the FINCH II matches the number of

compartments in the truck.

iv) In the event error messages are observed when applying power to the system, refer to the Troubleshooting section of this manual.

2.7 FINCH II Display & High-Level Shutdown Electrical Wiring Instructions

Refer to Figure 2-8 and Figure 2-9 for the wiring diagram and schematic.
Observe the recommended cable routing in Figure 2-9 to minimize external wiring connections. All wiring interconnections should be made inside a weatherproof enclosure.
The wiring steps described below and in Figure 2-8 and Figure 2-9 are the recommended TD100 Transmitter and FINCH II Display installation for hazardous locations. The most common control devices for high level shutdown are:

1. A **normally closed (NC)** bottom loading valve
   OR
2. A **normally open (NO)** hydraulic motor bypass valve

Note 2-3 Electrical Installation for High Level Shutdown

- Terminals on the FINCH II are identified by the name of the connector group: terminal name (terminal number), for example PWR IN: GND IN (1) describes the power ground terminal at the far-right hand side of the FINCH terminals. See Figure 2-2
- The Horn, Remote Alarm Acknowledge, Power Switch, Red and Green lights are optional accessories.
- The DISPLAY EN signal must be connected to a switch controlled by the Power Take-Off (PTO), brake air pressure or some other device to indicate product loading will take place. The terminal may be permanently connected to GND if this feature in not used.
- Power may be controlled by an optional brake air pressure switch when Anti-Lock Brake (ABS) power is used for the TD100 system.

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Electrical Wiring Instructions	
1	Optional power control switch on ABS power (J560 socket, pin 7) using a brake air pressure switch. Follow Step 1a and 1b for the optional power control or Step 1c for a dedicated TD100 system power. a. ABS power wire from the nose box socket or junction box to the pressure switch common (COM) terminal. b. The pressure switch normally closed (NC) terminal to the FINCH PWR IN: PWR IN (1). OR c. Locate a switched and fuse protected source of electrical power. Wire from the nose box to FINCH PWR IN: PWR IN (1). See Note 2-1.
2	Ground wire from the nose box socket or junction box to FINCH PWR IN: GND IN (2)
3	**Optional PTO or brake air pressure switch**. Follow the instructions in Steps 3a and 3b for the switch installation. Follow Step 3c if the switch is not installed. a. Wire the FINCH REMOTE IN: DISPLAY EN (3) to the normally open (NO) contact of the switch. b. Wire the FINCH REMOTE IN: GND (2) to the common (COM) terminal of the switch. OR

	c. Wire from the FINCH REMOTE IN: DISPLAY EN (3) to REMOTE IN: GND (2).
4	**Complete these steps for a single TD100 installation** TD100 Power (black wire) to FINCH TD100 #1: PWR (BLACK) (3) TD100 Ground (white wire) to FINCH TD100 #1: GND (WHITE) (2) TD100 SV Bus (red wire) to FINCH TD100 #1: SV (RED) (1) To install a second TD100 follow the following instructions: TD100 Power (black wire) to FINCH TD100 #2: PWR (BLACK) (3) TD100 Ground (white wire) to FINCH TD100 #2: GND (WHITE) (2) TD100 SV Bus (red wire) to FINCH TD100 #2: SV (RED) (1)
5	The following optional items listed in these following Steps, are mounted in a weather protected enclosure. Grouping these items together allows a common ground wire to the FINCH II display to minimize the number or wires and interconnections inside the FINCH enclosure. 1. For any optional Horn, Remote Acknowledge switch or light installation, follow 1a below and continue with **Steps 2 through 5**. If none of the optional accessories are installed, Skip to **Step 6**. a. Wire FINCH RELAY 3-4: RELAY GND (5) into the panel or enclosure containing the optional accessories. 2. Optional Remote Alarm Acknowledge push button. Follow the instructions below for the push button installation. Skip to **Step 3** if the push button is not installed. a. Wire REMOTE IN: REMOTE ACK (1) to one terminal of the **Normally Open (NO)** push button switch. b. Connect the wire from FINCH RELAY 3-4: RELAY GND (5) to the other terminal of the push button switch. 3. Optional Horn. Follow the instructions below for horn installation. Skip to **Step 4** if the horn is not installed. a. Wire from RELAY 3-4: RELAY PWR (4) to RELAY 3-4: RELAY4 COM (3). b. RELAY 3-4: RELAY4 NO (1) to **HORN (+).** c. Wire from FINCH RELAY 3-4: RELAY GND (5) to **HORN (–).**
6	Optional Red Light. Follow the instructions below for the Red light installation. Skip to **Step 8** if the light is not installed. a. Wire from RELAY 3-4: RELAY PWR (4) to RELAY 3-4: RELAY3 COM (8). b. RELAY 3-4: RELAY3 NO (6) to one terminal (ungrounded terminal) of the Red light. c. Wire from FINCH RELAY 3-4: RELAY GND (5) to the other terminal of the Red light.
7	Optional Green Light. Follow the instructions below for the Green light installation. Skip to **Step 9** if the light is not installed. a. RELAY 1-2: RELAY 2 NO (1) to one terminal (ungrounded terminal) of the Green light. b. Wire from FINCH RELAY 1-2: RELAY GND (5) to the other terminal of the Green light.
8	Solenoid wiring. a. Wire from RELAY 1-2: RELAY PWR (4) to RELAY 1-2: RELAY2 COM (3). b. Wire FINCH RELAY 1-2: RELAY 2 NO (1) to one terminal or wire lead of the Solenoid. c. Wire FINCH RELAY 1-2: RELAY GND (5) to the other terminal or wire lead of the Solenoid.
9	Tighten all terminal screws; both wired and unused. The screws may loosen and fall out due to vibration if not secured. Loose metal hardware inside the enclosure may cause permanent equipment damage.

WARNING:
DO NOT directly control the vehicle engine with the Engine Relay. It provides a control signal to an external accessory only. Refer to the vehicle or engine manufacturer's instructions for engine shutdown installation and testing.

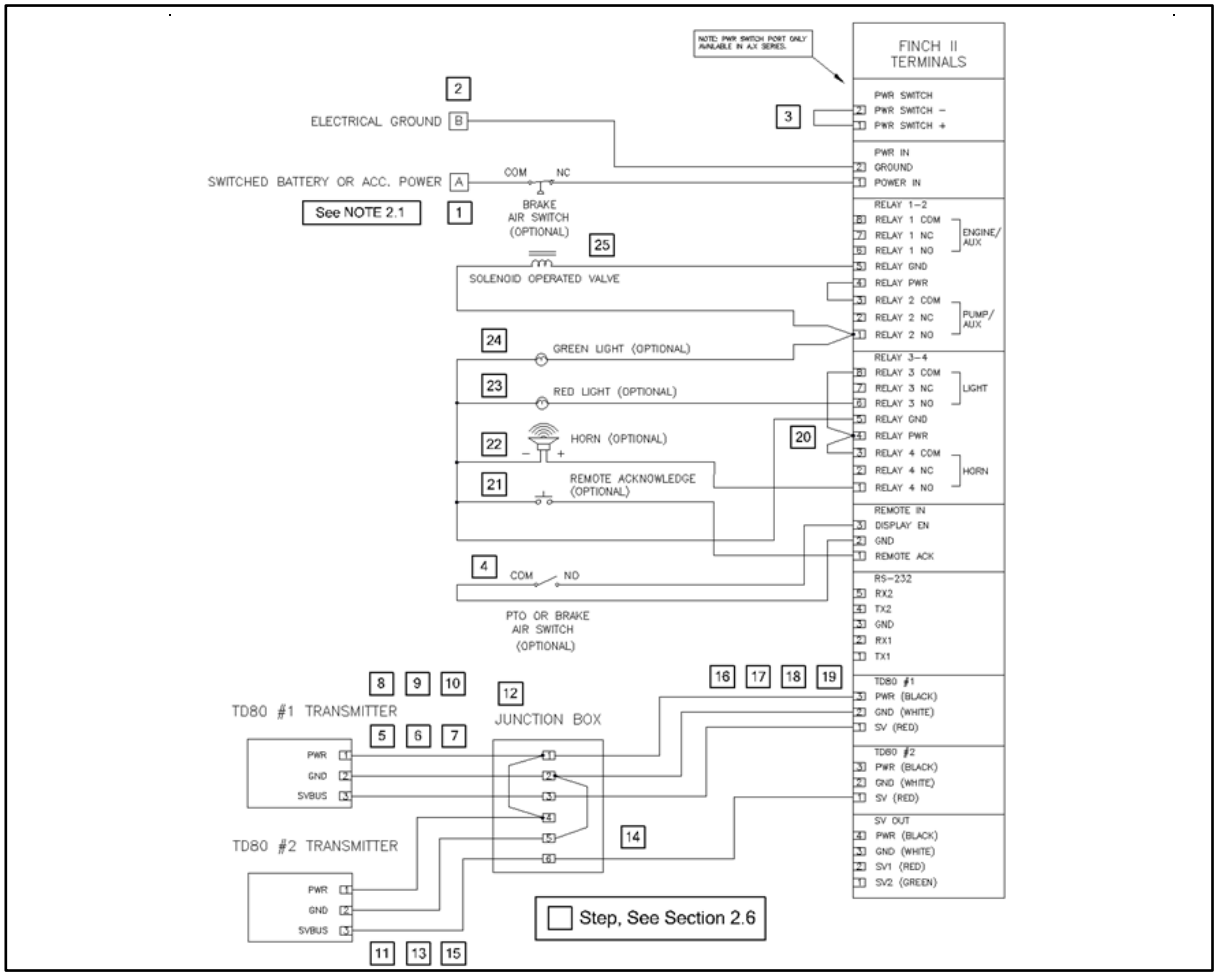

Figure 2-8: Dual TD100 Wiring Schematic for FINCH II External Display with High level Shutdown System

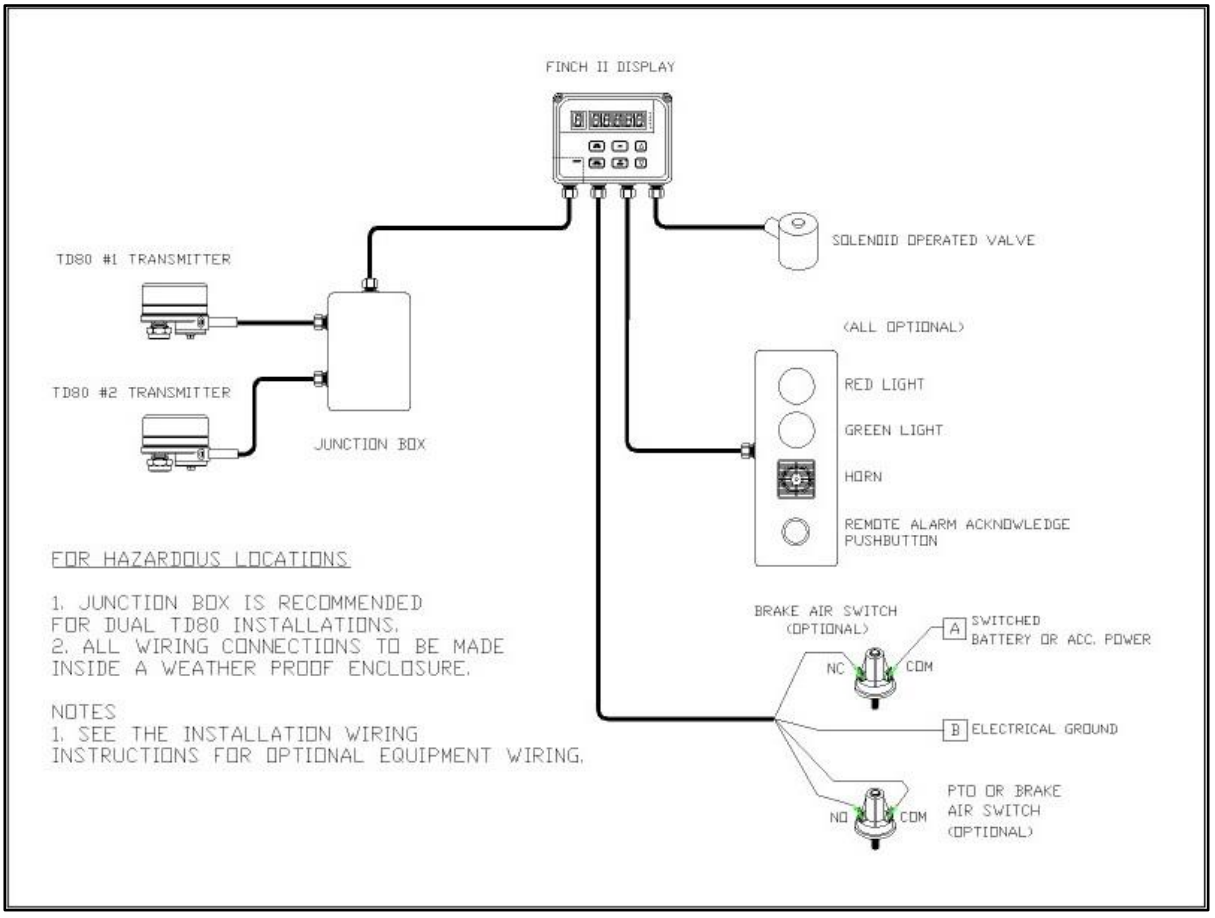

Figure 2-9: Dual TD80/100 Wiring Diagram for FINCH II External Display with High Level Shutdown System

2.8 Single Compartment Crude Oil Trailer with On-board Pump or Bottom Loading Valve Control

Wiring steps for a single TD80/100 transmitter and FINCH II Display installation with a high-level shutdown system. Refer to *Figure 2-10* and *Figure 2-11* for the wiring schematic and diagram. Observe the recommended cable routing in *Figure 2-11* to minimize external wiring connections. All wiring interconnections should be made inside a weatherproof enclosure. The wiring steps described below and in *Figure 2-10* and *Figure 2-11* are recommended TD100 Transmitter and FINCH II Display installation for hazardous locations.

The most common control devices for high level shutdown are:

1) A normally closed (NC) bottom loading valve **OR** 2) A normally open (NO) hydraulic motor bypass valve.

Note 2-4: Electrical Installation for high level shutdown system

- Terminals on the FINCH II are identified by the name of the connector group: terminal name (terminal number), for example PWR IN: GND IN (1) describes the power ground terminal at the far-right hand side of the FINCH terminals. See Figure 2-2.
- The Horn and Power Switch are optional accessories.
- The DISPLAY EN signal must be connected to a switch controlled by the Power Take-Off (PTO), brake air pressure or some other device to indicate product loading will take place. The terminal may be permanently connected to GND if this feature is not used.

- Power may be controlled by an optional brake air pressure switch when Anti- Lock Brake (ABS) power is used for the TD100 system.

2.8.1 Electrical Installation for high level shutdown system

Electrical Installation for high level shutdown system	
1	Optional power control switch on ABS power (J560 socket, pin 7) using a brake air pressure switch. Follow Step 1a and 1b for the optional power control or Step 1c for a dedicated TD100 system power. a) ABS power wire from the nose box socket to the pressure switch common (COM) terminal. b) The pressure switch normally closed (NC) terminal to the FINCH PWR IN: PWR IN (1). or c) Locate a switched and fuse protected source of electrical power. Wire from the nose box socket or junction box to FINCH PWR IN: PWR IN (1). See Note 2-1.
2	Ground wire from the nose box socket or junction box to FINCH PWR IN: GND IN (2).
3	Optional PTO or brake air pressure switch. Follow the instructions in Steps 4a and 4b for the switch installation. Follow Step 4c if the switch is not installed. a) Wire FINCH REMOTE IN: DISPLAY EN (3) to normally open (NO) contact of the switch. b) Wire the FINCH REMOTE IN: GND (2) to the common (COM) terminal of the switch. or c) Wire from the FINCH REMOTE IN: DISPLAY EN (3) to REMOTE IN: GND (2)
4	- TD80/100 Power (black wire) to FINCH TD100 #1: PWR (BLACK) (3) - TD80/100 Ground (white wire) to FINCH TD100 #1: GND (WHITE) (2) - TD80/100 SV Bus (red wire) to FINCH TD100 #1: SV (RED) (1) If an additional TD100 is deployed: TD80/100 Power (black wire) to FINCH TD100 #2: PWR (BLACK) (3) - TD80/100 Ground (white wire) to FINCH TD100 #2: GND (WHITE) (2) - TD80/100 SV Bus (red wire) to FINCH TD100 #2: SV (RED) (1)
5	Optional Horn. Follow the instructions below for horn installation. a) - Wire RELAY 3-4: RELAY PWR (4) to RELAY 3-4: RELAY4 COM (3). b) - Wire RELAY 3-4: RELAY4 NO (1) to HORN (+). c) - Wire RELAY 3-4: RELAY GND (5) to HORN (-).
6	Solenoid wiring. The solenoid control may be for an on-board loading pump or bottom loading valve. a) - Wire RELAY 1-2: RELAY PWR (4) to RELAY 1-2: RELAY2 COM (3). b) - Wire RELAY 1-2: RELAY2 NO (1) to one terminal or wire lead of the Solenoid. c) - Wire RELAY 1-2: RELAY GND (5) to the other terminal or wire lead of the Solenoid.

WARNING:
DO NOT directly control the vehicle engine with the Engine Relay. It provides a control signal to an external accessory only. Refer to the vehicle or engine manufacturer's instructions for engine shutdown installation and testing.

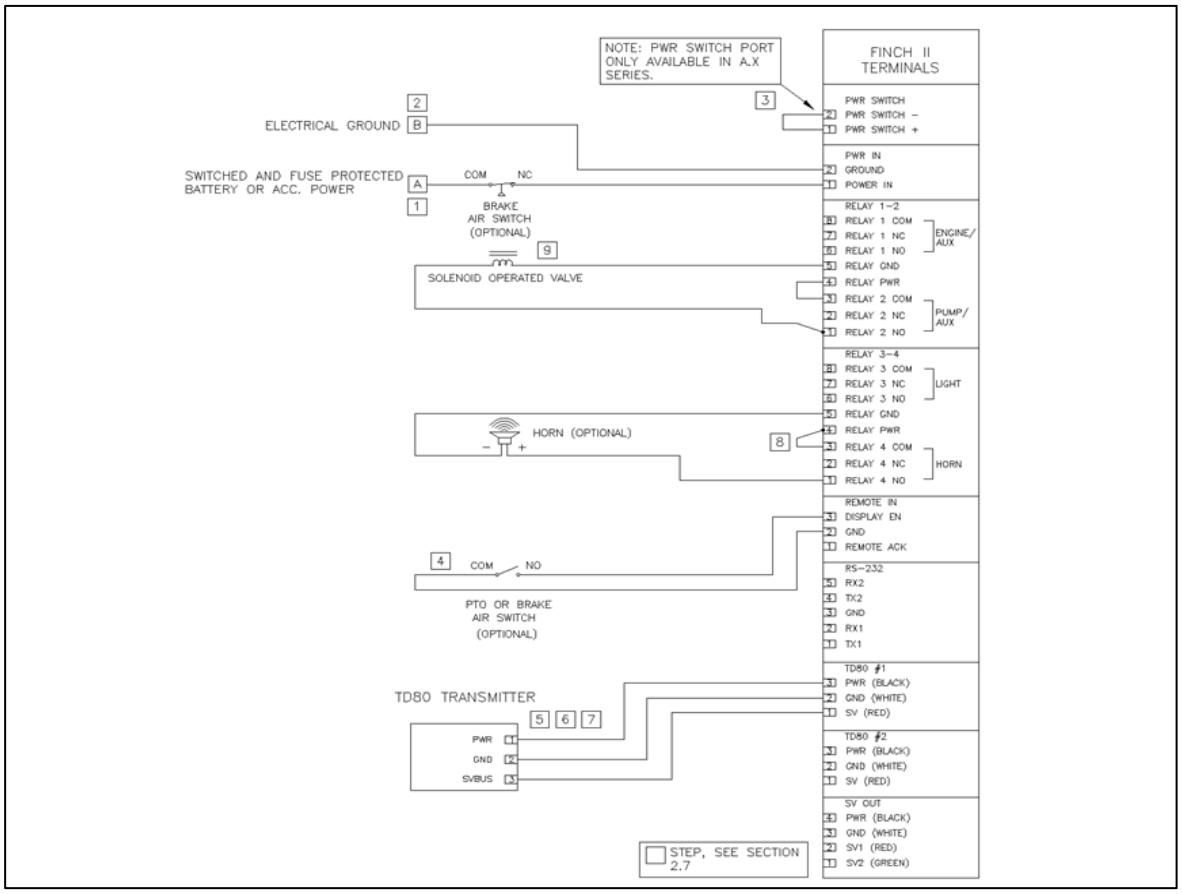

Figure 2-10: Typical Crude Oil Trailer Wiring Schematic

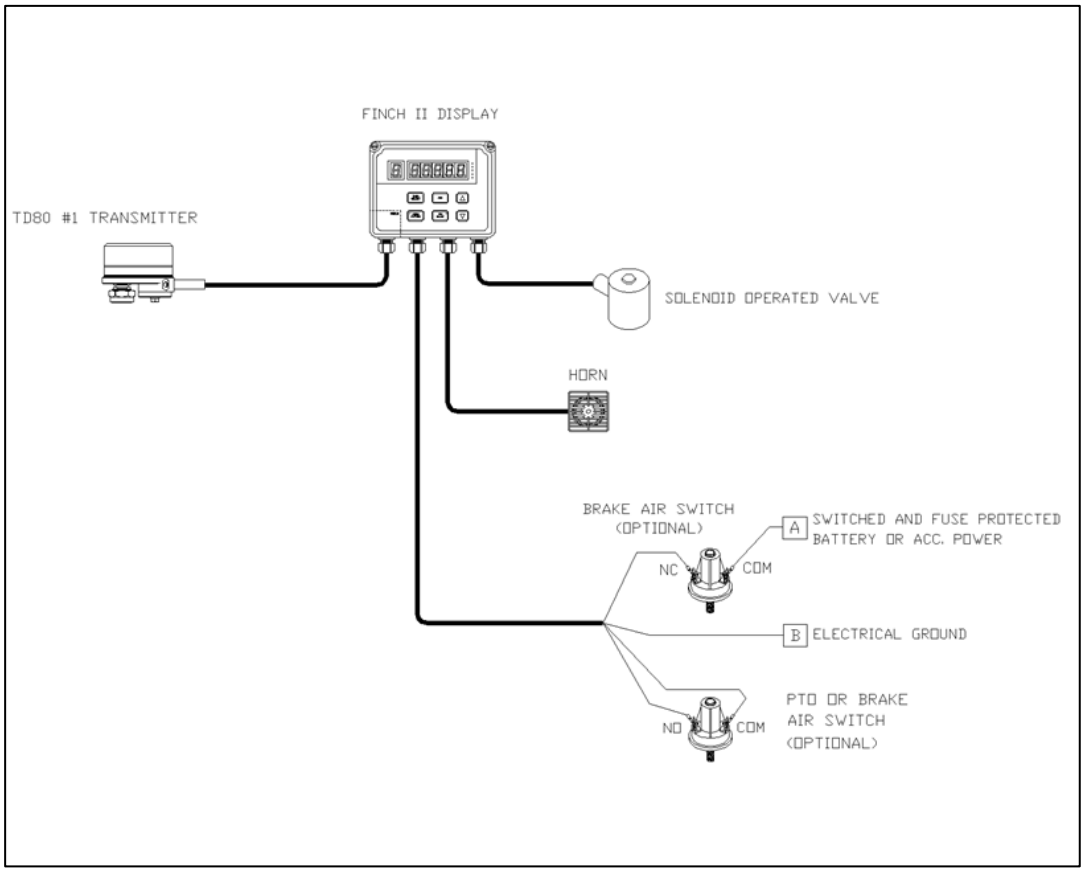

Figure 2-11: Typical Crude Oil Trailer Wiring Diagram

2.9 Installation Test & Calibration

2.9.1 TD100 Basic Operation Tests

The following steps describe basic tests to confirm that the TD100 system is functional after installation or repair. Troubleshoot and repair all problems if the test results differ from the ones shown. Ensure that the TD100 transmitter and FINCH II have been programmed and configured before proceeding with the tests.

1. Inspect installation before power is applied.
2. Turn power on to the TD100 system. The Display should turn on and go through its start-up sequence (approximately 10 seconds long). Display is tested, showing numbers 0 thru 9 and then letters A thru F
3. Display may show "-----" for up to several seconds, then one of the following:
   a. "2 LO" if the tank is empty or contains liquid and the depth is less than 5.5"
   b. Volume if the tank contains liquid and the depth is greater than 5.5"
   c. Error message "E xxxx" (where xxxx is a number).
   d. "SPILL"

2.9.2 TD100 System Testing and Verification

The following steps describe tests and to be completed after mechanical and electrical installation of the TD100 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. Ensure that the TD100 transmitter and FINCH II have been programmed and configured before proceeding with the tests.

TD 100 System Testing and Verification Steps	
1	Turn power on to the TD100 system. The Display should turn on and go through its start-up sequence (approximately 10 seconds long). a) Display is tested, showing numbers 0 thru 9 and then letters A thru F b) Horn relay is pulsed. (Optional horn will briefly sound)
2	Display may show "-----" for up to several seconds, then one of the following: a) "2 LO" if the tank is empty or contains liquid and the depth is less than 5.5" b) Volume if the tank contains liquid and the depth is greater than 5.5" c) Error message "E xxxx" (where xxxx is a number) d) "SPILL"
3	Test the volume display by doing the following: For **dual rod probes**, run your hand along 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. a) Volume displayed will increase as the hand or shorting rod moves toward the top of the compartment. b) Volume displayed will decrease as the hand or shorting rod moves toward the bottom of the compartment. 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. a) Volume displayed will increase as the shorting rod moves toward the top of the compartment. b) Volume displayed will decrease as the shorting rod moves toward the bottom of the compartment
4	Set the Fill and Fall alarm as per requirements.
5	Set and verify the FINCH II DIP switches. (See section 9.10 for switch position and settings)
6	Clear all active alarms.
7	a) Confirm that the following occurs when the probe is shorted at selected points: 1) "2 LO" or volume is displayed when tank level is less than 5.5". 2) Volume is displayed when the level is above 5.5". b. Optional Fall alarm activates when tank volume decreases to or is less than the Fall alarm setting. 1) Display flashes the volume and "FALL" 2) Optional alarm controlled device(s) activate or deactivate c. Optional Fall alarm deactivates when the ACK button is pressed. 1) Display returns to normal, not flashing 2) Optional alarm controlled device(s) activate or deactivate d. Optional Fill alarm activates when the tank volume increases to or exceeds Fill alarm setting. 1) Display flashes the volume and "FILL" 2) Optional alarm controlled device(s) activate or deactivate e) Optional Fill alarm deactivates when the ACK button is pressed. 1) Display returns to normal, not flashing 2) Optional alarm-controlled device(s) activate or deactivate f. HH alarm activates when the tank volume reaches the HH alarm setting. 1) Display shows blinking "HH" and volume

	2) Optional alarm-controlled device(s) activate or deactivate. g. HH alarm deactivates when ACK is pressed. 1) Display returns to normal, not blinking 2) Optional alarm-controlled device(s) activate or deactivate h. Spill alarm activates when the tank level reaches the Spill alarm setting. 1) Display shows flashing "SPILL" and the last known volume before the Spill alarm 2) Optional alarm controlled device(s) activate or deactivate i. Spill alarm deactivates when the tank level decreases below the Spill alarm setting. 1) Display returns to normal, not flashing "SPILL" 2) Optional alarm controlled device(s) activate or deactivate
8	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 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.

3 FINCH II Configuration

3.1 FINCH II Failsafe

FINCH II failsafe is an important safety feature of the FINCH II. Upon boot-up, FINCH II anticipates data on all configured compartments. The FINCH will issue a FAIL alarm is data is not received.

3.1.1 Single/Dual Compartment Failsafe Configuration (FINCH II-W)

FINCH II-W has the capability to monitor 1 or 2 compartments. FINCH II-W is shipped from factory with 2 compartments visible, however, only 1 compartment is FAILSAFE. If monitoring for 2 compartments is required, this configuration can be changed using SensorLink. This configuration can be changed in 2 ways:

1) Set DIP A3 high to set their display to Dual-compartment fail-safe.

OR

2) Set DIP B4 high to configure display in "software settings mode" and then use SensorLink to enable two (2) compartments.

3.1.2 Multicompartment Failsafe Configuration (FINCH II-6W)

The FINCH II-6W can monitor tank levels in real time for up to six compartments. (up to 5 compartments with RCM). The FINCH II-6W is shipped from factory preconfigured fail-safe for 6 compartments. This configuration can be changed using SensorLink.

FINCH II provides a flexible scheme for controlling external devices by TD100 and FINCH generated alarms. Alarms may provide operator prompts such as lights and horns or the loading and unloading process may be controlled to prevent unsafe conditions.

3.2 FINCH II Alarms

TD80/100 transmitter and FINCH generated alarms are:

- Fall Alarm

- Fill Alarm
- High-High (HH) Alarm
- Spill Alarm
- Fail Alarm

The Fall and Fill may be configured from the front panel buttons by the installer or operator. HH and Spill alarms are determined by settings programmed using Sensor software. This is done during transmitter programming only and cannot be changed by any FINCH II buttons or switches. The source of Fail alarm is from both the TD100 transmitter and FINCH II display. Internal malfunctions and loss of communication between transmitter and display are reported by the Fail alarm as error codes on the 7-segment.

3.3 FINCH II Relays

The FINCH display contains four independently controlled relays. These relays are fuse protected to limit short-circuit current. Each of the relays has a distinctive name that may be used to describe the controlled device such as the following:

- Relay 1, Engine/Aux Relay
- Relay 2, Pump/Aux Relay
- Relay 3, Light Relay
- Relay 4, Horn Relay

The relays have all contacts, Normally Open (NO), Normally Closed (NC) and Common (COM) contacts available for power or signal control. See *Figure 2-2* for the relay contacts location.

3.3.1 Configuring Relay Assignments and Alarming States

Relay Assignments (Factory Setting)	
SPILL and FAIL Alarm	ENGINE/AUX and PUMP/AUX RELAY
High-High (HH) Alarm	PUMP/AUX RELAY, LIGHT RELAY, HORN RELAY
Fill Alarm	HORN RELAY
FALL Alarm	None
Relay Alarming State (Factory Setting)	
ENGINE/AUX RELAY	Energized when alarming
PUMP/AUX RELAY	De-energized when alarming
LIGHT RELAY	Energized when alarming
HORN RELAY	Energized when alarming
User can acknowledge alarm (Can Ack?) – Factory Setting	
SPILL/FAIL Alarm	NO
HH Alarm	YES
FILL Alarm	YES
FALL Alarm	YES

Alarms are assigned relay actions through SensorLink software downloadable on the Titan Logix website. It also requires one serial port or USB to serial converter for the programming cable. All relay settings are permanently stored in the FINCH II and are reconfigurable at any time, in the shop or field using a laptop with SensorLink and the programming cable. A source of vehicle battery power or AC line power is required for the FINCH display. See the programming manual, TPM 051 for details.

4 System Operation

4.1 Start Up

When power is applied to the FINCH display and TD100 transmitter, the TD100 will run through a 10 second, warm-up cycle. During the warm-up cycle the FINCH II will run its own tests, during which the FINCH display will show the current software revision number, followed by a display test consisting of all five digits and compartment number showing the values from 0 to 9 and A to F. At the same time as the display test, the unit will test the HORN relay. It will pulse the HORN relay for 1 second.

The operator can set the unit into offset calibration mode, by pressing and holding either of the ▲ or ▼ buttons while turning the power on. If no button is pressed the unit will enter its normal mode of operation (either Monitor Mode or Sleep Mode depending on the Display Enable signal controlled by the PTO, parking brake or permanently enabled.

Note 4-1:

If the display test is completed before the transmitter warm-up; the unit will display five dashes (-----) for a few seconds while the transmitter warm-up completes.

4.2 Introduction to Operation

The TD100 continuously measures liquid level in the tank and transmits volume information with alarm states to the FINCH display. This information is presented the large 5-digit display and controls the relays. Alarms and any errors are clearly displayed for operator intervention as flashing messages on the FINCH display. Alarms and errors also control four separate relays that signal or control external devices.

4.3 FINCH II Operator Interface

Figure 4-1B: FINCH II Operator Interface

The FINCH II Display receives a continuous stream of volume information and alarm states from the. Volume alarm states and errors are shown on the numeric display. Alarms and errors control relays to signal or operate external devices. Relays can indicate Spill, High-High and system Fail alarms to external devices such as overfill prevention valves, lights, horns, and stationary loading controls. These relays can indicate a pre-set, increasing Fill or decreasing Fall level to warn of an approaching operator action while loading or unloading product.

<table>
<tr><th></th><th>Feature</th><th>Description</th></tr>
<tr><td>1</td><td>Green compartment Select Digit</td><td>The green digit is used to indicate the currently selected compartment. Each COMP SELECT button press will cycle the display through the available compartments and optional 3rd party devices. The digit flashes when the Auto Compartment Select feature has switched compartment displays due to an activated alarm.</td></tr>
<tr><td>2</td><td>Auto Compartment Select</td><td>The FINCH II display will automatically jump to a compartment if any alarms are triggered on that compartment. For example, if the display were monitoring tank 1 but the Fill alarm were to go off on compartment 2 then the display would jump automatically to compartment 2. The user can still manually go back to compartment 1.</td></tr>
<tr><td>3</td><td>Red 5 Digit Display</td><td>The 5 red digits can display volume readings, alarm messages, error codes, fill/fall settings, and offset calibration settings. When no TD100 connection is available, the display will show “-----“.</td></tr>
<tr><td>4</td><td>Red LED</td><td>The red LED at the top right of the display is used to indicate an error state. This LED is enabled during Spill and Fail alarms and any alarms set to “Not Acknowledgeable” during factory setup.</td></tr>
<tr><td>5</td><td>Level LED</td><td>These LEDs indicate the level of the currently selected compartment.
The Level LEDs are mapped in the following manner:
<table>
<tr><th>Level LED</th><th>% of HH</th></tr>
<tr><td>Level 4</td><td>100%</td></tr>
<tr><td>Level 3</td><td>75%</td></tr>
<tr><td>Level 2</td><td>50%</td></tr>
<tr><td>Level 1</td><td>25%</td></tr>
</table>
Table 4-1: Level LEDs Mapping</td></tr>
<tr><td>6</td><td>DIM/SLEEP</td><td>The DIM/SLEEP LED blinks when the display is in sleep or display mode.
The DIM/SLEEP button adjusts the brightness level of the display as well as puts the display into sleep mode. The display has 3 brightness levels max, medium, and low as well as sleep mode. When in sleep mode, the display is turned off and does not respond to any TD100 alarms.
This button press will put the display to sleep after the lowest brightness setting. All acknowledgeable alarms must be cleared with the ACK button before entering sleep. Non-acknowledgeable alarms do not prevent sleep mode entrance.</td></tr>
<tr><td>7</td><td>Horn Bypass</td><td>The Horn Bypass LED is on when the horn bypass feature is enabled. When enabled the horn relay does not respond to alarms. The attached horn remains silent.

The Horn Bypass button turns the horn bypass feature on and off. When the horn bypass feature is enabled the horn relay does not respond to alarms. The attached horn remains silent.</td></tr>
<tr><td>8</td><td>Compartment (COMP) Select</td><td>The Compartment Select button selects the active compartment to be displayed. It will cycle through all the available compartments and 3rd party devices. When a compartment is selected the 5-digit display and error/level LEDs will show information about the compartment. The Remote Alarm Acknowledge input optionally provides the same compartment selection feature. It is intended to provide operators with a single external push button to acknowledge alarms and to select a compartment for display.</td></tr>
<tr><td>9</td><td>ACK Button</td><td>The ACK button will acknowledge any active alarms that are acknowledgeable. The Fall, Fill and High High alarms are factory set as acknowledgeable. Once acknowledged the alarms are cleared and any assigned relays are deactivated. Spill and Fail alarms are not acknowledgeable. All alarms except for Spill and Fail can optionally be configured as acknowledgeable or locked until the alarm condition clears. For example, the Fall alarm may be configured as non-acknowledgeable and assigned to control a pump. This may be useful in applications where equipment can be damaged from running the tank dry.</td></tr>
<tr><td>10</td><td>Up / Down Arrow Button</td><td>The ▲ arrow is used when setting the Fill alarm level and the Fall alarm. The Set Fill alarm mode is entered by pressing the ▲ arrow for longer than 2 seconds and then releasing. The display will flash “Fill” 3 times followed by the fill alarm level. The level can be adjusted by pressing the ▲ and ▼ arrows. If you hold down the button it will</td></tr>
</table>

		continuously increase the level and after 5 seconds, it will increase in speed. The Set Fall alarm mode is entered by pressing the ▼ arrow for longer than 2 seconds and then releasing.

4.4 Offset Measurement

The offset measurement procedure outlined replaces any previous offset calibration procedures. This new procedure has replaced complicated manual activities with one time offset measurement.

4.4.1 Offset Measurement Description

Due to some installation parameters, there emerges a difference in height (Offset) between the point where the Titan System thinks the top of the tank is and the actual top of the tank. The point on the probe where the Titan system locates the top of the tank by default is called the probe tank top and is located at the bottom edge of the probe nut. The difference between the actual tank top and the probe tank top is called a probe offset. The tank thickness needs to be added to the probe offset to obtain the total offset:

TOTAL OFFSET = TANK THICKNESS + PROBE OFFSET

For Titan systems, the actual tank top and the probe tank top must be aligned at the same point on the probe to achieve optimum accuracy. For the TD100, the probe tank top reference point is located at the bottom edge of the probe nut and will always be at least a few inches above the actual top of the tank. To align these two reference points, it is necessary to measure the probe offset. Once programmed into the transmitter, this alignment ensures level measurement to the specified accuracy of the TD100.

4.4.2 How to measure Offset

1. To achieve highly accurate liquid level measurements, measure the distance known as the Total Offset, which is the total height of the probe offset and the tank thickness:

a. After drilling the hole at the location to install the probe and before the installation of the probe, measure the tank thickness with at least 1mm accuracy (see Figure 4-4-2). Record this measurement for later use.
b. In case it is not possible to measure the tank thickness due to retrofitting the TD80 with TD100 or for any other reason, use the tank thickness recorded on the strapping table provided by the tank manufacturer.
c. Measure the Probe Offset, the distance from the bottom of the probe nut and the outer tank surface, with at least 1mm accuracy. This distance must be measured after the probe is installed. Record this measurement for later use.

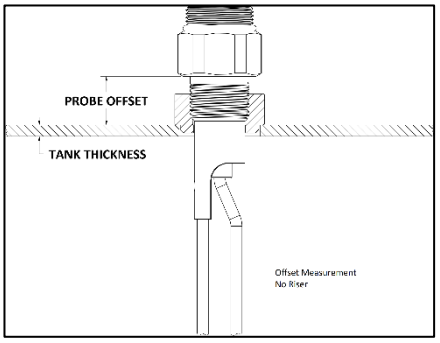

Figure 4-4-2, Probe Offset

2. If the probe is installed on top of the riser, include the riser height in the Probe Offset distance (see Figure 4-4-2 - Probe Offset with Riser). In this case, the distance is measured from the bottom edge of the probe nut to the outer tank surface (and not the top of the Riser). The SensorLink software requires the manual entries of the probe offset measurement and the tank thickness to calculate the Total Offset to align the probe tank top with the actual tank top.

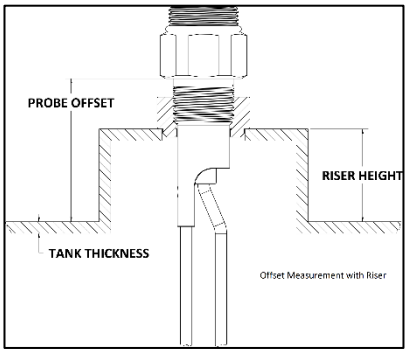

Figure 4-4-2B, Probe Offset with Riser

4.4.3 Programming the TD100

1. Open the SensorLink software and select TD100 from the sidebar.
2. From the TD100 selection, program the transmitter by completing
   Step 1: Probe Settings
   Step 2: Strapping Table as they apply to your installation (see Figure 3 - SensorLink Settings).
3. Ensure that you have access to the Tank Thickness and Probe Offset measurements, as measured during installation.
4. Click on the Offset Measurement button in Step 3: Offset Measurement as shown in Figure 3 - SensorLink Settings.
5. Enter the Tank Thickness and select the appropriate unit from the drop-down shown in Figure 4 - SensorLink Offset Measurement Input Screen.
6. Enter the Probe Offset and select the appropriate unit from the drop-down (Figure 4 - SensorLink Offset Measurement Input Screen). The total offset will calculate automatically and display underneath the input fields as shown in Figure 4.
7. Click 'OK' to exit.

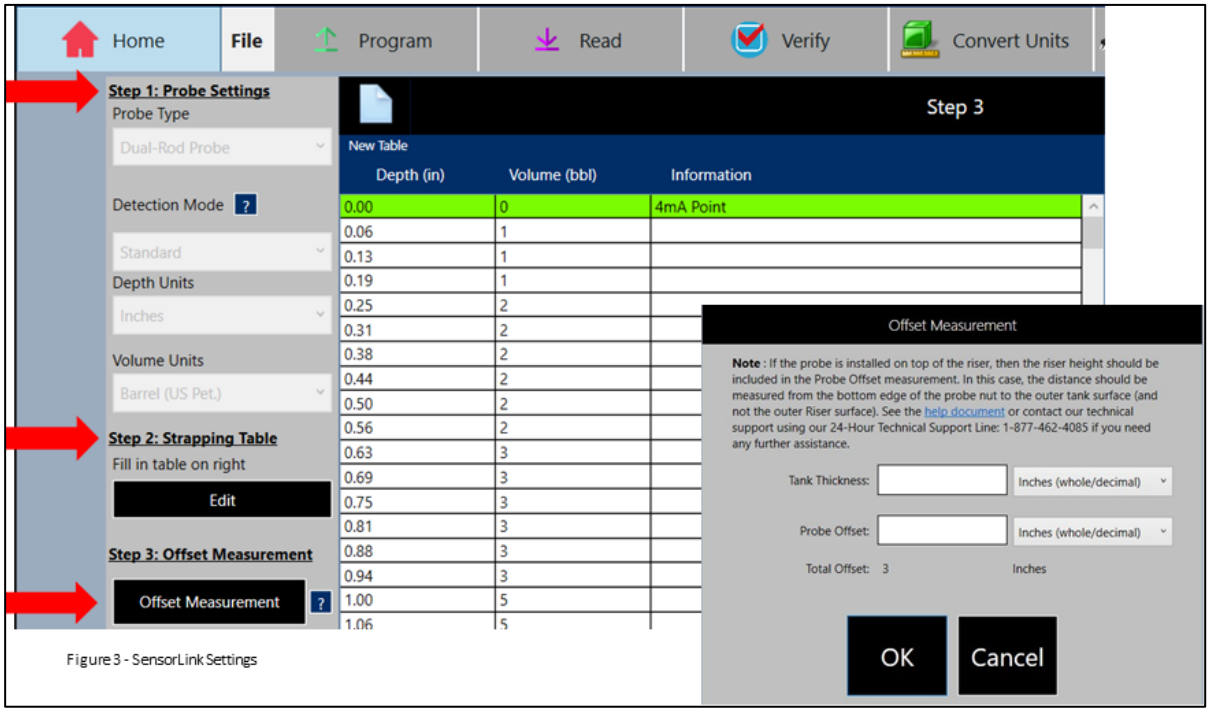

Figure 4-4-3 SensorLink

4.5 Modes of Operation

Sleep Mode	The FINCH display has a feature that allows the user to disable all the alarms on the unit and blank the display to reduce power consumption. While in sleep mode the FINCH Display DIM/SLEEP LED blinks, notifying the operator that the alarm functions are disabled. To view the current level of liquid, the operator presses either the ▲ or ▼ arrow button on the front panel to enter display mode. Sleep mode is entered when all acknowledgeable alarms have been cleared with the ACK button and by pressing the DIM/SLEEP button from the lowest brightness setting. Active non-acknowledgeable alarms do not prevent sleep mode entrance.
Display Mode	Display mode is entered by pressing the ▲ or ▼ arrow button while in sleep mode. In this mode the FINCH display shows the current tank level, as well as any errors received from the TD100 transmitter or FINCH Display. The unit remains in Display Mode for 30 seconds before returning to Sleep Mode. If the FINCH Display does not receive any information from the TD100 transmitter for 6 seconds, the unit displays five dashes (-----) to indicate a communications failure.
Monitor Mode	In this mode the FINCH Display shows the current volume, error messages, and alarm information sent by the TD100 transmitter. The unit responds to all alarms and errors. To enter Monitor Mode, the display enable signal must be active. The Fill or Fall Alarm is set by momentarily pressing the ▲ button for Fill and the ▼ button for Fall alarm volume. The FINCH Display shows the current volume, and when the level is below 5 ½" the unit will display "2 LO". Optional display of flashing "2Lo" and estimated volume is available. (If the display does not receive any information from the TD100 transmitter for 6 seconds, the display will show five dashes (-----) and triggers the Fail Alarm). The Spill, High High, Fill and Fall Alarms are all active in this mode and will respond when the conditions are reached. For more information on the alarms see the Alarms section 4.7.

4.6 Alarms

When the FINCH Display is in Monitor Mode, the unit responds to all alarms and errors. There are five alarm states associated with internal relays. The Spill and HH Alarms are controlled by the TD100 transmitter only. The Fail alarm is controlled by the TD100 transmitter and the FINCH Display. The Fill and Fall alarms are controlled by the FINCH Display only.

4.6.1 Spill Alarm

The level for the Spill alarm is set when programming the TD100 transmitter. This alarm can be assigned to relays. When the Spill Alarm level is reached, the FINCH Display flashes "Spill" and the last known volume; relays that are assigned to the Spill alarm will respond. The only way to clear the Spill alarm is to either pump out liquid until the level is below the Spill alarm level, or to put the unit into offset calibration mode, and then cycle the power. The display flashes "SPILL", the last known volume, and the red LED. It will remain in this state until the Spill alarm has been cleared. The FINCH Display and TD100 transmitter must remain turned ON while the liquid is pumped out to clear the Spill alarm. The Spill alarm will be stuck if power is turned OFF while unloading from Spill alarm level. Put the unit into offset calibration mode and cycle the power to clear the alarm.

NOTE:
The FINCH II Display will not allow the user to switch operating modes until all Acknowledgeable alarms have been acknowledged.

4.6.2 Fill and Fall Alarm

The Fill and Fall alarm volumes are an operator set value for use in filling or draining the tank to a predetermined level. These alarms can be assigned to the relays. The Fill and Fall alarms are intended for use with a horn and/or visible indicator. When the Fill or Fall volume is reached, the alarm is triggered, and the assigned relays are activated. The Fill and Fall alarm continues until it is acknowledged. To acknowledge the alarm, momentarily press the ACK button or the optional External Alarm Acknowledge button.

4.6.3 Set Fill or Fall Alarm

Fill and Fall alarm setting can be done from Monitor Mode or from Display Mode by momentarily pressing either the ▲ or ▼ button. Fill or Fall alarm setting is determined by pressing the ▲ button for Fill or the ▼ button for Fall. The display will flash "FILL" or FALL" when the button has been released to indicate which alarm is being set.

After a few seconds the display will show the current Fill or Fall alarm setting. The current setting can then be adjusted up or down by pressing the appropriate ▲ or ▼ button on the front panel. Each button press changes the level by one unit while holding the button down will rapidly change the setting. The fill and fall setting is prevented from exceeding the HH alarm volume. After 5 seconds of no button presses, the FINCH Display will return to the previous mode, either Monitor or Display Mode.

The Fill and Fall alarm setting can be set independently on each compartment. To set the Fill or Fall alarm on a given compartment that compartment must first be selected by pressing the COMP SELECT button.

The Fill and Fall alarms may be assigned to a relay. The relay can sound an external horn or turn on a light as a warning. The relay may also control a pump or valve for loading and unloading control.

4.6.4 High High Alarm

The High High alarm (HH) volume is set when programming the TD100 transmitter. The High High is the maximum safe volume of the tank. It is set to a volume that is a minimum 2" below the Spill Level. This alarm can be assigned to the relays. When the HH alarm is triggered, the assigned relays are activated, and the display alternately flashes the current volume and "HH". To acknowledge the alarm, momentarily press the ACK button or the optional External Alarm Acknowledge button.

If the Fill or Fall alarm and the High High alarms are triggered at the same time, they can both be acknowledged at the same time by pressing the ACK button or the optional External Alarm Acknowledge button.

4.6.5 Fail Alarm

The Fail alarm reports when a system error has occurred. This alarm can be assigned to the relays and is combined with the SPILL alarm when making relay assignments. This alarm will activate the relays when an error message is received from the TD100 transmitter, the FINCH Display detects an internal error or the FINCH Display does not receive any communications for over 6 seconds.

This alarm is self-resetting. When the cause of the alarm is removed, the alarm resets. No acknowledgment is required for this alarm. For example, if the unit does not receive any communications for 6 seconds the alarm will be set, but if communication is received later, the alarm will reset.

4.6.6 Disabling the 2 LO Message

The FINCH Display can show the low level within the bottom dead band by flashing "2 LO" and the estimated volume. The FINCH Display shows estimated tank volume all the way to the top of the shorting block (2 ½" minimum from the bottom of the tank). To enable the low level reading, set A-DIP, switch 2, ON. *See Figure 2-1 for the switch location.*

Note:

It is not recommended that the unit be operated in this state. The readings within the bottom dead band are inaccurate and unreliable.

4.7 Alarm Settings

4.7.1 Coax Probe Alarm Settings Diagrams

The alarm level settings vary based on the combination of probe type and whether standard or performance mode. The performance mode offers more accuracy and is the recommended configuration.

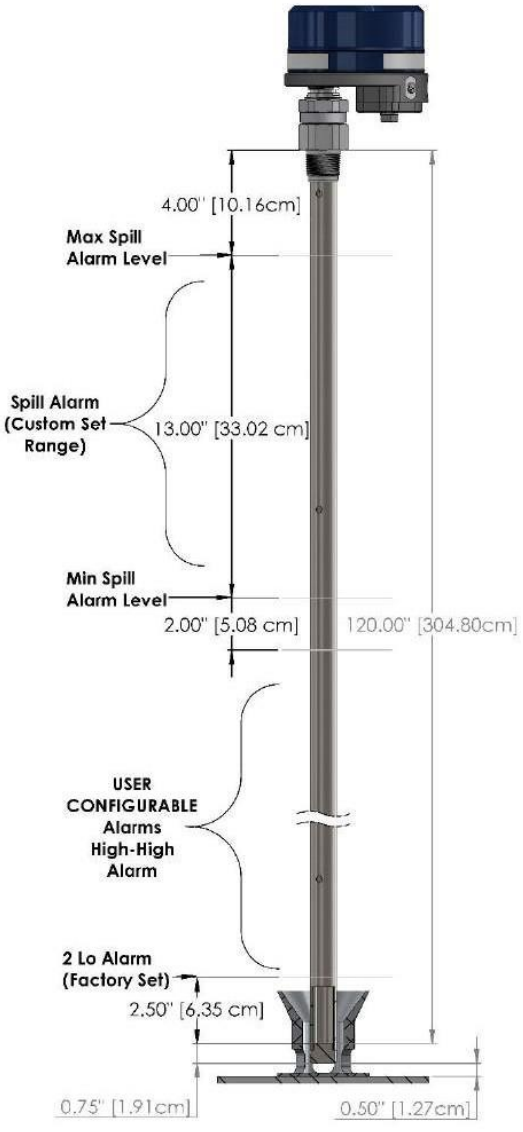

Figure 4-7-1A,
Coax Probe Performance Mode

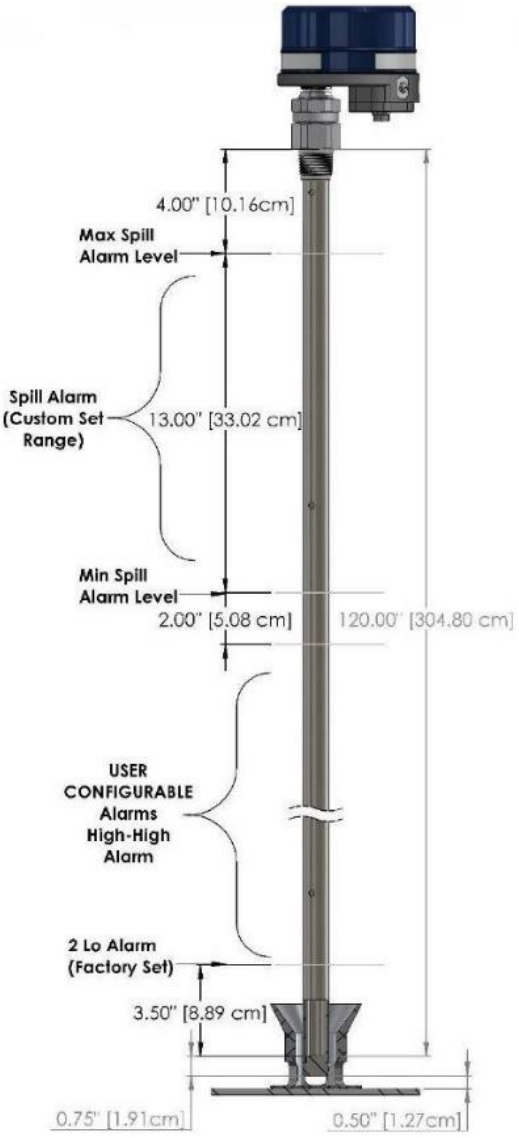

Figure 4-7-1B,
Coax Probe Standard Mode

4.7.2 Dual Rod Alarm Settings Diagrams

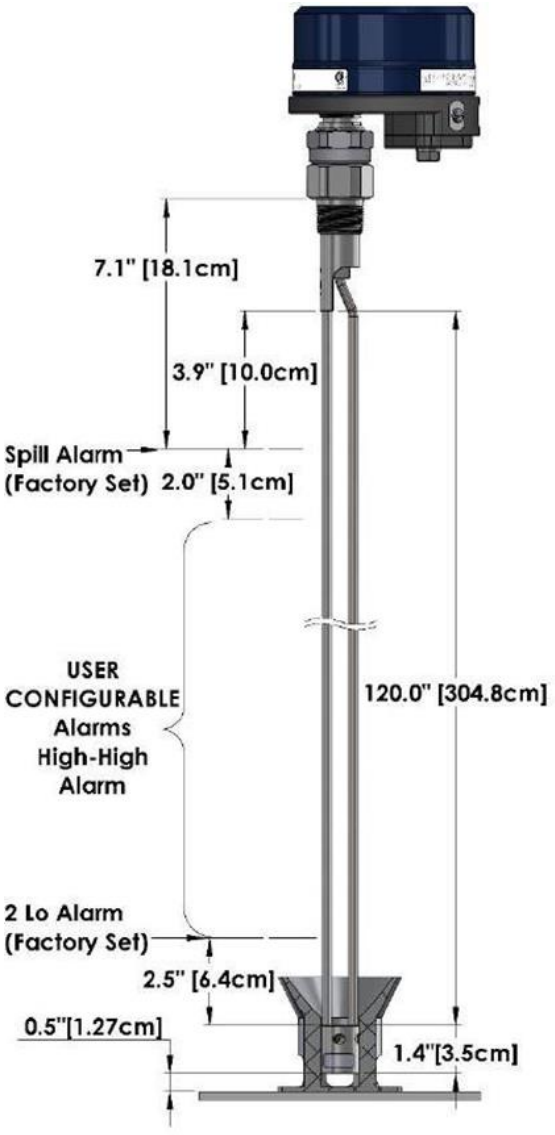

Figure 4-7-2A,
Dual Rod - Performance Mode

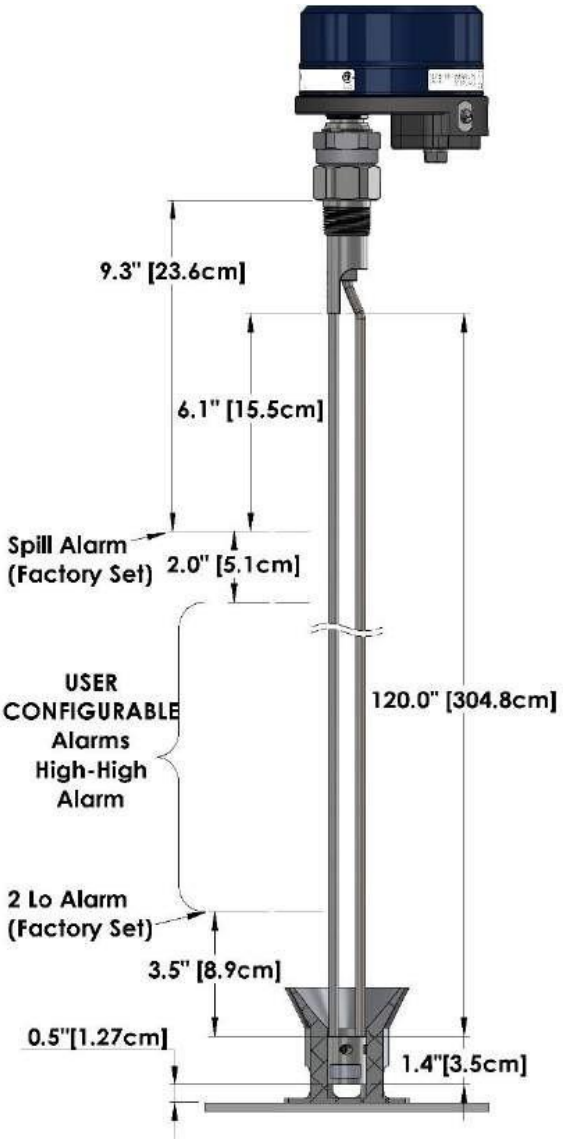

Figure 4-7-2B,
Dual Rod - Standard Mode

4.7.3 Configuring the Alarms

Alarm Type	
HH Alarm	Set by programming to a volume of 2" below the Spill Alarm or lower.
Spill Alarm (Factory Set)	- 7.1" for performance detection mode and 9.3" for standard detection mode on the Dual Rod Probes. This distance is measured from the bottom of probe nut/reference point. - 4.0" to 17" for Coaxial Probes from the bottom of probe nut /reference point. This remains the same for both performance detection mode and standard detection mode.
2 Lo Alarm	Factory Set
Fail Alarm	Controlled by error codes and loss of TD100 to FINCH communication.

5 Troubleshooting

Equipment Required:
1. Automotive Test light, 6VDC to 24VDC 2. Short length of wire bare at both ends or with alligator clips. 3. Optional Equipment: Digital Multimeter (DMM)

5.1 Overview and General Techniques

5.1.1 Error Codes

The TD100 constantly checks the system for errors. Detected errors are shown on the FINCH II display. These error codes assist in diagnosing and repairing the problems.

E 80 through E 84 indicate an error caused by an incorrect strapping table or internal transmitter malfunction. For these errors, review the programming information, correct if necessary and reprogram the transmitter. If the malfunction persists, then replace the transmitter and ensure it is programmed correctly.

The error codes and possible solutions are listed below:
*** The above error codes may be combined if more than one error code exists at a time (e.g., E26 = E02+E04+E20).

ERROR CODE	ERROR CODE DESCRIPTION	POSSIBLE SOLUTIONS
E0000	Could not measure level	- possibly bent or damaged probe - move the probe location to a less turbulent area of the tank - possibly defective transmitter
E0001	Too many samples rejected (too much turbulence)	- move the probe to a less turbulent area of the tank. - possibly defective transmitter
E0002	Internal transmitter error, Wrap around on Timer 1	- defective transmitter
E0004	Internal transmitter error, Timer 1 count is too large, PWM count out of range (TD100 only)	- defective transmitter
E0010	Internal transmitter error, timeout between captures	- defective transmitter

E0020	No fiducial detected	- possibly defective transmitter - possibly damaged or defective probe - possible turbulence in the tank - possible disconnection of transmitter and probe - possible liquid or grease contamination of transmitter to probe connection
E0040	Internal transmitter error, Watchdog reset	- defective transmitter
E0080	Internal strapping table error, HH alarm level set too close to Spill alarm level	- incorrect strapping table, reprogram the transmitter with a correct table

5.1.2 High Level Shutdown System Troubleshooting

The test light is a multi-purpose tool for checking the presence of power or ground in an automotive electrical circuit. The value of a test light is its inexpensiveness, ruggedness, ease of use and indications are readily apparent at a glance. 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.

Check presence of battery power

1) Test light clip is connected to power common or ground/return to battery power. (Usually the chassis of the vehicle.) Probe with test light tip in all circuit points that are energized by battery power. A dim/dark light indicates low or no voltage due to high resistance connection or open circuit.

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.
   Dim/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:

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

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.

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.

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1. Loss of power. No system operation, FINCH Display is blank.		
WHAT TO DO:	**DETAILS:**	**REMEDY:**
a. Check fuses, cable connections, wiring and power switches. See the following examples and suggestions.	i) Turn on the power/key switch	
	ii) Replace all blown fuses.	
	iii) Repair all defective wiring	
	iv) Replace all defective components.	
	v) Inspect wiring at the Power Switch terminals and repair as necessary	
	vi) Inspect the optional external power switch and wiring. Repair as necessary.	
b. Check the power supply for adequate operating voltage.	i) 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.	
	ii) Check the FINCH II display terminal board power supply 3V3 Status Green LED. See Figure 2-3 for location.	i) If 3V3 LED is OFF, check power supply wiring to Finch display. Possible incorrect or defective wiring. Possibly defective display. Repair or replace as necessary. ii) If 3V3 LED is ON, possibly defective display. Repair or replace as necessary.
c. Use a test light to test points for battery voltage in the following sequence.	i) Check all points from the FINCH II Display back to the battery	
	ii) Inspect all junction boxes, plugs and sockets for broken wires and corrosion	
d. If power is at all points, use a test light to check for grounds at points in the following sequence.	i) Check all points from the Finch Display back to the battery	
	ii) Inspect all junction boxes, plugs and sockets for broken wires and corrosion	
e. If fuses keep blowing:	i) Verify that the type and rating of the fuse is appropriate for the application	
	ii) Continue by disconnecting power to system components to isolate the short circuit. Clip on battery power; probe each component at the power terminal. A short circuit to ground is indicated by the light fully illuminating.	Repair or replace the defective component as necessary

5.2 TD100 System Specific Troubleshooting

Specific parts of the TD100 and High Level Shutdown System are tested using a combination of voltage checking and power/ground applied with the test light. The test light does not precisely measure the circuit voltage and is not a completely short circuit for applying voltage or ground. This must be kept in-mind during the troubleshooting process.

Troubleshooting a TD100 system is as uncomplicated as looking for circuit power and grounds. A circuit point is either properly connected to battery power or ground through wiring or devices controlled by the TD100; or not. 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.

5.2.1 Common System Wiring and Component Failures

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.

<table>
<tr><th colspan="4">FINCH II Display DIM/SLEEP LED blinks when the PTO is engaged or Display Enable is on.</th></tr>
<tr><th>WHAT TO DO:</th><th>DETAILS:</th><th>WHAT TO CHECK:</th><th>REMEDY:</th></tr>
<tr><td rowspan="3">Manually enable the DISPLAY EN signal. If the system activates, then check for an open circuit in the DISPLAY EN signal as follows:</td><td>i) Clip the test light to ground and probe tip to the DISPLAY EN signal at all points in the circuit. The test light will complete a path to ground and activate the display. Probe all points from the FINCH II display EN signal input back to the source. This will isolate a broken wire or defective.</td><td colspan="2">Inspect for broken or corroded wiring where the test light fails to activate the display and repair as necessary.</td></tr>
<tr><td rowspan="2">ii) An alternative method is to clip the test light to battery power and confirm the DISPLAY EN signal is grounded at all circuit points until the light does not illuminate. This will isolate the wire break or defective switch.</td><td colspan="2">Inspect for broken or corroded wiring where the test light fails to illuminate and repair as necessary</td></tr>
<tr><td>the SLEEP button or DISPLAY EN signal do not activate the system, then the Finch display is defective.</td><td>FINCH II Display is faulty, replace the unit.</td></tr>
</table>

<table>
<tr><th colspan="4">Loss of SV Bus Communication, FINCH II Display shows "----".</th></tr>
<tr><th>WHAT TO DO:</th><th colspan="2">DETAILS:</th><th>REMEDY:</th></tr>
<tr><td colspan="4">a. "----" displayed on the Finch indicates loss of SV Bus communication with the TD80/100 transmitter. Any other Display such as "2 LO", "E 20", Spill or level confirms proper communication with the transmitter.</td></tr>
<tr><td rowspan="2">b. If multiple compartments are displayed on the FINCH II, check compartment positions.</td><td colspan="2">i) If all compartments are inactive, check the wiring from the Transmitters to the SV Bus inputs on Finch and common power supply wiring to the TD80/100 transmitters.</td><td>a. Inspect for broken or corroded wiring and repair as necessary.
b. Finch display may be faulty, replace.</td></tr>
<tr><td colspan="2">ii) If one compartment; but not all are inactive, then troubleshoot the Transmitter and wiring to the FINCH II.</td><td>a. Inspect for broken or corroded wiring.
and repair as necessary.
b. FINCH II display may be faulty, replace.
c. Transmitter may be faulty, replace.</td></tr>
<tr><td rowspan="6">Check the SV LINK LED(s) for activity. Blinking fully on and fully off indicates normal bus voltages.

The LED will blink in bursts every second as the level information is transmitted to the Display.</td><td rowspan="6">i) Partially on or off indicates a defective TD80 system component, loss of power to a TD80/100 system component or an SV Bus short circuit to either power or ground.</td><td>a. Use the test light to check for power and ground to the TD80/100 system components on the SV Bus. Check at the power and ground terminals as well as any intermediate connections such as junction boxes, plugs and sockets.</td><td>Inspect for broken or corroded wiring where the test light fails to illuminate and repair as necessary.</td></tr>
<tr><td>b. SV LINK LED partially on indicates short circuit to power.</td><td>Troubleshoot SV Bus and repair or replace as necessary</td></tr>
<tr><td>c. SV Link LED partially off indicates a short circuit to ground.</td><td>Troubleshoot SV Bus and repair or replace as necessary</td></tr>
<tr><td>d. If the SV Link LED is off continuously</td><td>i) Check for power and ground to the TD80//100 Transmitter
ii) Clip the test light to ground and probe the SV Bus signal wire. Tap the probe tip on an SV Bus terminal and the LINK LED will blink with each tap to indicate continuity through the wiring and SV Bus receiver in the display. Probe at each SV</td></tr>
<tr><td colspan="2">e. If the SV LINK LED is on continuously, check for a short circuit to ground on the SV Bus. This can be done by disconnecting the devices from the SV Bus, clip the test light to battery power and probe for ground on the SV Bus at each circuit point until the short circuit or defective</td></tr>
</table>

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FINCH II Display restarts at erratic intervals. The digit test begins and then displays a level for some time, then restarts with the digit test.	
WHAT TO DO:	**DETAILS:**
a. Check power supply wiring for intermittent or corroded connections.	
b. Ensure that the battery voltage is at least 8VDC and steady	Provide power from a well charged battery or DC power source, 8VDC to 28VDC, steady output
c. FINCH II Display may be faulty, replace the unit	

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Fill or Fall Alarm remains inactive			
WHAT TO DO:	**DETAILS:**	**WHAT TO CHECK:**	**REMEDY:**
a. Check Fill or Fall alarm setting on the FINCH II. Confirm that the FINCH II display is flashing the volume to indicate an active alarm.	i) Confirm that the DISPLAY EN signal is active by either a switch operation or permanently enabled through wiring.	Activate the DISPLAY EN signal.	If the DISPLAY EN signal does activate, then troubleshoot the signal wiring and components.
	ii) If the FINCH II display does not flash at the desired Fill or Fall volume.	Confirm and reset the Fill or Fall alarm setting. If this does not fix the problem, then the FINCH II Display may be faulty, replace the unit.	
	iii) If the FINCH II Display flashes at the alarm setting then troubleshoot the Fill or Fall alarm wiring and components.		
	iv) Clip the test light to power and probe all Fill or Fall alarm circuit points to activate the Red light and/or Horn. Circuit points to confirm are as follows:	a. At the FINCH II LIGHT and HORN RELAY terminals	
		b. At any external wiring junctions	
		c. Red light and/or Horn terminals.	

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Fill or Fall Alarm continuously active.		
WHAT TO DO:	**DETAILS:**	**REMEDY:**
a. Check Fill or Fall alarm setting on FINCH II display. Confirm that the display is not flashing the volume to indicate an active alarm.	i) If the display is flashing volume, confirm and reset the Fill or Fall alarm setting. If this does not fix the problem, then the FINCH II may be defective. Replace the unit.	
	ii) If the display is not flashing, then troubleshoot the Fill or Fall alarm wiring and components.	

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High Level Shutdown System fails to allow loading.		
WHAT TO DO:	**DETAILS:**	**WHAT TO CHECK:**
i) Ensure that HH and Spill/Fail alarms are inactive, TD100 system is operating normally.		
ii) Check for a blown Pump Relay fuse and replace as necessary.		
iii) Check for power at Pump Relay terminal	1. If power is present, check wiring and power to solenoid	
	2. Energize and de-energize solenoid by pressing the PUMP RELAY TEST button to check for solenoid and valve operation.	
	3. Inspect for broken or corroded wiring and repair as necessary.	

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High Level Shutdown System fails to stop loading on high level alarms.	
WHAT TO DO:	**DETAILS:**
i) Ensure that HH and Spill/Fail alarms activate, TD80/100 system is operating normally.	
ii) Deactivate/reset the alarms for further troubleshooting.	

iii) Check for power at Pump Relay terminals.	1. If power is present, check wiring to solenoid for a short circuit to power. 2. If power is not present, check solenoid valve. 3. Energize and de-energize solenoid by pressing the PUMP TEST BUTTON to check for solenoid and valve operation.
iv) Inspect for defective, incorrect, or corroded wiring and repair as necessary	

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High Level Shutdown System fails to stop loading when DISPLAY EN signal is off.	
WHAT TO DO:	**DETAILS:**
i) Ensure that HH and Spill/Fail alarms activate, TD80/100 system is operating normally.	
ii) Deactivate/reset the alarms for further troubleshooting.	
iii) Energize and de-energize solenoid by pressing the PUMP RELAY TEST button to check for solenoid and valve operation.	
iv) Ensure that the FINCH II Display DIM/SLEEP LED blinks when the DISPLAY EN signal is disengaged.	
v) If the FINCH II displays volume when DISPLAY EN signal is disengaged, test for short circuit to ground on DISPLAY EN signal.	
vii) Check for power at PUMP RELAY terminals	1. If power is present, check wiring to solenoid for a short circuit to power. 2. If power is not present, check solenoid valve.

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FINCH II Display shows an Error Code (Exxxx).		
The transmitter constantly checks the system for errors. Detected errors are shown on the FINCH II Display as an error code, E, and a 4 digit number. This error code assists in diagnosing and repairing the problem. E 0080 through E 0084 indicate an error caused by an incorrect strapping table or internal transmitter malfunction. For these errors, review the programming information, correct if necessary and reprogram the transmitter. If the malfunction persists, then replace the transmitter and ensure it is programmed correctly. The error codes and possible solution are listed below.		
E0000	Can't Autorange (could not measure level	- possibly bent or damaged probe - move the probe location to a less turbulent area of the tank - possibly defective transmitter
E0001	Too many samples rejected (too much turbulence)	- move the probe to a less turbulent area of the tank - possibly defective transmitter
E0002	Internal transmitter error, Wrap around on Timer1	- defective transmitter
E0004	Internal transmitter error, Timer1 count is too large	- defective transmitter
E0020	No fiducial detected	- defective transmitter
E0010	Internal transmitter error. Timeout.	- possibly defective transmitter - possibly damaged or defective probe - possible turbulence in the tank - possible disconnection of transmitter and probe - possible liquid or grease contamination of transmitter to probe connection
E0040	Internal transmitter error, Watchdog reset	- defective transmitter
E0080	Internal strapping table error, HH alarm level set too close to Spill alarm level	- incorrect strapping table, reprogram the transmitter with a correct table

E0081	Internal strapping table error, Alarms set, No strapping table	- program the transmitter with a strapping table - possibly defective transmitter
E0082	Internal strapping table error	- reprogram the transmitter - possibly defective transmitter
E0083	Internal strapping table error, error detected in strapping table during operation	- restart the transmitter if problem persists then reprogram the transmitter - possibly defective transmitter
E0084	Internal strapping table error, error detected in strapping table during operation	- restart the transmitter if problem persists then reprogram the transmitter - possibly defective transmitter
E0180	RS-232 #2 communication error	- check the RS-232 #2 connector and wiring connections. - possible defective display. - possible defective remote RS-232 device.
E0190	RS-232 #1 communication error	- check RS-232 # 1 connector and wiring connections - possible defective display - possible defective remote RS-232 device.
E0500	Could not send the Global Acknowledge to remote FINCH II displays	- check B-DIP, switch 3 is ON. - Unlock the hardware settings by turning B-DIP, switch 4 OFF - possible defective display
E0700	Can't read compartment or DIM/SLEEP settings from flash	- possibly defective display
E0701	Can't read relay assignments or fill/fall settings from flash	- possibly defective display
E0703	Serial Flash timeout	- possibly defective display
E0704	Loaded old settings from memory	- check current compartment and DIM/SLEEP settings
E0705	Loaded old settings from memory	- check relay assignments and Fill/Fall alarm settings
E0706	Could not read the advanced config. setting from memory	- recently upgraded FW, power cycle and message should go away - possible defective display
E0707	Loaded old, advanced configuration settings from memory.	- recent settings change not saved, try saving settings again - possible defective display
E0780	Engine relay failed	- possibly defective display
E0781	Pump relay failed.	- possibly defective display
E0782	Light relay failed	- possibly defective display
E0783	Horn relay failed	- possibly defective display

Error codes 01, 02, 04, 10, 20 and 40 can be combined if there is more than one error code at a time. For example, E 26 is E 02 + E 04 + E 20.
E 80 to E 84 will not be combined with any other error codes.

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FINCH II Display continuously shows "2 LO".		
WHAT TO DO:	**DETAILS:**	**REMEDY:**
a. Check the probe for physical damage, defects, corrosion, or product build up.	i) Probe maybe faulty.	Replace the probe.
	ii) Probe may be bent or twisted.	Repair or replace the probe.

	iii) Inspect the probe for product buildup.	Clean the probe with a solvent compatible with the product.
b. The TD80/100 transmitter may be defective.	Replace the TD transmitter with a serviceable unit that has been programmed with same information as the one it is replacing.	
c. Check the probe to TD80/100 transmitter connection for contamination.	The connectors must be clean and make a solid mechanical connection. Clean out any contamination such as water, oil, grease, or dirt. Retighten the connectors and test the system.	
d. Check installation of the transmitter to probe.	The transmitter must be securely fastened to the probe	Hand tighten the transmitter nut until it is at the O-ring, then fully tighten with a wrench.

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FINCH II Display shows erratic level measurements or "2 LO"		
WHAT TO DO:	**DETAILS:**	**REMEDY:**
a. FINCH II Display shows erratic level measurements while a mobile radio is keyed or other radio equipment		Physically separate all TD80/100 system components and wiring from the radio devices.
b. FINCH II Display shows erratic level measurements or "2 LO" while loading or unloading product.	i) Check the probe for physical damage, defects, corrosion, or product build up.	1. Probe may be faulty, replace the probe. 2. Probe may be bent or twisted, repair or replace probe. 3. Probe may be corroded, replace the probe. 4. The shorting block may be loose or missing, repair or replace the shorting block. 5. Inspect the probe for product buildup. Clean the probe with a solvent compatible with the product.
	ii) The TD80/100 transmitter may be defective.	Replace the TD80/100 transmitter with a serviceable unit that has been programmed with same information as the one it is replacing.
	iii) Check the probe to TD80/100 transmitter connection for contamination.	Clean out any contamination such as water, oil, grease, or dirt. The connectors must be clean and make a solid mechanical connection. Retighten the connectors and test the system.
c. Check installation of the transmitter to probe.	The transmitter must be securely fastened to the probe	Hand tighten the transmitter nut until it is at the O-ring, then fully tighten with a wrench.

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Spill alarm is on continuously, unable to clear the alarm by unloading while the TD80/100 is turned.		
WHAT TO DO:	**DETAILS:**	**REMEDY:**
a. Check installation of the dual rod probe if installed.	i) The tank mounting collar or fitting must not extend more than 1.5" below the 1 ¾" nut on the probe.	The mounting fitting height must be reduced to 1.5" or less.
	ii) A 4" minimum diameter around the probe must be free of any metal objects.	The probe must be relocated to an area that has at least 4" diameter around it free from metal objects.
	iii) The transmitter must be securely fastened to the probe	Hand tighten the transmitter nut until it is at the O-ring, then fully tighten with a wrench.
b. Check installation of the coaxial probe if installed.	Inspect the inside of the probe near the top for any metal foreign objects.	Shake or flush out any foreign objects inside the coaxial probe.
c. Check probe for buildup of product at or near the top of the probe.	Clean the probe with a solvent compatible with the product	The probe may require removal for thorough inspection and cleaning.

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Unable to offset calibrate the TD80/100			
WHAT TO DO:	**DETAILS:**	**REMEDY:**	
a. FINCH II Display shows "2 LO" after flashing "CAL".	i) The tank may be empty or the level is less than 5 ½" from the bottom of the tank.	Fill the tank above 5 ½" and calibrate.	
b. FINCH II Display continues to flash "CAL" without showing current volume.	i) Possibly defective FINCH II Display	Replace FINCH II Display	
	ii) possibly defective TD80/100 transmitter	Replace TD80/100 transmitter.	
	iii) TD80/100 transmitter power may be independent from the FINCH II Display power. Power must be cycled to the FINCH II Display and TD80/100 at the same time for offset calibration.		
c. FINCH II Display shows a level after flashing "CAL", unable to set the Display to the actual volume.	i) The TD80/100 transmitter may be defective.	Replace the TD80/100 transmitter with a serviceable unit that has been programmed with same information as the one it is replacing.	
	ii) The TD80/100 transmitter may be incorrectly programmed.	Reprogram the transmitter with correct information.	
	iii) FINCH II Display button presses do not change the setting in one or both directions	Inspect the push button switches and wiring inside FINCH II Display for a loose or removed connector(s)	Reinstall push button connector(s) if disconnected or replace the defective FINCH II Display.

5.2.2 Common System Installation Problems

The following troubleshooting steps are organized by problems commonly experienced after installation. They may be encountered after a new installation, retrofit or repair of an in-service vehicle. These are some of the most common frequent system wiring and component installation errors along with suggested troubleshooting and repair steps. The problems may also be the result of a normal breakdown or component malfunction.

Loss of power. No system operation, FINCH II Display is blank.		
WHAT TO DO:	**DETAILS:**	**REMEDY:**
a. Check fuses, cable connections, wiring and power switches. See the following examples and suggestions.	i) Turn on the power/key switch	
	ii) Replace all blown fuses	
	iii) Repair all defective wiring	
	iv) Replace all defective components.	
	v) Inspect wiring at the Power Switch terminals and repair as necessary	
	vi) Inspect the optional external power switch and wiring. Repair as necessary.	
b. Check the power supply for adequate operating voltage.	i) 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.	
	ii) Check the FINCH II display terminal board power supply 3V3 Status Green LED.	i) If 3V3 LED is OFF, check power supply wiring to FINCH II display. Possible incorrect or defective wiring. Possibly defective display. Repair or replace as necessary. ii). If 3V3 LED is ON, possibly defective display. Repair or replace as necessary.

c. Use a test light to test points for battery voltage in the following sequence.	i) Check all points from the FINCH II Display back to the battery	
	ii) Inspect all junction boxes, plugs and sockets for broken wires and corrosion	
d. If power is at all points, use a test light to check for grounds at points in the following sequence.	i) Check all points from the FINCH II Display back to the battery	
	ii) Inspect all junction boxes, plugs and sockets for broken wires and corrosion	
e. If fuses keep blowing:	i) Verify that the type and rating of the fuse is appropriate for the application.	
	ii) Continue by disconnecting power to system components to isolate the short circuit. Clip on battery power. Probe each component at the power terminal. A short circuit to ground is indicated by the light fully illuminating.	Repair or replace the defective component as necessary

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Fuses keep blowing.		
WHAT TO DO:	**DETAILS:**	**REMEDY:**
a. Verify that the type and rating of the fuse is appropriate for the application	Install fuse with the correct type and rating.	
b. Verify that the system components are installed and wired correctly.	i) Inspect all wiring for installation errors.	
	ii) Continue by disconnecting power to system components to isolate the short circuit. Clip on battery power; probe each component at the power terminal. A short circuit to ground is indicated by the light fully illuminating.	Repair or replace the defective component as necessary

Spill alarm stuck on.		
WHAT TO DO:	**DETAILS:**	**REMEDY:**
a. Check installation of the dual rod probe if installed.	i) The tank mounting collar or fitting must not extend more than 1.5" below the 1 ¾" nut on the probe.	The mounting fitting height must be reduced to 1.5" or less.
	ii) A 4" minimum diameter around the probe must be free of any metal objects.	The probe must be relocated to an area that has at least 4" diameter around it free from metal objects.
	iii) The transmitter must be securely fastened to the probe	Hand tighten the transmitter nut until it is at the O-ring, then fully tighten with a wrench.
b. Check installation of the coaxial probe if installed.	Inspect the inside of the probe near the top for any metal foreign objects.	Shake or flush out any foreign objects inside the coaxial probe.

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FINCH II Display continuously shows "2 LO"		
WHAT TO DO:	**DETAILS:**	
Check installation of the probe and transmitter.	The transmitter must be securely fastened to the probe.	Hand tighten the transmitter nut until it is at the O-ring, then fully tighten with a wrench.

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Display continuously shows a level in an empty tank.		
WHAT TO DO:	**DETAILS:**	**REMEDY:**
a. Check the probe for physical damage, defects or product build up.	i) Probe may be bent or twisted	Repair or replace the probe.
	ii) Inspect the probe for heavy product buildup bridging the rods.	Clean the probe with a solvent compatible with the product.

b. The TD80/100 transmitter may be defective.		Replace the TD80/100 transmitter with a serviceable unit that has been programmed with same information as the one it is replacing.
c. The TD80/100 transmitter may be incorrectly programmed.		Reprogram the transmitter with correct information.

FINCH II Display shows incorrect volume.	
WHAT TO DO:	**DETAILS:**
a. The TD80/100 transmitter may be defective.	Replace the TD80/100 transmitter with a serviceable unit that has been programmed with same information as the one it is replacing
b. The TD80/100 may be incorrectly programmed.	Reprogram the transmitter with correct information.

FINCH II Display DIM/SLEEP LED blinks when the PTO is engaged or Display Enable is on.		
WHAT TO DO	**DETAILS**	**REMEDY**
Check the Display Enable wiring at the FINCH II Remote In terminals	Confirm wiring for an external PTO controlled switch or permanent wiring to GND.	Correct or repair wiring as necessary
Press the DIM/SLEEP button	Observe that the FINCH II display shows normal volume or alarms. DIM/SLEEP light is OFF.	If still in sleep, inspect the display enable wiring.

FINCH II Display shows erratic level measurements.		
WHAT TO DO:	**DETAILS:**	**REMEDY:**
a. FINCH II Display shows erratic level measurements while a mobile radio is keyed or other radio equipment transmits	Physically separate all TD80/100 system components and wiring from the radio devices.	
b. FINCH II Display shows erratic level measurements or “2 LO” while loading product.	Check placement of the probe near inlet or agitator	The probe must be relocated to an area of the tank away from turbulence while loading or normal operation.

High Level Shutdown System does not permit loading.		
WHAT TO DO:	**DETAILS:**	**WHAT TO CHECK:**
i) Ensure that HH and Spill/Fail alarms are inactive, TD80/100 system is operating normally.		
ii) Confirm the FINCH II relay assignments and relay alarming states. Verify the settings using SensorLink and correct as necessary.		
iii) Check for a blown Pump Relay fuse and replace as necessary		
iv) Check for power at Pump Relay terminal	1. If power is present, check wiring and power to solenoid.	
	2. Energize and de-energize solenoid by pressing the PUMP RELAY TEST button to check for solenoid and valve operation.	
	3. Inspect for broken or corroded wiring and repair as necessary.	

High Level Shutdown System fails to stop loading on high level alarms.	
WHAT TO DO:	**DETAILS:**
i) Ensure that HH and Spill/Fail alarms activate, TD80/100 system is operating normally.	
ii) Confirm the FINCH II relay assignments and relay alarming states. Verify the settings using SensorLink and correct as necessary.	
iii) Deactivate/reset the alarms for further troubleshooting.	
iv) Check for power at Pump Relay terminals.	1. If power is present, check wiring to solenoid for a short circuit to power. 2. If power is not present, check solenoid valve. 3. Energize and de-energize solenoid by pressing the PUMP TEST BUTTON to check for solenoid and valve operation.
v) Inspect for defective, incorrect, or corroded wiring and repair as necessary	

Fill or Fall Alarm continuously active.		
WHAT TO DO:	**DETAILS:**	**REMEDY:**
a. Confirm the FINCH II relay assignments and relay alarming states.	Verify the settings using SensorLink and correct as necessary.	
b. Check Fill or Fall alarm setting on FINCH II display. Confirm that the display is not flashing the volume to indicate an active alarm.	i) If the display is flashing volume, confirm and reset the Fill or Fall alarm setting. If this does not fix the problem, then the FINCH II may be defective. Replace the unit.	
	ii) If the display is not flashing, then troubleshoot the Fill or Fall alarm wiring and components.	

5.3 Alternate TD100 System Troubleshooting

Sometimes it is easier and less complicated to isolate a system problem by disconnecting all the components and then rewiring them back in a logical sequence. This method is described below:

TD100 System Troubleshooting	
1	Ensure that the power is off and disconnect all external wiring to the FINCH II Display.
2	Connect the two wires providing power and ground.
3	Turn on the power and verify that the FINCH II Display powers up normally, then displays "----". The DIM/SLEEP LED may blink, or the FINCH II Display may continue to display "----" if the DISPLAY EN is permanently wired to ground. Resolve all problems at this point before continuing.
4	Turn the power off.
5	Install the DISPLAY EN wiring if applicable. Turn power on, verify that the FINCH II displays "----" continuously with the DISPLAY EN signal active, then the DIM/SLEEP LED blinking when inactive. Resolve all problems at this point before continuing.
6	Turn power off.
7	Install the three wires from the TD100 transmitter to the FINCH II Display. Turn power on, verify that the FINCH II displays something other than "----". If the DIM/SLEEP LED is blinking, press a button and verify that something other than "----" is displayed. Resolve all problems at this point before continuing.
8	Turn power off. At this point, the TD100 system is functioning and reporting level, an alarm condition or an error code.
9	Resolve all problems until the TD100 is functioning normally with a level display and inactive alarms.
10	Turn power off.
11	Continue to wire accessory components one at a time and verify correct system operation. Ensure power is off before connecting or disconnecting any wiring.

5.4 FINCH II Relay Tests

The following tests are used to determine correct operation of optional alarm accessories such as horns, lights, and high level shutdown system. They do not verify correct operation of the TD100 level transmitter, probe, or display. The purpose is to exercise the optional components for troubleshooting or repair tests.

1) Verify normal TD100 system operation. Resolve all problems at this point before continuing.
2) Turn on power to the TD100 system and activate the DISPLAY EN signal.
3) Ensure all alarms are inactive and reset as necessary.
4) Press the HORN RELAY TEST button and verify that the horn sounds.
5) Release the HORN RELAY TEST button and verify that the horn silences.
6) Press the LIGHT RELAY TEST and verify that the red light illuminates.
7) Release the LIGHT RELAY TEST and verify that the red light goes out.
   Confirm normal operation or resolve all problems at this point before continuing.

5.4.1 Fill or Fall Alarm Test

1) Verify normal TD100 system operation. Resolve all problems at this point before continuing.
2) Turn on power and activate the DISPLAY EN signal.
3) Ensure all alarms are inactive and reset as necessary. Follow steps 4 and 5 to test the optional onboard loading pump or bottom loading valve.
4) Press the PUMP RELAY TEST button and verify that the valve solenoid de-energizes. The onboard loading pump or bottom loading valve prevents loading.
5) Release the PUMP RELAY TEST button and verify that the valve solenoid energizes. The onboard loading pump or bottom loading valve allows loading.
6) Follow steps 6 and 7 to test optional engine kill system.
7) Press the ENGINE RELAY TEST button and verify that the engine is killed. The
8) onboard loading pump is shut down and prevents loading.
9) Release the ENGINE RELAY TEST button and verify that the engine can be restarted. The onboard loading pump now allows loading.
10) Confirm normal operation or resolve all problems at this point before continuing.

5.4.2 High level shutdown System Test

1) Verify normal TD100 system operation. Resolve all problems at this point before continuing.
2) Turn on power and activate the DISPLAY EN signal.
3) Ensure all alarms are inactive and reset as necessary. Follow steps 4 and 5 to test the optional onboard loading pump or bottom loading valve.
4) Press the PUMP RELAY TEST button and verify that the valve solenoid de-energizes. The onboard loading pump or bottom loading valve prevents loading.
5) Release the PUMP RELAY TEST button and verify that the valve solenoid energizes. The onboard loading pump or bottom loading valve allows loading.
6) Follow steps 6 and 7 to test optional engine kill system.
7) Press the ENGINE RELAY TEST button and verify that the engine is killed. The
8) onboard loading pump is shut down and prevents loading.
9) Release the ENGINE RELAY TEST button and verify that the engine can be restarted. The onboard loading pump now allows loading.
10) Confirm normal operation or resolve all problems at this point before continuing.

5.5 TD100 System Test & Verification Checklist

	Steps
1	Power ON Check. Confirm FINCH II display and RCM startup
2	Check FINCH II display for communication with the TD100
3	Volume display
4	Set the Fill and/ or Fall alarms
5	Set and verify the switch settings
6	Clear all alarms
7	Simulated level and alarm response. Volume display, alarm response and RCM indicators are tested from 2LO to Spill and back to 2LO
8	Test the optional 4-20mA output

Table 6-1: TD100 System Test & Verification

6 Graphical Glossary of Terms

6.1 Dual Rod Probe Truck and Trailer Installation

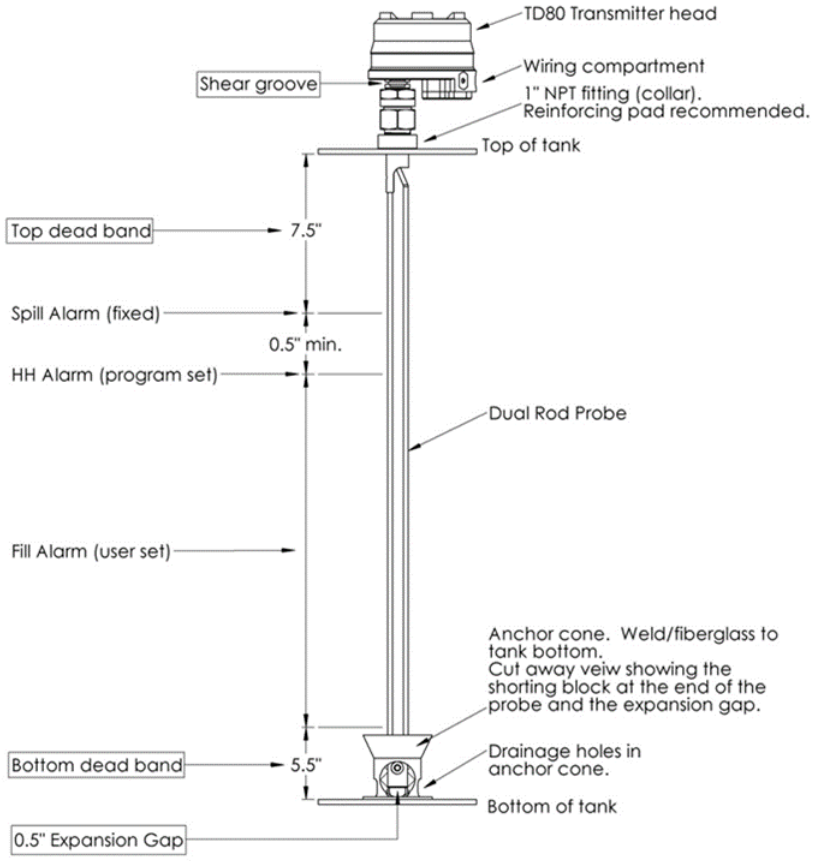

Figure 6-1: Dual Rod Probe Truck & Trailer Installation

6.2 Coaxial Probe Truck and Trailer Installation

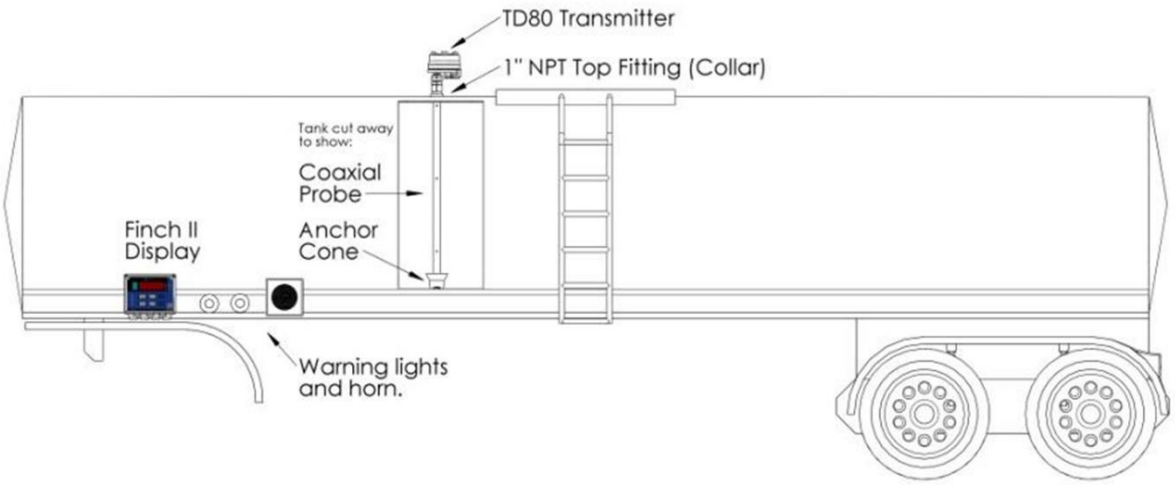

Figure 6-2: Coaxial Probe Truck & Trailer Installation

7 Technical Reference

This Technical Reference is intended to provide a brief overview of the FINCH II and provide information on how to install and use a FINCH II. This section includes information on how to wire the FINCH II as well as a brief overview of the user interface.

7.1 Installation/Wiring Instructions:

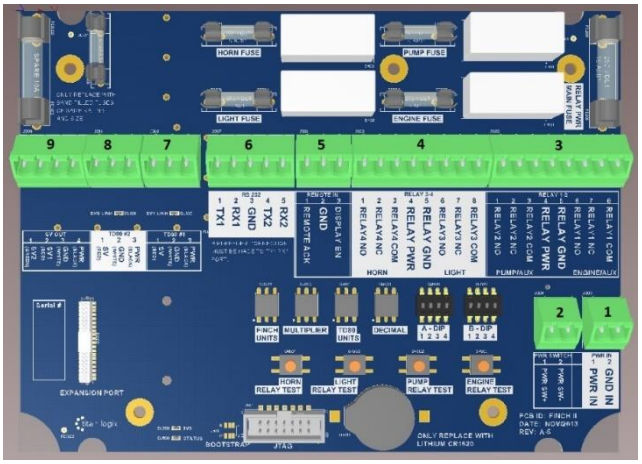

Figure 7-1: FINCH II Terminals

7.2 Terminal Block Descriptions:

There are 8 terminal blocks on the FINCH II

Connector #	Position
Connector 1 (2pos) Main Power Input (PWR IN)	• Position 1 (PWR IN) – connect to 8-30V DC power supply. • Position 2 (GND) – connect to power supply ground.

Connector 2 (2pos) Power Control Switch (PWR SW). Connect a dry contact switch between terminals 1 and 2 for system ON/OFF control. Replace the switch with a wire to remain ON. Wire PWR SW+(1) to PWR SW-(2) is factory installed.	• Position 1 (PWR SW-) • Position 2 (PWR SW+) **WARNING:** Do not connect power or ground to the PWR SW terminals.
Connector 3 (8pos) – Relay 1-2 connections	PUMP/AUX RELAY Position 1 (RELAY2 NO) – Relay 2 normally open terminal. Position 2 (RELAY2 NC) – Relay 2 normally closed terminal. Position 3 (RELAY2 COM) – Relay 2 common terminal. Position 4 (RELAY PWR) – Relay power supply is 10A fused and the same voltage as the main input. Position 5 (RELAY GND) – Relay ground connection
	ENGINE/AUX RELAY Position 6 (RELAY1 NO) – Relay 1 normally open terminal. Position 7 (RELAY1 NC) – Relay 1 normally closed terminal. Position 8 (RELAY1 COM) – Relay 1 common terminal.
Connector 4 (8pos) – Relay 3-4 connections	HORN RELAY Position 1 (RELAY4 NO) – Relay 4 normally open terminal. Position 2 (RELAY4 NC) – Relay 4 normally closed terminal. Position 3 (RELAY4 COM) – Relay 4 common terminal. Position 4 (RELAY PWR) – Relay power supply is 10A fused and the same voltage as the main input. Position 5 (RELAY GND) – Relay ground connection
	LIGHT RELAY Position 6 (RELAY3 NO) – Relay 3 normally open terminal. Position 7 (RELAY3 NC) – Relay 3 normally closed terminal. Position 8 (RELAY3 COM) – Relay 3 common terminal.
Connector 5 (3pos) – Remote Inputs	Position 1 (REMOTE ACK) – Remote Acknowledge input and Compartment Select. **Active when grounded.** Position 2 (GND) – Ground connection for remote inputs. Position 3 (DISPLAY EN) – Display Enable input. **Active when grounded.**
Connector 6 (5pos) – RS232 connections (all directions are from FINCH II point of view)	Position 1 (TX1) – RS232 transmit 1 output. Position 2 (RX1) – RS232 receive 1 input. Position 3 (GND) – RS232 ground connection Position 4 (TX2) – RS232 transmit 2 outputs. Position 5 (RX2) – RS232 receive 2 inputs
Connector 7 (3pos) – SVbus 1 input, TD100 #1 connection	Position 1 (SV) – SVBus 1 data line (connect to TD100 red wire) Position 2 (GND) – SVBus ground (connect to TD100 white wire) Position 3 (PWR) – SVBus power (connect to TD100 black wire)
Connector 8 (3pos) – SVbus 2 input,	Position 1 (SV) – SVBus 2 data line

TD100 #2 connection	(connect to TD100 red wire) Position 2 (GND) – SVBus ground (connect to TD100 white wire) Position 3 (PWR) – SVBus power (connect to TD100 black wire)
Connector 9 (4pos) – SVbus output (RCM connection)	Position 1 (SV2) – SVBus 2 data line, TD100 #2 (connect to RCM green wire) Position 2 (SV1) – SVBus 1 data line, TD100 #1 (connect to RCM red wire) Position 3 (GND) – SVBus ground (connect to RCM white wire) Position 4 (PWR) – SVBus power (connect to RCM black wire)

WARNING
DO NOT directly control the vehicle engine with the Engine Relay. It provides a control signal to an external accessory only. Refer to vehicle/engine manufacturer's instructions for engine shutdown installation and testing.

7.3 Relay Assignments:

The FINCH II display contains four independently controlled relays. These relays are fuse protected to limit short-circuit current. The relays have all contacts, Normally Open (NO), Normally Closed (NC) and Common (COM) contacts available for power or signal control. The TD100 generated alarms, or alarms generated by the FINCH II display can control these relays for various purposes including overfill prevention.

The following connections are recommended.

Relay 1	ENGINE/AUX	Connect to engine shutdown mechanism or a loading permit light.
Relay 2	PUMP/AUX	Connect to the pump or valve shutdown mechanism or a loading permit light.
Relay 3	LIGHT	Connect to the light.
Relay 4	HORN	Connect to the horn

For typical installations there will be only one high level shutdown system handled either by shutting down the pump (or valve) itself or by shutting down truck engine power. If Relay 2 is used to control a pump or valve solenoid, then Relay 1 can be used to connect to a light indicating whether loading is permitted. If Relay 1 is used for engine shutdown, then Relay 2 can be used for the loading permit light.

WARNING
DO NOT directly control the vehicle engine with the Engine Relay. It provides a control signal to an external accessory only. Refer to the vehicle or engine manufacturer's instructions for engine shutdown installation and testing.

To provide a mechanism for toggling relays by specific alarms there is a flexible assignment that exists within the FINCH II. This assignment is configurable over RS232 using a PC and SensorLink. When that alarm occurs then the corresponding assigned relays will respond. FINCH II sleep mode causes all relays to be de-energized. This must be considered when planning relay assignments and external alarm device operation.

7.4 Relay Alarming States

Finch II Relay Assignments

	Engine/AUX	Pump	Light	Horn	Can Ack?
Spill/Fail	✓	✓			
HH		✓	✓	✓	✓
Fill				✓	✓
Fall					✓

7.5 SVBus Connections:

The FINCH II has connections available for 2 TD100's via connectors 7 and 8. It also has 1 SV out connector (connector 9) that is intended to be connected to an RCM. The SV out connector can also be used for programming using an SVBus converter box. In this configuration, any connected TD100's can be programmed using SensorLink.

7.6 Remote Input Connections:

The Remote Input connections are active when grounded and are intended to be toggled by closing a switch to ground. The Remote Acknowledge input operates identically to the ACK button on the overlay. It also provides a compartment selection feature while no alarms are reported and require acknowledgement. The Display Enable input is intended to be connected to a PTO (or brake operated switch) that will enable the display when the truck is stopped, and the PTO engaged. In all other scenarios the display will be disabled.

7.7 RS232 Connections:

There are two available RS232 connections on the FINCH II. RS232 #1 is used to communicate with the FINCH II Configuration Utility and for firmware updates. RS232 #2 is used for optional 3rd party devices.

7.8 Maximum Relay Capacity:

The FINCH II contains 4 high power relays. The following maximum current ratings apply to the relays:

- Each individual relay can draw a maximum of 3.3A.
  (HORN, LIGHT, PUMP/AUX and ENGINE/AUX Fuse Rating is 5A).
- All 4 relays can draw a maximum of 6.6A, with no individual relay drawing more than 3.3A.
  (RELAY MAIN Fuse Rating is 10A).

7.9 Hardware Configuration Settings:

The FINCH II contains various hardware configuration parameters that allow an installer flexibility of the configuration during installation. To modify the hardware settings, first unlock the hardware settings by setting B-DIP, switch 4, OFF, then make the appropriate change to the DIP switch and then optionally lock the hardware settings by setting B-DIP, Switch 4, ON.

7.9.1 Rotary Switches:

The Rotary Switches in the FINCH II have been disabled. As of FINCH II firmware v2.8.5, decimal point and volume units will be received from the TD100. User will see the units and decimal point placement of the associated strapping table.

7.9.2 Dip Switches

Dip switch A contains 4 positions. A-DIP, ON = up, OFF= down.
Dip switch B also contains 4 positions. B-DIP, ON = up, OFF= down

The FINCH II contains 2 Dip Switch banks that contain 4 switches per bank.

Dip Switch A	Dip Switch B
1 = Enable Offset Calibration (Factory set to ON) **2** = Enable Low Level Readings (Factory set to OFF) **3** = Dual Compartment Failsafe (Factory set to OFF) **4** = Reserved	**1** = Reserved **2** = Set Remote Acknowledge to be an Alarm Input (Factory set to OFF) **3** = Global Acknowledge Enable (Factory set to OFF) **4** = Hardware Settings Lock (Factory set to OFF) B-DIP -switch 4 may be turned ON to lock the hardware settings to prevent accidental changes. · ON = Locked to prevent setting changes · OFF = Unlocked to change settings

7.9.3 Push Button Switches

There are 4 push button switches directly below the bank of rotary and dip switches. These switches control each of the 4 relays and allow testing of the relays during installation. Note that they are intended to energize a relay so during operation if any of the relays are already energized due to an active alarm then pushing the test button for that relay will do nothing.

8 FINCH II and TD100 Transmitter Programming Cable Adapter

TD100 transmitter programming may be done without disconnecting any wires at the FINCH II display. Ensure that the latest version of SensorLink is installed on a PC and the Programming Kit is available.

Refer to Figure 10-1 for connector details.

Remove any attached cables from Connector C. Attach the TD100 Programming cable 3-pin connector to Connector C. At the FINCH II display, remove the plug inserted in the SV OUT socket.

See Figure 2-2 for the location, labeled connector block 9.

Plug the TD100 Programming Cable 4-pin plug into the SV OUT socket on the FINCH II Circuit board.
Transmitter selection for programming is by the rocker switch on the 4-pin plug.
TD100 programming is ready to begin once the SensorLink program is launched.

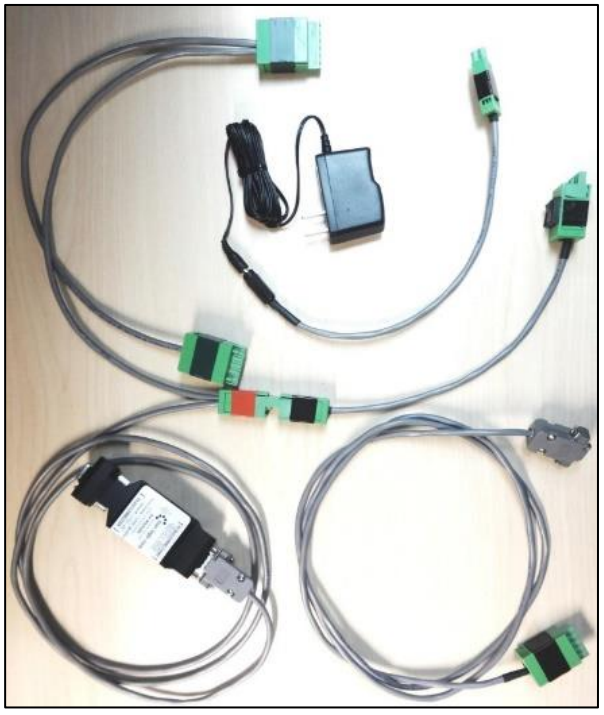

Figure 10-1: Titan Logix Programming Kit

9 Technical Specifications

Power: 8-30 VDC

Current Consumption: 300mA at 12V

Fuse Ratings: 5A (HORN, LIGHT, PUMP/AUX and ENGINE/AUX) 10A (RELAY MAIN)

Relay Ratings: 3.3A Max on any individual relay AND 6.6A Max across all 4 relays

Ambient Temperature Range: 40°C to +65°C

Humidity: RH 95% max

Altitude: 2000 m

Environment/ Enclosure: Flame Retardant Fiberglass, Weatherproof Type 4X

Communications: RS-232, TD100 SVBus

Approvals: Class I, Div. 2, Groups C & D, T3

Pollution degree: 4

Installation category: I

Use: Suitable for Indoor or Outdoor Use.

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